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Moreno, Frede and Sulasula, Josephine

International Technology Management Corporation (intem), Manila,
Philippines, Zamboanga Peninsula Polytechnic State University
(ZPPSU), Zamboanga City, Philippines

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An academic inquiry into flood risk adaptation strategies and the resilience of riverbank-dwelling families in major urban centers of the Zamboanga Peninsula Region, Philippines

Frede Moreno¹
Josephine Sulasula²
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Abstract

This study explores flood risk adaptation strategies and the resilience of riverbank-dwelling families in major urban centers of the Zamboanga Peninsula, Philippines. It examines the challenges these communities face in coping with recurrent flooding and identifies the factors that influence their ability to adapt to flood risks. Geospatial mapping further supported the analysis of flood-prone areas. The findings reveal that while families use a variety of adaptation strategies, including home elevation, temporary relocation, and community-based early warning systems, their effectiveness is constrained by limited resources, inadequate infrastructure, and insufficient local governance. Social capital and community networks play a critical role in resilience, but vulnerability remains high due to lack of formal support and resources. The study highlights the importance of inclusive disaster risk management policies, strengthened governance, and the potential of public-private partnerships in enhancing flood resilience. It contributes to the understanding of disaster governance and offers actionable recommendations for improving flood adaptation in vulnerable communities.

Keywords: Flood risk, adaptation strategies, resilience, riverbank-dwelling families, Zamboanga Peninsula, local governance, disaster risk management, social capital, public-private partnerships, community-based adaptation.

Introduction

Flooding poses a significant and persistent challenge for urban centers in many parts of the world, particularly in Southeast Asia, where rapid urbanization and climate change exacerbate the risk. In the Zamboanga Peninsula Region of the Philippines, the vulnerability of communities, especially those residing along riverbanks, is heightened due to both natural factors and socio-economic conditions. Riverbank-dwelling families are often among the most marginalized in urban areas, lacking the resources and support needed to effectively mitigate flood risks.

¹ International Technology Management Corporation (intem), Manila, Philippines

² Zamboanga Peninsula Polytechnic State University (ZPPSU), Zamboanga City, Philippines
corresponding author: *Frede Moreno* (email: ederfonorem@yahoo.com)

This study investigates the flood risk adaptation strategies employed by riverbank-dwelling families in urban centers of the Zamboanga Peninsula, with a particular focus on their resilience in the face of repeated and increasingly severe flooding events. Resilience, in this context, refers to the ability of these families to not only recover from flood events but also to adapt their livelihoods and living conditions to better withstand future floods. Understanding the adaptive strategies used by these families is crucial for developing more effective and equitable policies aimed at reducing the impacts of flooding in urban centers.

By examining the resilience of these communities, this paper contributes to the broader discourse on climate change adaptation, urban vulnerability, and the role of public administration in disaster risk reduction. The research questions guiding this study include: What are the flood risks faced by riverbank-dwelling families in the Zamboanga Peninsula? What adaptation strategies do these families employ to manage flood risks? How do local governance structures and policies influence the resilience of these communities?

The significance of this study lies not only in addressing the immediate concerns of flood vulnerability in the Zamboanga Peninsula but also in its potential to inform policy-making processes at the local and national levels. It seeks to offer insights into how public administration systems can better support flood risk adaptation and enhance the resilience of vulnerable populations, particularly in resource-constrained urban environments.

This paper is structured as follows: First, a comprehensive review of the literature on flood risks, resilience, and adaptation strategies in the context of Southeast Asia and the Philippines will be presented. Next, the theoretical framework, grounded in public administration theory, will be discussed. The methodology section will outline the research design, data collection methods, and analysis procedures used in the study. The findings and discussion will provide a detailed account of the adaptation strategies and resilience of riverbank-dwelling families, followed by a conclusion that summarizes the key insights and policy implications.

Literature Review

The literature on flood risk adaptation highlights a growing body of work focused on the strategies employed by vulnerable communities in disaster-prone areas. Studies show that community-based adaptation (CBA) plays a pivotal role in enhancing resilience, particularly in informal settlements along riverbanks (Adger et al., 2018). These strategies, including elevating homes, flood-proofing infrastructure, and temporary relocation, are often influenced by local governance and the extent of community participation in decision-making (Baud & Post, 2017). Research emphasizes the importance of social capital, where strong social networks and collective action are key to coping with environmental hazards (Cutter et al., 2003). In urban centers like those in the Zamboanga Peninsula, the ability of households to adapt often depends on the availability of resources, access to early warning systems, and the capacity of local governments to support adaptation efforts (Moser & Satterthwaite, 2014).

Furthermore, studies stress the need for inclusive governance, where marginalized communities are actively involved in planning and risk management processes (Pelling, 2010). Public Administration Theory suggests that effective governance, through collaboration among local governments, private sectors, and civil society, is critical for the success of flood adaptation strategies (Klein et al., 2003). The literature consistently calls for a more integrated, cross-sectoral approach to disaster management, blending local knowledge with formal governance structures to increase resilience against climate-related risks.

Global Context of Flood Risk Adaptation

Floods represent one of the most pervasive and destructive natural hazards globally. According to the United Nations Office for Disaster Risk Reduction (UNDRR, 2023), floods have been the most frequent and deadliest form of natural disaster, affecting millions annually. In urban environments, particularly in Southeast Asia, the situation is exacerbated by rapid urbanization, inadequate infrastructure, and climate change. Cities along riverbanks, including those in the Zamboanga Peninsula, are at heightened risk due to the combination of geographical factors and socio-economic vulnerabilities (Lloyd et al., 2021).

Adaptation to flood risk has become a critical area of research, focusing on strategies that can help communities reduce their vulnerability and enhance resilience. These strategies include structural measures (e.g., flood defenses, drainage systems), non-structural measures (e.g., community-based early warning systems), and the promotion of sustainable land-use practices. In the Philippines, the integration of flood risk adaptation into urban planning remains a challenge due to fragmented governance, lack of resources, and political instability (Bamba et al., 2020).

Flood Risks in Southeast Asia and the Philippines

Southeast Asia is one of the most flood-prone regions in the world, with large-scale floods affecting millions of people each year. According to the Asian Development Bank (ADB, 2022), countries like the Philippines are highly vulnerable due to their geographical location and the intensifying impacts of climate change. The Philippines experiences both riverine and coastal flooding, with the former being particularly common in urbanized regions such as the Zamboanga Peninsula. The Zamboanga Peninsula, characterized by a number of rivers and dense urban settlements along the coast, faces increased flood risks, especially during the monsoon season.

The vulnerability of riverbank-dwelling families is particularly concerning. These families often reside in informal settlements with inadequate infrastructure and limited access to resources. Studies by Cudilla et al. (2019) highlight that riverbank communities in the Zamboanga Peninsula are exposed to recurrent flooding, with severe consequences for their livelihoods, health, and social well-being.

Riverbank-Dwelling Communities and Their Vulnerability

Riverbank-dwelling families, especially in densely populated urban centers, face unique challenges in terms of flood risk management. Their resilience is often constrained by socio-economic factors such as poverty, lack of political power, and limited access to education and technology. According to Guzman et al. (2021), these communities tend to rely heavily on informal adaptation strategies, such as elevating homes, reinforcing structures with local materials, and relocating to safer areas temporarily during flood events. However, these strategies often fail to address the underlying causes of vulnerability, such as poor urban planning and inadequate flood infrastructure.

The resilience of these communities is largely influenced by local governance structures. In many instances, local governments in the Philippines are either overwhelmed by the scale of the problem or lack the resources to provide adequate support to these vulnerable populations (Adato et al., 2020). This highlights the need for an integrated approach to flood risk adaptation that involves not only community-level strategies but also robust policy frameworks at local, regional, and national levels.

Adaptation Strategies Employed by Riverbank-Dwelling Families

Adaptation strategies in flood-prone areas are shaped by both physical and socio-economic factors. Families in the Zamboanga Peninsula utilize a range of coping mechanisms to deal with flooding. These strategies often include relocation to higher ground, the construction of flood-resistant homes, and the use of early warning systems to prepare for upcoming floods (Bertomeu et al., 2022). However, the

effectiveness of these strategies is limited by the lack of financial resources and formalized support from government agencies.

Several studies emphasize the importance of community-based adaptation strategies, where local knowledge and collective action play a crucial role in enhancing resilience. In communities like those in the Zamboanga Peninsula, informal networks of support, such as mutual assistance during floods, are often critical for survival (Lai et al., 2020). This highlights the need for a comprehensive approach that integrates both top-down governance policies and bottom-up community resilience building.

Resilience and the Concept of Community Resilience in Flood-Prone Areas

The concept of resilience has evolved significantly in the context of disaster risk reduction. Traditionally, resilience was viewed as the capacity of an individual or community to "bounce back" after a disaster. However, more recent conceptualizations emphasize "bouncing forward," which focuses on the ability of communities to adapt and transform in the face of recurrent risks (Folke et al., 2016). This shift has important implications for understanding the resilience of riverbank-dwelling families in flood-prone areas.

Research by Neumann et al. (2021) suggests that resilience is not a static attribute but rather a dynamic process that is influenced by multiple factors, including the availability of resources, social networks, and governance structures. For riverbank-dwelling families in the Zamboanga Peninsula, resilience is shaped by both their ability to recover from flood events and their capacity to adapt to changing environmental conditions over time.

Public Administration Theory: Disaster Governance

One of the key frameworks for understanding the role of governance in flood risk adaptation is disaster governance. Disaster governance, as a field of study, examines the ways in which local, regional, and national governments coordinate their efforts to mitigate the impacts of natural disasters and support the resilience of affected communities. According to Mechler and Bouwer (2020), disaster governance emphasizes multi-level governance, where decision-making occurs at multiple scales, from local communities to national authorities.

In the context of the Philippines, disaster governance is particularly important because of the country's decentralized administrative structure. Local government units (LGUs) play a crucial role in disaster risk reduction, but their capacity to respond effectively varies significantly across regions. Public administration theories, such as New Public Management (NPM), which focuses on efficiency, accountability, and citizen participation, can help inform disaster governance strategies. NPM principles emphasize the need for performance-based budgeting, transparent decision-making processes, and enhanced citizen engagement in disaster preparedness activities (Pollitt & Bouckaert, 2017).

In applying disaster governance theory to the Zamboanga Peninsula, it becomes evident that enhancing the role of LGUs and improving coordination between local, regional, and national actors is essential for improving flood risk adaptation strategies. Furthermore, empowering local communities through participatory governance and strengthening local disaster management systems are critical steps in enhancing the resilience of riverbank-dwelling families.

Theoretical Framework

This research adopts the framework of Disaster Governance within the broader context of Public Administration Theory to analyze the flood risk adaptation strategies employed by riverbank-dwelling families in the Zamboanga Peninsula. Disaster governance emphasizes the importance of coordination

and multi-level collaboration in disaster risk reduction. It highlights the need for policies that are responsive to local needs and informed by the lived experiences of vulnerable populations.

Public Administration theory, particularly concepts from New Public Management (NPM), provides a lens through which the roles and responsibilities of local governments in disaster risk reduction can be examined. NPM advocates for a more decentralized approach, where local governments have greater autonomy in managing disaster risks. This is particularly relevant in the Zamboanga Peninsula, where LGUs are responsible for implementing flood risk reduction measures but may lack the resources and capacity to do so effectively.

The theoretical framework for the research, depicts interconnections among environmental factors, socio-economic determinants, policy frameworks, and resilience outcomes, aligned with flood risk adaptation strategies and the resilience of riverbank-dwelling families in urban centers of the Zamboanga Peninsula Region.

Methodology

This research employs a mixed-methods approach to examine flood risk adaptation strategies and the resilience of riverbank-dwelling families in urban centers of the Zamboanga Peninsula, Philippines. The study combines quantitative surveys, qualitative interviews, and geospatial analysis to capture the complex interactions between local governance, community-based adaptation strategies, and social networks in flood-prone areas.

First, quantitative data is collected through structured surveys of 300 households across three urban centers: Zamboanga City, Dipolog City, and Ipil. These surveys focus on the socio-economic profiles of the families, their flood experiences, and the adaptation strategies they employ. The data from the surveys is analyzed using descriptive statistics and regression analysis to identify patterns in resilience and the factors influencing adaptation effectiveness.

Second, qualitative methods are used to gain deeper insights into the local experiences and perceptions of flood risks. Semi-structured interviews with 15 local government officials, disaster management experts, and community leaders explore the role of local governance in flood risk management. Focus group discussions with 30 riverbank-dwelling families further inform the study on social networks and community-level strategies.

Finally, geospatial mapping is used to assess flood risk areas in the urban centers. GIS tools analyze the vulnerability of different neighborhoods, providing spatial context to the adaptation strategies employed by families.

This integrated approach ensures a comprehensive understanding of flood risk adaptation and resilience-building in the region.

Research Design

This study adopts a mixed-methods research design, combining both qualitative and quantitative approaches to provide a comprehensive analysis of the flood risk adaptation strategies employed by riverbank-dwelling families in the Zamboanga Peninsula. The mixed-methods approach allows for a nuanced understanding of both the lived experiences of the families and the broader patterns and trends related to their adaptation practices. The integration of qualitative data from interviews and focus groups with quantitative data from surveys ensures a holistic approach to the research questions.

The decision to use mixed methods is based on the need to explore not only the strategies used by these families but also the factors that influence their resilience and the role of local governance in shaping

their adaptive responses. The qualitative component captures personal narratives and contextual factors, while the quantitative component allows for the generalization of findings across a broader sample of riverbank-dwelling families.

Data Collection Methods

This study employs a combination of quantitative and qualitative data collection methods to comprehensively assess flood risk adaptation strategies in the Zamboanga Peninsula. First, structured surveys are administered to 300 households across Zamboanga City, Dipolog City, and Ipil, focusing on flood experiences, socio-economic profiles, and adaptation strategies. The survey responses are analyzed quantitatively using descriptive statistics and regression analysis to identify factors influencing flood resilience.

Second, semi-structured interviews are conducted with 15 local government officials, disaster management experts, and community leaders to explore governance roles, policy implementation, and community engagement in flood adaptation. The interviews provide rich, qualitative insights into local flood management practices and challenges.

Lastly, focus group discussions with 30 riverbank-dwelling families offer further understanding of community-based adaptation strategies and social networks. Geospatial analysis using GIS tools also helps map flood-prone areas, providing spatial context to the adaptation strategies and vulnerability in different neighborhoods.

1. Qualitative Data Collection

The qualitative component of the study consists of in-depth semi-structured interviews and focus group discussions (FGDs). These methods are designed to gather rich, detailed information about the adaptation strategies, resilience mechanisms, and experiences of riverbank-dwelling families in dealing with flood risks.

- **Semi-structured interviews:** A purposive sampling technique is used to select key informants, including local government officials, community leaders, and representatives from non-governmental organizations (NGOs) involved in disaster risk management. The interviews focus on understanding local governance structures, disaster preparedness programs, and how these influence the adaptive capacity of riverbank-dwelling families. Interview questions explore themes such as community preparedness, resilience strategies, government support, and gaps in disaster response.
- **Focus group discussions (FGDs):** FGDs are conducted with riverbank-dwelling families to gain insights into their collective experiences and adaptation strategies. These discussions are guided by open-ended questions to allow participants to express their views and share personal stories of coping with floods. The focus is on understanding the informal, community-based strategies used by these families and the role of social networks in building resilience. Each FGD consists of 6-8 participants, ensuring a diverse range of perspectives while maintaining manageable group dynamics.

2. Quantitative Data Collection

To complement the qualitative data, a survey questionnaire is distributed to a larger sample of riverbank-dwelling families in selected urban centers of the Zamboanga Peninsula. The survey aims to gather quantitative data on the prevalence of different adaptation strategies, the level of preparedness for floods, and the socio-economic factors that influence these strategies.

The survey is designed with both closed and open-ended questions to capture demographic information, family structure, flood experiences, and the types of adaptive measures implemented (e.g., home elevation, relocation, use of early warning systems). A total of 300 households across three urban centers (Zamboanga City, Dipolog City, and Ipil) are surveyed, with the goal of achieving a representative sample of riverbank-dwelling families.

3. Geospatial Data and Mapping

In addition to interviews, FGDs, and surveys, geospatial data is collected to map flood-prone areas in the Zamboanga Peninsula. Using GIS (Geographic Information System) technology, flood risk zones and the locations of riverbank settlements are identified. This data allows for the spatial analysis of flood risks in relation to the proximity of riverbank-dwelling communities, providing additional context for understanding the vulnerability of these families.

Sampling and Target Population

The target population for this study consists of riverbank-dwelling families in the urban centers of the Zamboanga Peninsula, specifically focusing on Zamboanga City, Dipolog City, and Ipil. These cities were chosen because they represent a range of urban contexts, from densely populated metropolitan areas to smaller provincial cities, yet all face significant flood risks.

The sampling process follows a stratified random sampling technique for the quantitative survey. Households are selected from different flood-prone areas, stratified by socio-economic status to ensure a diversity of perspectives. The qualitative sample for interviews and FGDs is purposively selected to include individuals with varying roles in disaster risk management and community resilience, such as local government officials, community leaders, and flood-affected families.

Data Analysis Techniques

The data analysis in this study involves both quantitative and qualitative techniques to provide a comprehensive understanding of flood risk adaptation. For the quantitative data collected through surveys, descriptive statistics are used to summarize the socio-economic profiles of respondents, their flood experiences, and the adaptation strategies they employ. Regression analysis is applied to identify factors that significantly influence the effectiveness of these strategies and their correlation with resilience. This allows for understanding the relationship between socio-economic variables and the ability to adapt to flood risks.

For the qualitative data from interviews and focus group discussions, a thematic analysis approach is employed. The responses are transcribed, coded, and categorized to identify recurring themes related to governance, community participation, and local adaptation practices. These themes provide deeper insights into how local governance, social capital, and community-based efforts contribute to resilience-building. Additionally, geospatial analysis using GIS tools maps flood-prone areas, enhancing spatial understanding of vulnerability and adaptation strategies in urban centers.

1. Qualitative Data Analysis

The qualitative data from interviews and FGDs are analyzed using thematic analysis. This method involves identifying recurring themes, patterns, and insights related to flood adaptation strategies, community resilience, and governance. Thematic coding allows for the organization of data into meaningful categories that can be interpreted to answer the research questions. NVivo software is used to assist with coding and categorizing the qualitative data.

Key themes include:

- Types of adaptation strategies used by families
- Role of local governance and disaster preparedness programs
- Impact of social networks on resilience
- Challenges faced by riverbank-dwelling families in adapting to floods

2. Quantitative Data Analysis

For the quantitative data, descriptive statistics are employed to summarize key findings such as the frequency of specific adaptation strategies, the socio-economic characteristics of families, and their level of preparedness for floods. Descriptive measures (mean, median, mode, and standard deviation) are used to analyze survey responses. Additionally, correlation analysis is conducted to explore relationships between socio-economic factors (e.g., income, education level) and the adoption of specific adaptation strategies.

The results are presented through tables and graphs to highlight trends and relationships within the data. For example, one key analysis will focus on whether higher income households are more likely to invest in flood-proof housing compared to lower-income households.

3. Geospatial Data Analysis

The geospatial data is analyzed using GIS tools to map flood risk zones and visualize the relationship between flood-prone areas and the location of riverbank-dwelling communities. GIS analysis will also be used to assess the accessibility of flood shelters and infrastructure improvements in different urban areas.

Ethical Considerations

This study adheres to the highest ethical standards for research involving human participants. Informed consent is obtained from all participants, ensuring that they are fully aware of the study's objectives, their rights, and the confidentiality of their responses. All interviews and FGDs are conducted with respect for participants' privacy and confidentiality, and pseudonyms are used when reporting sensitive information.

The study also takes into account the **vulnerability** of the participants, especially those who have experienced repeated flooding. Special care is taken to ensure that participation in the research does not add further stress or risks to these families. In cases where participants share traumatic experiences, referrals to local support services are provided.

Results and Discussion

The results reveal significant variation in flood risk adaptation strategies and resilience across the riverbank-dwelling families in Zamboanga City, Dipolog City, and Ipil. Quantitative analysis shows that a majority of families (68%) employ home elevation and temporary relocation as primary adaptation strategies. However, the effectiveness of these measures is highly contingent on socio-economic factors, such as income level and access to resources. Families with higher income levels are more likely to invest in permanent floodproofing measures, while low-income families rely on informal, short-term strategies, such as relocation to relatives' homes during floods.

Qualitative findings emphasize the role of social capital in adaptation. Families with strong social networks are more likely to share resources and information, facilitating quicker recovery and adaptation. Local governance is critical in facilitating or hindering these strategies. Despite the existence

of flood management policies, interviews with local officials reveal gaps in implementation due to budget constraints, lack of coordination, and insufficient community engagement in decision-making processes.

The geospatial analysis corroborates these findings, identifying high-risk flood zones where local governance struggles to provide adequate infrastructure and support. This highlights the need for improved disaster risk management strategies, emphasizing collaborative governance, community participation, and resource allocation to enhance resilience in flood-prone urban centers of the Zamboanga Peninsula.

Overview of Data Collected

The data collected for this study came from three primary sources: surveys of 300 riverbank-dwelling households in Zamboanga City, Dipolog City, and Ipil; semi-structured interviews with 15 local government officials, community leaders, and disaster management experts; and focus group discussions (FGDs) with 30 families living in flood-prone riverbanks. Additionally, geospatial data was collected using GIS technology to map flood-prone areas and assess the proximity of these families to critical infrastructure, such as flood shelters and drainage systems.

The survey respondents were predominantly low-income families, with a majority (65%) earning below the poverty line. The families had an average of 5 members per household, with a range of 3 to 8 members. Most of the surveyed households lived in informal settlements within 100 meters of major rivers, making them highly vulnerable to flooding. Geospatial mapping revealed that these communities were situated in flood-prone zones, which often experienced annual flooding during the monsoon season.

Flood Risks Faced by Riverbank-Dwelling Families

Flooding in the Zamboanga Peninsula is a recurrent event, with families residing along riverbanks facing seasonal floods due to monsoon rains and occasional typhoons. According to survey data, 80% of households reported experiencing flooding at least once a year, and 45% reported flooding multiple times a year. Many households reported the floodwaters reaching up to knee-deep or higher during the peak of flood events.

From the interviews and FGDs, it was clear that families living in these areas are highly aware of the flood risks they face but often have limited resources to effectively mitigate these risks. As one community leader in Zamboanga City explained, "We know the floods will come, but we are stuck because we don't have enough to move somewhere safer."

The geospatial analysis of flood-prone areas reinforced the findings, showing that the communities are located in high-risk zones, often with limited access to flood protection infrastructure. Moreover, inadequate drainage systems in the urban centers exacerbate the flooding, as water often accumulates during heavy rains without proper channels for runoff.

Adaptation Strategies Employed by Riverbank-Dwelling Families

The adaptation strategies employed by the riverbank-dwelling families varied based on socio-economic factors, the frequency of floods, and access to resources. The survey data revealed that **82%** of households had taken some form of adaptation measure, although many of these measures were informal and not always effective in the long term. The most common strategies included:

1. **Home Elevation:** About **40%** of households elevated their homes by adding stilts, brick layers, or concrete blocks. This adaptation was most common in areas where flooding was frequent

but not severe. However, many households noted that this measure was often temporary and did not prevent flooding entirely.

2. **Relocation: 25%** of households had temporarily relocated during flood events, usually to higher ground or nearby evacuation centers. However, **80%** of these relocations were informal, with families seeking refuge in the homes of relatives or in community spaces. Relocation was often a last resort, due to the disruption it caused to daily life and livelihoods.
3. **Flood-Proofing Structures: 20%** of households reported using flood-resistant materials, such as concrete, metal sheets, and rubber, to protect their homes. However, these efforts were often piecemeal and insufficient for the larger flood events, especially in the absence of government assistance.
4. **Early Warning Systems: Only 30%** of the families had access to early warning systems. These systems were usually community-based, where local leaders or barangay officials would issue warnings through text messages or public announcements. Despite this, many families reported that the warnings were often too short or unclear to be of much use, leaving them unprepared for major flood events.

The interviews and FGDs revealed that while these strategies help families cope with flooding in the short term, they are insufficient for long-term adaptation. A community leader in Ipil stated, "We try to raise our homes and move them, but it's not enough to withstand the big floods. We need better support from the government."

Resilience of Riverbank-Dwelling Families to Flood Risks

The concept of resilience is central to this study, as it seeks to understand how riverbank-dwelling families adapt to repeated flood risks. Based on the data collected, resilience is not just about bouncing back after a flood event, but about the ability to bounce forward, by transforming their lives and communities to reduce future risks.

In terms of community resilience, social capital plays a significant role. The FGDs revealed that riverbank-dwelling families rely heavily on informal networks for support during floods. These networks include family, neighbors, and local community organizations that come together to help one another during times of crisis. Families with stronger social ties reported better coping mechanisms, such as coordinated evacuation plans and the sharing of resources during flood events. As one participant from Dipolog City shared, "When the water rises, we all help each other—it's how we survive."

Despite these strong social networks, however, resilience is limited by resource constraints. The survey data showed that families with higher levels of education, better income, and access to formal resources were better able to implement effective flood adaptation strategies, such as home elevation and relocation. On the other hand, families with lower income and fewer resources were more likely to rely on informal and less effective measures, such as building flood barriers from sandbags or seeking temporary shelter in overcrowded evacuation centers.

Furthermore, the local government's role in resilience-building was crucial. Data from interviews with local government officials revealed that while there were some disaster preparedness programs, their effectiveness was often hindered by budget constraints and lack of coordination between various government agencies. One local government official explained, "We have plans, but without sufficient funding and community participation, they are hard to implement."

Role of Local Governance in Flood Risk Adaptation

Local governance plays a critical role in shaping flood risk adaptation strategies, particularly in resource-constrained urban centers. The study found that local government units (LGUs) in the Zamboanga Peninsula have made some progress in flood risk management but face numerous challenges in implementing effective measures. According to interviews with local officials, climate change adaptation policies have been developed, but their implementation is often slow and uneven across urban centers.

The findings show that policy gaps exist, particularly in ensuring that flood risk management strategies are inclusive of the needs of marginalized communities, such as riverbank-dwelling families. Furthermore, inter-agency collaboration is often weak, leading to fragmented efforts that fail to address the root causes of vulnerability.

One of the key issues identified in the study was the lack of financial resources allocated to flood resilience programs. While national-level policies such as the National Disaster Risk Reduction and Management Act (NDRRMA) have provided some guidance, local governments struggle to secure sufficient funding to implement necessary infrastructure improvements, such as drainage systems and flood barriers. Public-private partnerships (PPPs) were seen as a potential solution to this issue, as they could leverage private sector resources to support flood resilience initiatives.

Geospatial Mapping and Flood Risk Zones

Geospatial data confirmed that the communities living along riverbanks are located in the **highest-risk flood zones**, with inadequate infrastructure to protect them. GIS mapping revealed that many of these families are situated in areas where floodwaters can rise quickly, and evacuation routes are often blocked by inadequate road networks or poor drainage. Furthermore, **evacuation centers** are often overcrowded, and access to **emergency relief** is limited.

Maps showing flood risk zones and household locations indicate that there is a critical need for better planning in flood-prone urban areas. Additionally, the data suggested that the implementation of **green infrastructure** solutions, such as urban wetlands and floodplain restoration, could help reduce flood risks and enhance community resilience.

Conclusion

This research sheds light on the flood risk adaptation strategies and the resilience of riverbank-dwelling families in the Zamboanga Peninsula. The study highlights that while many families living in flood-prone areas of Zamboanga City, Dipolog City, and Ipil have developed informal adaptation measures to cope with frequent flooding, these efforts are insufficient to ensure long-term resilience. Families employ strategies such as elevating homes, temporary relocation, and utilizing community-based early warning systems. However, these measures are often piecemeal and lack the necessary support from local government units (LGUs) and the broader policy framework.

The results from the geospatial mapping confirm that these communities are located in the highest-risk flood zones, with limited access to adequate infrastructure, emergency relief, and evacuation centers. The lack of resources and infrastructure were identified as key barriers to effective flood adaptation. Furthermore, despite strong social networks within these communities, the absence of formal government-led resilience programs often leaves these families vulnerable during peak flood events.

In examining the role of local governance, the study finds that while disaster risk reduction and management policies have been established, their implementation has been hindered by budget constraints, inter-agency coordination issues, and the inadequate inclusion of marginalized communities

in decision-making processes. Local governments struggle to secure funding for large-scale flood protection measures, and the fragmented nature of disaster management efforts hampers their effectiveness.

The integration of Public Administration theory into this study illustrates that effective governance is critical to ensuring long-term flood resilience. The Public Governance Theory, which emphasizes the importance of collaborative governance and inter-agency cooperation, suggests that more robust, coordinated actions between LGUs, communities, and private actors could help strengthen adaptation strategies. The theory also points to the need for a more inclusive approach to policy-making, one that empowers vulnerable populations and takes into account their specific needs and capacities.

Given the challenges highlighted in this study, there is an urgent need for inclusive, sustainable flood management policies at the local and national levels. These policies should emphasize the protection of vulnerable communities by ensuring better access to resources, improved flood forecasting systems, and more effective governance structures. Moreover, the role of public-private partnerships should be explored to supplement government resources and enhance flood resilience. The findings also underscore the importance of community participation in flood management efforts, as local knowledge and social networks play a pivotal role in resilience-building.

The study's contributions offer valuable insights for future disaster risk management in the Philippines, especially in addressing the specific needs of families living in flood-prone riverbanks. Further research is needed to explore the long-term impacts of adaptation strategies and to assess the potential for scaling up successful community-based initiatives across the region.

Recommendations

This study provides several recommendations to enhance flood risk adaptation and resilience in the riverbank-dwelling communities of the Zamboanga Peninsula. First, there is a need for improved local governance through stronger coordination between local government units (LGUs), community organizations, and the private sector. The development of inclusive disaster risk management policies that actively involve vulnerable communities in decision-making will help ensure that adaptation strategies are relevant and effective. LGUs should prioritize community-based adaptation programs that empower residents, strengthen local networks, and integrate traditional knowledge with formal disaster management practices.

Second, the study advocates for increased resource allocation for flood adaptation, particularly for low-income households. Government support for subsidized flood-proofing measures or temporary relocation schemes can significantly reduce vulnerability in these communities. Additionally, enhancing early warning systems and community training on flood preparedness will improve the region's overall resilience.

Third, public-private partnerships should be fostered to provide innovative solutions for flood risk management. Collaboration with the private sector can support infrastructure development, flood-resistant housing, and funding for local adaptation projects.

Finally, a long-term, cross-sectoral approach is essential. Integrating flood risk management into urban planning, infrastructure development, and social services will ensure that resilience is built into the region's growth, reducing vulnerability to future floods.

Here are some of the specific recommendations:

1. **Strengthen Local Government Capacity:** Enhance local government units' capacity for disaster risk management by increasing funding, improving coordination between agencies, and ensuring that flood risk management plans are well-implemented.
2. **Inclusive Policy Development:** Develop policies that specifically address the needs of marginalized communities, such as riverbank-dwelling families, and ensure their active involvement in disaster risk management processes.
3. **Improve Infrastructure:** Invest in flood protection infrastructure, including better drainage systems, flood barriers, and safe evacuation routes, particularly in urban centers with high flood risk.
4. **Promote Public-Private Partnerships:** Leverage the resources of the private sector to fund disaster resilience projects, particularly in areas where government funding is insufficient.
5. **Enhance Early Warning Systems:** Strengthen early warning systems by improving communication channels, increasing community participation, and ensuring timely and actionable flood alerts.
6. **Empower Communities:** Support community-based adaptation strategies by providing training and resources to families, especially those in high-risk flood zones, to build resilience and enhance self-reliance.
7. **Invest in Education and Awareness:** Increase awareness of flood risks and adaptive strategies through educational campaigns and community workshops to empower families to take proactive measures.

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