



Gander Analysis of Flood Mitigation in West Kalimantan: Sociobiology, Structural Functionality, and Equilibrium

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Abstract

This study analyzes gender roles in flood mitigation in West Kalimantan using sociobiological lenses, structural-functional theory, and the concept of social equilibrium. The aim of the study is to understand how men's and women's roles are shaped through biological and social adaptations, and how gender interactions contribute to social coordination, community resilience, and post-disaster recovery. A qualitative case study approach was applied with purposive sampling of participants including affected women, community leaders, and local officials. Data collection was conducted through field observations, semi-structured interviews, and document analysis, while data analysis followed the interactive model of Miles and Huberman, encompassing condensation, presentation, and drawing conclusions. The results show that gender-based ecological adaptation is flexible and collective, with men handling physical labor and women managing domestic logistics and family health, while cross-gender participation strengthens community solidarity and coordination. Post-flood recovery mechanisms through mutual cooperation and collective participation reflect the principle of social equilibrium, where functional balance between individuals, families, and communities is maintained. The structural-functional approach explains the complementary division of roles, while the sociobiological perspective highlights the adaptive basis of gender behavior. This research confirms that effective flood mitigation requires the integration of local practices, gender-based strategies, and adaptive social coordination to achieve sustainable community resilience. These findings contribute to the development of inclusive, equitable, and community-based disaster mitigation policies.

Keywords: Gender, Disaster Mitigation, Sociobiology, Structural Functionality, Equilibrium.

INTRODUCTION

Flood disaster mitigation in West Kalimantan is still dominated by technical-structural approaches, such as embankment construction, water channel normalization, and reforestation and reforestation programs for critical land. This approach, which emphasizes physical aspects, is indeed in line with the national policy for infrastructure-based disaster risk reduction, but its effectiveness remains questionable, given that flooding remains a widespread and recurring annual event in various regions of the province. (Muliadi & Warsidah, 2024; Soeryamassoeka et al., 2023). West Kalimantan BPBD data (2024) noted that there were 559 villages or sub-districts in 114 districts that were classified as flood-prone, indicating a significant gap between technocratic policy designs and socio-ecological realities on the ground. (Hamidah, 2023; Novianti & Jiu, 2024). Studies show that gender-neutral policy orientations have neglected the social dimensions of structurally unequal communities, where women are often the most impacted group yet also play a strategic role in post-disaster mitigation and recovery processes. Therefore, flood mitigation in West Kalimantan needs to shift toward a more inclusive approach, one that emphasizes not only physical infrastructure but also integrates socio-ecological perspectives and gender equity as a basis for strengthening community resilience. (Bahri et al., 2024; Wirayuda, n.d.).

Various studies show that women play a strategic role in household and environmental management, particularly in providing clean water and food, and maintaining family health, vital functions that become increasingly important when disaster strikes. However, the limited involvement of women in mitigation decision-making processes indicates that the social system continues to explicitly ignore the gender dimension. Women are often positioned as objects of protection, rather than as empowered subjects in

formulating solutions. Yet, women's experience in managing risk and adapting to flooding constitutes a form of social capital within local communities that has the potential to strengthen more effective and equitable mitigation policies. The lack of inclusion of a gender perspective in policies risks repeating the failure of infrastructure approaches that fail to address the root causes of community social problems.

Recent studies at both national and international levels have consistently demonstrated that gender plays a critical role in strengthening disaster risk reduction and community resilience. In Indonesia, research conducted in Bandung showed that women act not only as disaster victims but also as effective risk communicators who facilitate preparedness activities, disseminate disaster information, and strengthen social networks within communities (Mulyasari & Shaw, 2013). Likewise, studies from Aceh revealed that gender mainstreaming within the Disaster-Resilient Village Programme significantly improved disaster preparedness by increasing women's participation in planning, preparedness training, and community-based response mechanisms (Oktari et al., 2021). At the international level, Gaillard et al. (2017) argued that disaster governance should move beyond viewing women merely as vulnerable groups, emphasizing instead their diverse capacities and agency in disaster risk reduction. These findings collectively indicate that integrating gender perspectives into disaster mitigation enhances adaptive capacity, strengthens social cohesion, and contributes to more sustainable community resilience. Nevertheless, most previous studies have primarily examined gender from the perspectives of participation, vulnerability, or institutional inclusion. Limited attention has been given to understanding how gender roles emerge through the interaction between biological adaptation, social structures, and mechanisms of social equilibrium, particularly within flood-prone communities in West Kalimantan. This gap forms the principal rationale and theoretical novelty of the present study.

Studies on flooding in West Kalimantan have so far been dominated by technical and ecophysical approaches, such as hydrological analysis, land degradation, and forest conversion. (Muliadi & Warsidah, 2024; Soeryamassoeka et al., 2023). Meanwhile, research that highlights the social dimensions and gender relations is still very limited, both in terms of quantity and theoretical framework. (Bahri et al., 2024; Hamidah, 2023). In fact, gender issues in disasters are not only about who is most affected, but also who has access to information, who is involved in mitigation planning, and who plays a role in the post-disaster recovery process (Novianti & Jiu, 2024; Wirayuda, n.d.). Therefore, this study attempts to fill this gap by combining a sociobiological approach, which views gender roles as the result of adaptive evolution to the environment, with social equilibrium theory which explains the ability of social systems to adapt to disturbances, and structural-functional theory which emphasizes the vital function of each social role in maintaining the stability and sustainability of society (Pratama et al., 2022).

Therefore, unlike previous studies that primarily focus on gender participation or disaster governance separately, this study integrates sociobiological theory, structural-functional analysis, and social equilibrium to explain how gender-based adaptive behaviors are formed, maintained, and transformed in community flood mitigation. This integrated theoretical perspective constitutes the main novelty of this research.

This interdisciplinary approach allows for a more comprehensive understanding that gender roles in disaster mitigation are not merely cultural constructs but also rooted in the adaptive needs of communities to their environments. In the context of increasingly complex climate change and ecological crises, social systems must be able to transform, including through an equal redistribution of strategic roles between men and women. If this transformation fails, structural inequalities will continue to create ineffective disaster management policies. Furthermore, the tendency for flood mitigation policies to be centered on local governments and formal institutions also neglects local, community-based practices that are largely driven by women, such as mutual cooperation activities, river flow monitoring, and emergency food provision. The lack of recognition of these social practices indicates that disaster mitigation has not been sensitive to the social capital of the community. (Bahri et al., 2024).

Thus, this research seeks to provide theoretical and practical contributions to the development of a gender-equitable, community-based, and adaptive flood mitigation approach to local socio-ecological structures. Mitigation success should not be measured solely by the number of embankments built or canals normalized, but by the extent to which all social elements, including women, are actively and equally involved in the entire mitigation process. This article argues that ecological disasters such as floods cannot be separated from power relations and social structures, so that their resolution requires an approach that is not only technical, but also sociological, ecological, and based on gender justice.

METHODS

This study employed a qualitative case study approach to explore gender roles in flood mitigation practices across flood-prone areas in West Kalimantan Province. Rather than focusing on a single district, the research was conducted in several locations representing different socio-ecological characteristics and flood experiences, namely Singkawang City, Sambas Regency, Kubu Raya Regency, Pontianak City, Sekadau Regency, and Mempawah Regency. These locations were selected purposively because they frequently experience flooding and represent diverse ecological settings, settlement patterns, and community adaptation practices. The multi-site case study design enabled the researchers to examine similarities and variations in gender-based mitigation strategies across different local contexts while maintaining an in-depth understanding of each case. The case study design was chosen because it provides a deep contextual understanding of the interrelationships between social structures, local policies, and gender participation in disaster risk reduction. Data collection was conducted through three main techniques: direct field observation, semi-structured interviews, and document analysis. (Miles, M. B., & Huberman, 1994). Observations were directed at understanding community social interactions in facing floods, including household preparedness practices, mutual cooperation mechanisms, and gender-based division of labor during the emergency response and post-disaster periods. (Albi Anggianto dan Johan Setiawan, 2018; Sugiyono, 2017)

Eleven participants were selected using purposive sampling, including women affected by the flood, community leaders, hamlet heads, and BPBD officers. This selection aimed to obtain a diversity of experiences and perspectives in understanding the dynamics of social roles and community responses to the flood. (Elvis F. Purba & Parulian Simanjuntak, 2012). Semi-structured interviews were used to elicit personal narratives about participants' experiences, perceptions, and involvement in the mitigation process, while providing flexibility to explore issues that emerged naturally within their social context. (Ramdhan, 2021). Eleven participants were selected through purposive sampling from six flood-prone locations across West Kalimantan, representing different social backgrounds, occupations, and experiences in flood mitigation. The participants consisted of housewives, farmers, community health workers, civil servants, teachers, traders, private-sector employees, and local residents. This diversity enabled the study to capture multiple perspectives on gender roles and community adaptation in flood mitigation.

Fieldwork was conducted from May to June 2025. Preliminary observations were undertaken in May 2025 to identify flood-prone communities, establish initial contact with local stakeholders, and understand the local disaster context. Semi-structured interviews were subsequently carried out between 12 and 27 June 2025, corresponding to the dates listed in the interview references. Documentary data, including reports issued by the West Kalimantan Regional Disaster Management Agency (BPBD), local government regulations, and disaster mitigation documents, were collected during the same period to support data triangulation. Conducting observations, interviews, and document analysis within the same research period ensured consistency in capturing community experiences and mitigation practices.

Document analysis was conducted on local regulations, BPBD policy reports, and disaster mitigation training programs to strengthen data triangulation and enhance the internal validity of the findings. Data analysis followed the interactive model of Miles and Huberman (1994), which includes three main stages: data condensation, data presentation, and conclusion drawing or verification. Interview transcripts and field notes were categorized based on the research focus and themes that emerged during the analysis process. Descriptive summaries and direct quotes from participants were used to strengthen the interpretation of the results. Research validity was maintained through triangulation between data sources, member checking with key informants, and peer discussions within the research team to reduce interpretative bias. All participants provided voluntary informed consent prior to data collection. This study adhered to the ethical code of qualitative social research, including maintaining the confidentiality of participants' identities, privacy, and information security. (Matthew B. Miles dan A. Michael Huberman, 1994).

Analytically, this research utilizes the lens of sociobiological theory, a structural-functional framework, and the concept of social equilibrium, integrated from the formulation stage to the interpretation of the data. This approach is used to explain how gender roles are formed through biological adaptation and social structures in the face of natural disasters. (Wilson, 2000). Social equilibrium theory complements the analysis by explaining the mechanisms by which communities reorganize their social functions amidst crises, as well as how the distribution of gender roles contributes to maintaining social stability and sustainability post-flood (Alexander, 2021; Parsons, 1952). As an empirical illustration, this study also highlights the importance of women's roles in building adaptive capacity and resilience to flooding at the community level, showing how women can become strategic actors in local mitigation based on their experiences and social practices.

RISULTS

Sociobiology; Gender's Natural Adaptation and Responsibility to the Environment

The people of West Kalimantan demonstrate a high level of ecological awareness in responding to environmental dynamics, particularly the periodic flooding. These responses are not merely reactive but also reflect proactive, collective, and adaptive actions that have been internalized in daily life. The resulting adaptation patterns encompass self-protection, risk mitigation, and the sustainable maintenance of family and social well-being. These strategies are implemented through practical steps such as preparing safe places for valuables, maintaining household activities during floods, and cleaning up the environment after the water recedes. This pattern demonstrates a structured yet flexible social system, where each family member plays a distinct but complementary role according to their capacity and the situation. Such ecological adaptation is not only a form of adjustment to natural conditions but also a manifestation of collective awareness and social solidarity that strengthens community resilience in the face of recurring disasters.

One informant, U.A.A., a housewife from Singkawang, explained her family's routine in dealing with the periodic flooding in her area:

"Before the flood came, we usually moved our belongings to higher ground. During the flood, we continued our activities as usual. After the flood receded, we all cleaned the house because mud had accumulated in the yard." (Interview with U.A.A., 2025)

Uli's U.A.A.'s narrative emphasized that ecological adaptation not only protects physical assets but also maintains the family's psychological and social well-being. Each family member has a distinct but complementary role in this adaptive routine. Safea, S.F., a street vendor, highlighted the importance of dividing labor based on physical ability and experience:

"Before the flood, we secured valuables, during the flood, we evacuated to a safe place, and after the flood, we cleaned the house. We helped each other; women cleaned the house, men lifted heavy objects." (Interview with S., S.F., 2025).

This statement demonstrates that the gender division of labor is practical and functional, not symbolic. Women tend to handle domestic tasks, such as cleaning the house and preparing meals, while men do the heavy physical labor. However, this pattern is flexible, adapting to the situation and emergency needs. This was emphasized by H.S., a farmer from Sakaro Hamlet:

"If rainfall increases, we prepare to move things to a higher part of the house and build emergency shelves. During floods, we help each other. Sometimes women also help carry things, and men cook. The most important thing is that children and pregnant women are safe." (Interview with H.S., 2025).

These findings demonstrate that gender-based ecological adaptation is dynamic, with gender role boundaries expanding as conditions dictate. This flexibility allows communities to respond effectively to emergencies while maintaining the social and psychological stability of families. R., a community health center staff member from Sambas Regency, added a collective dimension to adaptation:

"During floods, women help prepare food for the family and surrounding community, while men build emergency platforms and bridges. After the flood, we work together to clean the house." (Interview with R., 2025).

This quote demonstrates that ecological adaptation involves not only asset protection and safety, but also the collective maintenance of community well-being. Women and men work together to mitigate the impacts of flooding, complementing each other and affirming the ongoing intergenerational transfer of knowledge. Overall, these findings demonstrate that the role of gender in ecological adaptation is complex and multifaceted. Adaptation is not simply an individual behavior, but rather the result of the interaction between biological capabilities, social experiences, and the pragmatic needs of the community. These patterns form resilient, effective, and sustainable adaptive strategies, ensuring family safety while maintaining social networks and community solidarity. Thus, a sociobiological approach helps explain why gender-based adaptive behaviors emerge, how they are inherited, and how they contribute to maintaining the socio-ecological resilience of the people of West Kalimantan. Gender-based ecological adaptation is not simply a response to disasters but also an integral and adaptive life strategy, integrating biological, social, and cultural experiences to support community safety, well-being, and sustainability.

Structural-Functional; Role Division and Social Coordination

Research results show that West Kalimantan communities cope with floods using structured and adaptive social mechanisms, combining formal and informal practices. Each phase of flood management, pre-flood, during, and post-flood, is carried out with specific tasks tailored to the capabilities of family members, reflecting a pattern of effective and minimally conflicting social coordination. Dwi Kurniawan Budi D.K.B., a private employee, emphasized the importance of systematic disaster preparedness:

“Before the flood, I sought information from the BMKG (Meteorology, Climatology, and Geophysics Agency), packed my belongings, and saved emergency numbers. During the flood, I turned off the electricity and sealed the gaps in the house to prevent animals from entering. After the flood, we cleaned up the debris and monitored for possible follow-up flooding.” (Interview with D.K.B., 2025).

This statement demonstrates the integration of modern scientific knowledge and local practices, forming a pattern of adaptive coordination. Information from the BMKG is combined with concrete actions at home, such as securing electricity and sealing gaps in the house, thereby minimizing physical risks. Men's roles in the community emphasize physical protection and security, as explained:

“I always check with the BMKG (Meteorology, Climatology, and Geophysics Agency), make sure the electricity is safe, and clean up after the water recedes. We men usually stay on guard at night when the water rises.” (Interview with V., 2025).

This role demonstrates not only physical preparedness but also a social responsibility to keep families and communities safe. Men act as the frontline in mitigating physical risks, while women tend to emphasize domestic stability, logistics, and family health, as explained by Deby Peranita D.P., a civil servant:

“I prepare food supplies, secure important documents, and ensure electrical appliances are safe. During the flood, I take care of my family's health. After the flood recedes, we clean the house and the environment.” (Interview with D.P., 2025).

This role of women emphasizes the importance of internal family and community management, including maintaining health, food, and important documents. These roles complement men's roles, forming a holistic and effective system of social coordination. Harmonious coordination is evident in the family of Ihamudin I., a teacher in Sekadau:

“The men prepare emergency supplies, the women prepare food and medicine. During floods, I evacuate the family, my wife looks after the children and ensures everyone is safe. After the flood, we clean the house together.” (Interview with I., 2025).

This case highlights flexible gender interactions, where each family member plays a specific role but still collaborates in emergency situations. This mechanism ensures smooth risk mitigation while strengthening social ties and family solidarity. Other informants, such as Rania R., a community health center staff member, and Achmad Sahroni A.S., a grocery seller, emphasized that cross-gender mutual cooperation is a social norm:

“The division of tasks runs smoothly because everyone is aware of their respective responsibilities. There are no conflicts; everyone helps each other according to their abilities.” (Interview with R., 2025).

These findings demonstrate that gender-based social structures are not rigid, but rather adaptive and flexible. This structured yet dynamic division of roles ensures that the entire community can effectively cope with flooding, reducing the potential for conflict, and increasing collective efficiency. Overall, the Structural-Functional approach explains how gender role patterns and social coordination shape community resilience. Each member has a clearly defined role, but flexibility allows for adjustments as the situation demands, enabling the community to minimize risk, maintain social stability, and implement post-flood recovery quickly and effectively. This system reflects a functional balance between individual, family, and community responsibilities, which is a crucial foundation for community-based disaster mitigation.

Social Equilibrium; Recovery, Balance, and Mutual Cooperation

Interviews indicate that communities in West Kalimantan developed a natural social recovery mechanism, or social equilibrium, that emerged immediately after the flood. This mechanism emphasized the collective participation of all residents, without rigid gender roles, allowing recovery activities to

proceed systematically and sustainably. Recovery activities included environmental cleanup, flood residue management, and prevention of further flooding. U.A.A., a housewife from Singkawang, emphasized the involvement of all residents in the recovery process:

"Everyone participated in the cleanup; no one remained silent because the mud entered all the houses." (Interview with U.A.A., 2025).

This quote emphasizes that post-flood mutual cooperation was carried out by the entire community, not limited to one family or group, and became a routine that emerged as a collective response to environmental damage. Hery Suhendra H.S., a farmer from Sakaro Hamlet, explained the community's sequence of actions after a flood:

"If the flood hasn't receded, we evacuate to a higher-level family home. After the water recedes, we clean the house together so we can live in it again." (Interview with H.S., 2025).

H.S.'s statement demonstrates an adaptive post-flood sequence: temporary evacuation is followed by collective physical restoration of the house and environment. This activity involves not only immediate family members but also neighbors and local residents, forming a broad social support network. Safea S.F., a street vendor, and Rani R., a community health center staff member, emphasized that the division of labor is based on practical skills, not simply gender:

"We work together to pack and clean. Men carry things, women help cook and wash clothes." "After the flood, we clean together. Men clean the ditches, women clean the house and yard." (Interview with R., 2025).

This quote demonstrates the flexibility of gender roles during recovery activities. Men tend to handle heavy physical labor such as lifting objects or cleaning drains, while women prepare domestic needs and clean the house and yard. However, both groups work synergistically, emphasizing effective cross-gender coordination. Jali-J., a senior farmer, added a post-flood anticipation dimension:

"Cleaning the house of debris left over from the flood, monitoring the possibility of further flooding, and cleaning the drains to prevent blockages." (Interview with J., 2025).

This statement indicates that recovery activities do not stop with the initial clean up but also include preventive measures to mitigate the risk of subsequent flooding. These activities are carried out collectively and repeatedly, becoming part of the community's experience in dealing with the annual flood cycle.

Overall, the interviews indicate that post-flood mutual cooperation serves to restore the physical condition of homes and the environment, while strengthening social solidarity, support networks, and trust among residents. The flexibility of gender roles and collective participation are key characteristics of this recovery mechanism. All residents, both men and women, contribute according to their practical abilities, ensuring a rapid, efficient, and comprehensive recovery process. These findings also demonstrate that post-flood community resilience depends not only on formal structures, but also on everyday practices built through repeated experiences, collective awareness, and adaptive social coordination. The participation of all residents in cleanup and physical environmental restoration activities is an important indicator that social equilibrium is achieved through social interaction, solidarity, and cross-gender mutual cooperation.

DISCUSSION

Sociobiology and Gender Adaptation

Interview data indicates that the people of West Kalimantan developed holistic, collective, and local experience-based ecological adaptation strategies, aimed not only at protecting themselves and their assets but also at maintaining the social and psychological well-being of their families. From a sociobiological perspective, this behavior can be understood as an evolutionary adaptation, in which gender roles emerged as a mechanism that increased the chances of survival and community resilience. Findings from the U.A.A. emphasize that ecological adaptation encompasses pre-flood, flood-time, and post-flood phases, carried out systematically and involving all family members (Hamidah, 2023). Activities such as moving belongings to higher ground, maintaining daily routines during floods, and working together to clean the house after the flood recedes indicate that this adaptation is collective and repetitive, becoming part of social habits passed down through generations. This indicates that adaptive behavior is driven not only by physical conditions but also by social experiences and understanding of environmental risks (Bahri et al., 2024)

The gendered division of labor is clearly evident in Safea's statement. Women handle domestic and logistical tasks, such as cleaning and preparing meals, while men undertake the heavier physical labor. However, this pattern is flexible and situational, adapting to emergency conditions. This flexibility is important because it demonstrates that gender-based ecological adaptation is not simply a biological determinism, but rather a complex interaction between physical capacity, social experience, and the pragmatic needs of the community. One analysis confirmed that the boundaries of gender roles can expand during emergencies: women help lift goods, men cook, and the safety of children and pregnant women remains the primary priority. This demonstrates that ecological adaptation is dynamic and responsive, combining ecological awareness, risk mitigation strategies, and maintaining socio-psychological stability. This flexibility also indicates that communities develop effective adaptive mechanisms to deal with environmental uncertainty, while minimizing the potential for internal conflict because each member can adjust their role as needed (Gaillard et al., 2017).

The collective dimension is reflected in Rani's narrative, which emphasizes cross-gender mutual cooperation. Women prepare meals for their families and surrounding communities, while men construct emergency physical structures such as platforms and bridges. This collaboration demonstrates that ecological adaptation is not limited to the nuclear family but also involves broader social networks, strengthening solidarity, and ensuring intergenerational knowledge transfer. In other words, these adaptive behaviors are not simply individual responses, but social strategies that are inherited and maintained. These findings are consistent with previous studies demonstrating that women play a central role in strengthening household resilience and community preparedness in disaster-prone areas. Mulyasari and Shaw (2013) found that women in Bandung functioned as effective risk communicators by disseminating preparedness information and reinforcing social networks, thereby enhancing collective disaster resilience. Similarly, Oktari et al. (2021) reported that gender mainstreaming within the Disaster-Resilient Village Programme in Aceh increased community preparedness through women's active participation in disaster planning and response. However, unlike these studies, which primarily emphasize women's participation in disaster governance, the present study reveals that gender adaptation is also shaped by the interaction between biological capacities, accumulated local experiences, and adaptive social practices. This finding extends existing knowledge by demonstrating that sociobiological adaptation and social learning operate simultaneously in forming resilient gender roles within flood-prone communities.

These findings confirm that gender-based adaptation is multifaceted. It encompasses physical preparedness, social protection, flexible division of labor, and maintaining community solidarity (Hamidah, 2024). From a sociobiological perspective, these behaviors reflect the interaction between biological predisposition and social learning, resulting in a holistic adaptive strategy. Ecological adaptation is not merely a temporary response to disasters, but an integral part of community life systems, integrating biological, social, and cultural experiences to achieve safety, well-being, and sustainability (Parasasri & Nurhaeni, 2021)

In conclusion, the data demonstrates that gender-based ecological adaptation in West Kalimantan is a complex and resilient strategy, combining role flexibility, collective preparedness, and intergenerational knowledge transfer. A sociobiological approach explains the evolutionary basis of this behavior, but the social, cultural, and practical contexts determine how these strategies are implemented. Thus, this adaptation is not simply a response to disaster, but an integral and sustainable life strategy, ensuring the resilience of families and communities to recurring environmental risks.

Structural-Functional and Social Coordination

Research findings indicate that the people of West Kalimantan cope with flooding through structured, functional, yet adaptive social mechanisms. This approach aligns with the structural-functional perspective, which emphasizes that each part of the social system, in this case individuals and groups, has specific, complementary functions to maintain balance, sustainability, and community resilience (Pratama et al., 2022). This mechanism is not rigid; the flexibility of roles allows communities to adjust mitigation strategies according to flood intensity, individual capacity, and situational needs. D.W.K.'s findings underscore the importance of systematic preparedness. Before a flood, he sought information from the BMKG (Meteorology, Climatology, and Geophysics Agency), packed valuables, and saved emergency numbers. During the flood, mitigation measures included turning off electricity and sealing gaps in the house to prevent animals from entering. After the flood, activities focused on clearing debris and monitoring for possible follow-up flooding. This pattern demonstrates the integration of modern scientific knowledge with local practices, forming an adaptive coordination that combines external information with concrete actions on the ground, thus minimizing physical risks and better planning community responses. (Akramia Syafirati, 2023; Trinirmalaningrum, Lien Sururoh, 2018).

Men's roles, as explained by V, emphasize physical protection and security. Men act as the vanguard of risk mitigation, safeguarding family and environmental safety, and ensuring the continuity of community activities during floods. These tasks are not only physical but also have a social dimension, as maintaining the safety of others is a collective responsibility recognized by social norms. In contrast, women emphasize domestic stability, logistics, and family health, as explained by D.B. They manage food supplies, important documents, electrical equipment, and the health of family members. These functions are not simply traditional domestic chores, but part of a holistic social coordination system, ensuring the stability and security of the entire family unit.

Harmonious gender interactions are evident in Ilhamudin's family. Men prepare emergency supplies, while women prepare food and medicine. During floods, men evacuate families, while women look after children and ensure safety. After the flood, cleanup is carried out together. This case highlights the flexibility of gender roles in social systems, where each member has specific responsibilities but still collaborates to achieve collective goals. This coordination mechanism not only improves the efficiency of risk mitigation but also strengthens family solidarity and social cohesion (Parasari & Nurhaeni, 2021).

The adaptive division of responsibilities identified in this study also supports broader findings in disaster governance literature. Rather than reinforcing rigid gender hierarchies, recent studies argue that flexible and complementary role allocation enables communities to respond more effectively to environmental uncertainty. Gaillard et al. (2017) emphasized that disaster risk reduction should recognize both women's and men's capacities instead of categorizing one group solely as vulnerable. Likewise, recent research on community-based disaster risk reduction in Indonesia highlights that resilience is strengthened when disaster management incorporates inclusive participation and locally embedded social capital. In the context of West Kalimantan, the present findings demonstrate that gender complementarity functions not as a fixed cultural norm but as an adaptive social mechanism that maintains community stability while facilitating rapid disaster response and recovery.

The norm of cross-gender mutual cooperation is a key mechanism for maintaining social balance. Informants such as R. and A.S. emphasized that the division of tasks runs smoothly because all residents are aware of their respective responsibilities. There are no conflicts, and everyone helps each other according to their abilities. These findings indicate that gender-based social structures are dynamic and adaptive, able to adjust to emergency situations without causing internal tension. Cross-gender mutual cooperation also strengthens social networks, community solidarity, and a sense of collective responsibility, which are essential elements in community-based disaster mitigation. This highlights several important points. First, the social structure of the community serves as an adaptive mechanism that allows the community to adjust roles and responsibilities based on the situation. This flexibility maintains a balance between individual functions and collective interests. (Pratama et al., 2022). Second, the division of gender roles is complementary, with men and women having different but complementary roles, increasing the efficiency of risk mitigation and family stability. Third, the integration of local practices and scientific information demonstrates a community's ability to leverage internal and external resources to enhance disaster resilience. Fourth, cross-gender mutual cooperation serves as a social mechanism that reduces the potential for conflict, strengthens solidarity, and ensures effective post-flood recovery.

Overall, the structural-functional approach explains how patterns of social coordination and gender role allocation shape the social and ecological resilience of communities. This system reflects a functional balance between individual, family, and community responsibilities. The flexibility and adaptability of roles enable communities to respond quickly to changing situations, minimize risks, maintain social stability, and ensure effective post-flood recovery. Thus, gender-based social coordination is not only a disaster mitigation strategy but also a crucial foundation for building resilient, adaptive, and sustainable communities. (Djumaty & Hayam Dey, 2023).

Social Equilibrium and Collective Recovery

Data analysis shows that communities in West Kalimantan developed post-flood recovery mechanisms based on the principle of social equilibrium, where community resilience is maintained through collective participation, cross-gender mutual cooperation, and adaptive social coordination. This mechanism emphasizes that post-disaster recovery is not merely about physically cleaning homes or the environment, but also a social process that strengthens solidarity, trust, and support networks among residents. Recovery activities demonstrate that social equilibrium is dynamic, flexible, and adapts individual roles according to practical needs, capacities, and emergency conditions (Shofia, 2021; Wilson, 2000).

Collective participation is a key characteristic of this mechanism. All community members are actively involved in recovery activities, regardless of rigid gender boundaries. This demonstrates that social resilience relies not only on formal structures, but also on local practices that emerge through repeated

experiences with flooding. Collective participation creates shared awareness, fosters a sense of environmental responsibility, and strengthens relationships among residents, creating a solid social network. The social interactions that occur during the recovery process help maintain community stability, reduce the potential for conflict, and foster a strong culture of solidarity (Muliadi & Warsidah, 2024). Post-flood recovery mechanisms are systemic and adaptive, with a structured sequence of actions. After a disaster strikes, communities prioritize temporary evacuation to ensure the safety of family members, especially children and vulnerable residents. Afterward, physical recovery activities are carried out collectively, including cleaning houses, yards, and drains. These activities are not limited to the immediate household but involve neighbors and surrounding communities, forming a broad support network.

The emphasis on collective recovery observed in this study is also consistent with recent discussions on community resilience that position social capital, mutual trust, and collective action as fundamental elements of post-disaster recovery. International evidence suggests that communities with stronger social cohesion recover more rapidly because cooperation reduces institutional dependence and accelerates local decision-making. Nevertheless, the findings from West Kalimantan provide an additional contribution by illustrating that social equilibrium is sustained not only through community solidarity but also through adaptive gender interactions that continuously evolve according to environmental conditions. This demonstrates that resilience is maintained through the integration of ecological adaptation, social coordination, and gender complementarity rather than through physical recovery alone. This iterative process becomes part of the community's experience, establishing an efficient and sustainable response pattern (Hamidah, 2023)

Gender role flexibility is a crucial aspect of recovery strategies. Men tend to handle heavy physical labor, such as lifting or cleaning drains, while women focus on domestic management, including preparing household needs, cleaning the house, and maintaining the health of family members. Despite these differences in tasks, both groups work synergistically, emphasizing effective cross-gender coordination. This flexibility allows communities to adjust individual roles based on their abilities and the urgency of the situation, allowing all residents to contribute optimally. Beyond physical recovery, post-flood activities also emphasize a preventative dimension. Communities collectively clean up flood debris, monitor for potential follow-up flooding, and maintain drains to prevent clogging. This approach demonstrates that post-flood recovery is proactive and sustainable, rather than simply a reactive response to the damage (Soeryamassoeka et al., 2023). These preventive activities reduce the risk of subsequent flooding and shape local experiences that serve as a learning basis for future generations. This strategy demonstrates that socio-ecological resilience arises not only from emergency measures but also from adaptive practices integrated into community routines. Overall, the post-flood recovery mechanisms in West Kalimantan exhibit a multidimensional character. From a physical perspective, recovery ensures that homes, neighborhoods, and waterways are restored to a safe and proper condition. From a social perspective, mutual cooperation (gotong royong) strengthens networks of support, solidarity, and trust among residents. From a psychological perspective, active involvement in collective activities fosters a sense of security, minimizes post-disaster anxiety, and enhances community resilience. This combination confirms that social equilibrium is the result of an adaptive interaction between individual capabilities, social experiences, and the needs of the community as a whole. (Bahri et al., 2024; Pratama et al., 2022)

Post-flood community resilience relies heavily on local practices, repeated experiences, social coordination, and collective awareness. Adaptive interactions, collective participation, and preventive strategies are key to creating sustainable and resilient resilience. These mechanisms reflect a functional balance between individual, family, and community responsibilities, while ensuring effective physical and social recovery. In other words, post-flood recovery is not simply about mitigating damage, but rather an integral life strategy for maintaining community well-being, safety, and sustainability. Collective recovery practices in West Kalimantan confirm that social equilibrium is formed through a combination of adaptive coordination, cross-gender participation, and repeated local experiences. These mechanisms not only mitigate the physical impacts of flooding but also strengthen the community's social, psychological, and ecological capacities, enabling it to weather the annual disaster cycle in a sustainable and resilient manner (Alexander, 2021; Parsons, 1952; Wilson, 2000).

CONCLUSION

This research confirms that flood mitigation in West Kalimantan cannot rely solely on a technical-structural approach, as its effectiveness is limited without considering social dynamics and gender roles. Women are not only affected but also key actors in post-flood recovery, managing domestic logistics, family health, and community well-being, while men handle physical labor. These role patterns are flexible and adaptive, adapting to the needs of emergency situations, thus forming a resilient collective strategy.

The structural-functional approach demonstrates that gender-based social coordination creates a balance between individual, family, and community responsibilities. Cross-gender mutual cooperation strengthens solidarity, minimizes conflict, and ensures effective post-flood recovery. Collective recovery mechanisms emphasize the participation of all residents, preventive practices, and inherited local experiences, building sustainable socio-ecological resilience.

Overall, effective flood mitigation in West Kalimantan requires a combination of technical approaches, gender-based ecological adaptation, social coordination, and collective recovery. This strategy not only protects physical assets but also strengthens the social, psychological, and ecological capacities of communities, enabling them to cope with the annual flood cycle in a resilient and sustainable manner.

Despite these contributions, this study has several limitations. First, the research involved a relatively limited number of participants from selected flood-prone areas in West Kalimantan, which may not fully represent the diversity of socio-cultural conditions across the province. Second, the study employed a qualitative case study approach, emphasizing an in-depth understanding of community experiences rather than producing findings that can be statistically generalized. Future studies are therefore encouraged to incorporate broader geographical coverage, larger participant samples, and mixed-methods approaches to examine gender dynamics in disaster mitigation more comprehensively. From a practical perspective, the findings suggest that the West Kalimantan Regional Disaster Management Agency (BPBD), local governments, and other disaster management stakeholders should strengthen gender-responsive disaster risk reduction by ensuring the active involvement of women and men in disaster planning, preparedness training, emergency response, and post-disaster recovery programmes. Community-based mitigation initiatives should also recognize and integrate local knowledge, mutual cooperation practices (gotong royong), and adaptive gender roles as strategic resources for enhancing community resilience. Such measures are expected to contribute to more inclusive, adaptive, and sustainable flood mitigation policies in West Kalimantan.

INTERVIEWED PARTICIPANTS

The qualitative data presented in this study were obtained through semi-structured interviews with eleven participants from flood-prone communities across West Kalimantan. To maintain transparency while protecting participants' privacy, each participant is identified using initials throughout the manuscript.

U.A.A. – Housewife, Singkawang City, West Kalimantan (Interview: 12 June 2025).
S.F. – Mobile trader, Singkawang City, West Kalimantan (Interview: 13 June 2025).
H.S. – Farmer, Sakaro Hamlet, Sambas Regency, West Kalimantan (Interview: 16 June 2025).
R. – Community health center staff, Sambas Regency, West Kalimantan (Interview: 17 June 2025).
D.K.B. – Private-sector employee, Pontianak City, West Kalimantan (Interview: 20 June 2025).
V. – Community member, Kubu Raya Regency, West Kalimantan (Interview: 21 June 2025). D.P. – Civil servant, Pontianak City, West Kalimantan (Interview: 22 June 2025).
I. – Teacher, Sekadau Regency, West Kalimantan (Interview: 24 June 2025).
R.A. – Community health center staff, Sekadau Regency, West Kalimantan (Interview: 25 June 2025).
A.S. – Grocery trader, Sekadau Regency, West Kalimantan (Interview: 25 June 2025).
J. – Senior farmer, Mempawah Regency, West Kalimantan (Interview: 27 June 2025).

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