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Building Resilient Food Systems: Government Community Collaboration in Flood Mitigation

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Abstract

Palembang, one of Indonesia's major urban centers, is increasingly affected by recurrent flooding that severely disrupts local food systems. As a low-lying delta city intersected by the Musi River, Palembang faces compounded challenges due to rapid urban expansion, poor drainage infrastructure, and climate-induced rainfall variability. These factors contribute not only to physical flooding but also to food insecurity, particularly among poor urban communities who depend on fragile food supply chains and informal markets. This study investigates how collaborative governance between local authorities and community stakeholders in Palembang can contribute to building resilient food systems amid recurrent flood risks. Using a case study approach, it analyzes local policy responses, community-led initiatives such as floating vegetable gardens, and urban farming on flood-resilient land. The findings indicate that while municipal disaster management agencies provide early warning and evacuation support, food access and distribution during floods are primarily sustained by grassroots networks and community-organized food banks. The paper emphasizes the importance of institutionalized support for community-based adaptation, integrated spatial planning utilizing flood-risk mapping, and policy frameworks that acknowledge food as a vital component of urban disaster preparedness. Palembang serves as a microcosm for examining the broader implications of decentralized disaster governance and food resilience in rapidly urbanizing flood-prone cities.

Keywords: Food Security, Community-based Governance, Urban Agriculture, Climate Adaptation, Disaster Risk Management

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Introduction

Global climate change has intensified the frequency and severity of hydrometeorological disasters, such as floods, increasingly endangering critical systems, including food security, in vulnerable urban settings (Fekete, 2024). Rapid urbanization, inadequate infrastructure, and socio-economic inequalities further amplify the impact of flooding events on the accessibility, availability, and stability of food supply chains (Ikudayisi, 2024; Matooane et al., 2025). In Indonesia, a country regularly impacted by extreme weather events, floods account for over 30% of annual disaster occurrences, often disrupting agricultural production, transportation networks, and urban food markets (Langlois et al., 2024; Nugroho et al., 2022).

Palembang exemplifies this risk as one of Indonesia's urban centers prone to recurrent flooding due to its lowland deltaic geography along the Musi River (Fraiture et al., 2017; Salsabila et al., 2024). With urban sprawl and reduced natural drainage capacity, floods increasingly interfere with food provisioning mechanisms for vulnerable populations (Baig et al., 2024; Hemmati et al., 2021; Seemuangngam & Lin, 2024). Disruptions in local logistics, declining household purchasing power, and poor emergency preparedness further threaten urban food systems during such events (Liu et al., 2025; Reed et al., 2022).

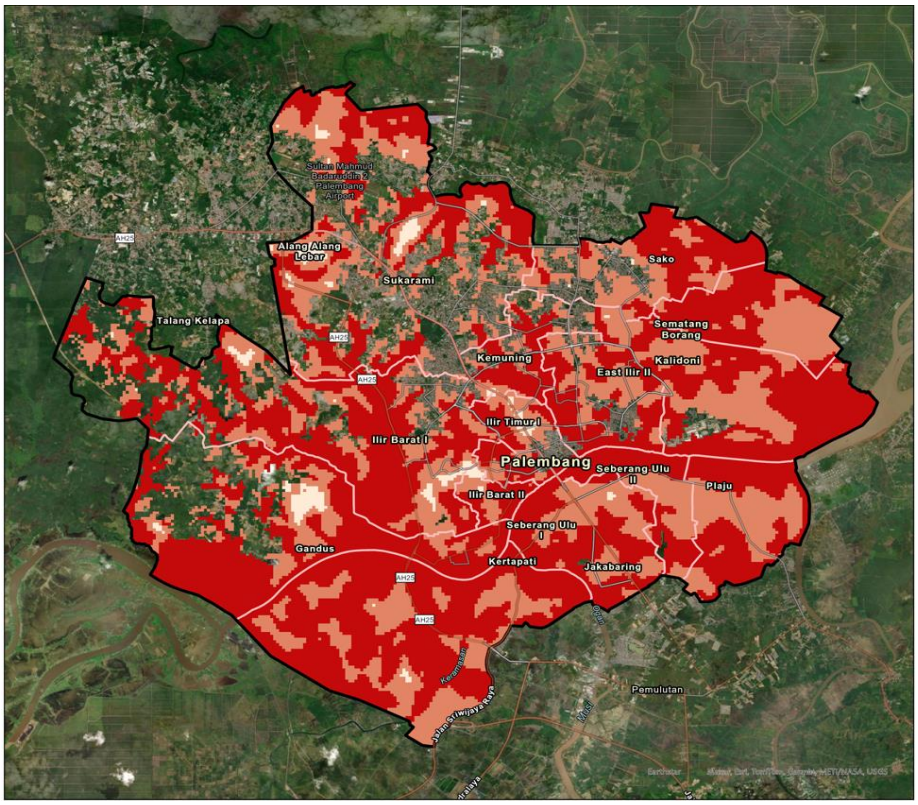

Figure 1. Flood hazard index map of Palembang. Source: results of geospatial data analysis using GIS software, 2025

Based on Figure 1 from the flood hazard index map of Palembang, it can be observed that the city faces significant flood risks, particularly in certain areas. The map indicates the varying levels of flood hazards across the city, categorized into three distinct zones: high, moderate, and low flood risk. The red areas, representing the high flood hazard zones, are the most vulnerable parts of Palembang. These areas are prone to frequent and severe flooding, which often destroys agricultural land and infrastructure and causes significant disruption to daily life. These high-risk areas, which

include neighborhoods such as Ilir Timur, Ilir Barat, and Seberang Ulu, are critical hotspots where the impact of floods can be devastating, not only for the local population but also for food production and food security. The frequent flooding in these areas threatens the sustainability of local agriculture and makes it difficult for the food supply chain to function effectively, thereby jeopardizing food security.

The orange areas, which indicate moderate flood risk, suggest that while flooding in these regions may not occur as frequently or as severely as in the high-risk zones, they are still susceptible to significant water-related disruptions. These areas often experience periodic flooding, which can still have a detrimental impact on local agriculture and the transportation of food, leading to delays and increased costs. The light brown areas, representing low flood risk, are relatively less prone to flooding but are not immune to it. These zones, while generally safer from regular inundation, can still experience localized flooding during extreme weather events or heavy rainfall. Despite the lower risk, these areas could still face challenges in the future if flood management and urban planning are not adequately addressed.

In conclusion, the map of the flood hazard index reveals that Palembang's central and southern areas are especially vulnerable to flooding, with Ilir Timur and Seberang Ulu being some of the most affected regions. This highlights the urgent need for targeted flood mitigation measures in these high-risk areas to protect both food systems and the livelihoods of the residents. Addressing the flood risks through effective government-community collaboration, improving infrastructure, and ensuring sustainable agricultural practices are essential for safeguarding food security and building resilience in these vulnerable zones.

Food security, as defined by the FAO, is a condition in which all people always have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs for a healthy life (Pérez-Escamilla, 2024). However, food systems are increasingly fragile under the compounded pressure of climate change and inadequate risk governance (Mirzabaev et al., 2023; Ouyang et al., 2023). In urban flood scenarios, production losses, access barriers, and price spikes collectively destabilize food availability, especially for low-income households (Asl et al., 2025; Echendu, 2022; Loreti et al., 2022).

To mitigate these impacts, building resilient food systems becomes a necessity (Ebissa & Desta, 2022; Handayani et al., 2024; Mugagga et al., 2025). Resilience in this context refers to the ability of food systems to anticipate, absorb, adapt to, and recover from climate-related shocks while maintaining core functions (Zurek et al., 2022). Yet, strengthening resilience requires more than technological intervention—it calls for inclusive, participatory governance structures that integrate local knowledge, cross-sectoral coordination, and community empowerment (Paganini et al., 2025).

A growing body of research underscores the significance of community-based governance in disaster risk reduction (Dwirahmadi et al., 2023; Ruslanjari et al., 2024). This approach emphasizes the active role of local actors in decision-making, resource mobilization, and adaptive responses before, during, and after disasters (Elkady et al., 2024; Karunarathne, 2024; Turner-Walker, 2023). In Palembang, community-led urban farming initiatives, floating food gardens, and local food banks have emerged as grassroots responses to mitigate the adverse effects of floods on daily food access (Junaidi et al., 2024; Siaga & Lakitan, 2021). Such initiatives demonstrate that localized, flexible strategies often outperform centralized responses in emergency contexts.

At the same time, government policies and institutional support remain critical in mainstreaming community innovations into official disaster management frameworks (Lassa et al., 2022; Supriatna et al., 2023). Studies have found that hybrid governance models, where state actors collaborate with community networks, lead to more effective, context-sensitive disaster responses and long-term food security(Clark-Ginsberg et al., 2022; Yasmin et al., 2022).

Furthermore, the application of Geographic Information Systems (GIS), climate mapping, and landscape approaches offers powerful tools for identifying risk hotspots, targeting vulnerable populations, and planning resilient infrastructure (Dimasaka et al., 2024; Jumadi et al., 2024; Nalarsih

et al., 2023). These tools, when combined with bottom-up data from community assessments, create an integrated framework for urban food resilience planning (Liddy et al., 2023).

This article aims to explore the multifaceted dimensions of building resilient food systems in flood-prone cities, focusing on the collaborative roles of government institutions and local communities (Ambily et al., 2024; Vidal Merino et al., 2021; Wolff et al., 2021). Drawing on the case of Palembang and supported by a comprehensive review of global literature, it proposes a model of food governance that bridges policy, practice, and community agency to reduce disaster vulnerability and ensure equitable access to food during flood crises (Abdillah et al., 2025; Boossabong, 2017; Mugari et al., 2025). By advancing a dialogue between empirical case studies and theoretical perspectives, this research contributes to the ongoing effort to create food systems that are not only technically robust but also socially just and ecologically sustainable.

Research Methods

This research focuses on the role of government-community collaboration in enhancing food system resilience through flood mitigation strategies in Palembang, Indonesia. Palembang, a city prone to frequent flooding, faces significant challenges to its food security, agriculture, and local economy due to the impact of climate change and inadequate urban flood management. The study investigates the role of collaborative efforts between local governments and communities in mitigating flood impacts and enhancing the local food system. By adopting a qualitative research approach, the study aims to provide deeper insights into the lived experiences of stakeholders involved in flood management and to uncover the social and cultural dynamics that influence the success of mitigation efforts.

This study follows a structured qualitative research approach to explore government-community collaboration in flood mitigation and food system resilience in Palembang. The research will be conducted in the following stages:

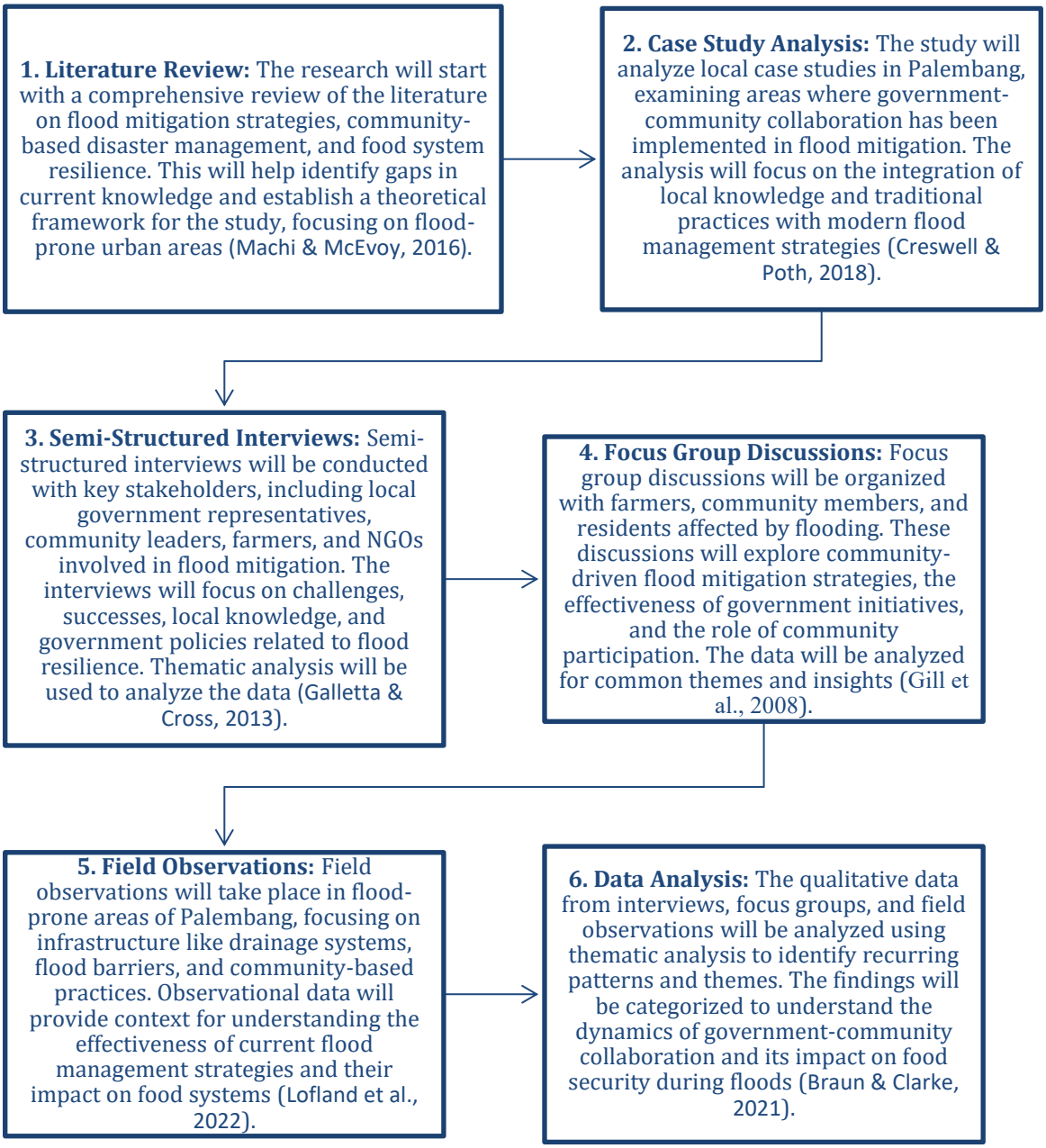

Figure 2. Research Stages. Source: Processed by researchers, 2025

Based on the stages (figure 2) of the research process in the image, the qualitative data from interviews, focus groups, and field observations will be analyzed using thematic analysis to identify recurring patterns and themes. The findings will be categorized to understand the dynamics of government-community collaboration and its impact on food security during floods. To validate the findings, workshops will be held with community members, local government officials, and experts in flood risk management. These workshops will allow for feedback and discussion on the study's conclusions and help develop practical recommendations for improving flood mitigation and food system resilience in Palembang.

By focusing exclusively on qualitative methods, this research aims to provide an in-depth understanding of the role of government-community collaboration in flood mitigation efforts in Palembang. Through interviews, focus groups, and case studies, the study will uncover the social dynamics, challenges, and successes of flood management strategies, ultimately contributing valuable insights for policymakers, community leaders, and practitioners working to build more resilient food systems in flood-prone areas.

Results and Discussion

The study of government-community collaboration in flood mitigation and its impacts on food system resilience in Palembang reveals the complexities of urban flood risk management in flood-prone regions. The results presented here combine qualitative data from interviews, focus groups, and field observations, along with quantitative findings derived from the flood hazard index and food security assessments. This section discusses the relationship between flood risks, food security, and the effectiveness of community-based initiatives and government responses in Palembang.

1. Flood Hazard Index and Vulnerability in Palembang

The flood hazard index for Palembang reveals significant flood risks, particularly in the central and southern regions of the city. Data collected from the flood hazard map (as shown earlier) indicate that:

- High flood risk zones are mainly concentrated in the central areas of Palembang, including neighborhoods such as Ilir Timur, Ilir Barat, and Seberang Ulu. These areas face recurrent flooding due to their lowland deltaic geography along the Musi River.
- Moderate flood risk zones are scattered across the southern and western parts of the city, where flooding is less frequent but still significant during extreme weather events.
- Low flood risk zones, typically located in the northern parts of the city, still face some localized flooding during heavy rainfall but experience fewer disruptions to food systems compared to high-risk areas.

This risk distribution emphasizes the urgent need for targeted flood mitigation efforts in the high-risk zones to protect food security and ensure the sustainability of local agriculture and food systems.

Table 1. The percentage of the impact of food security due to flooding

Flood Risk Zone	Percentage of Palembang Area	Description	Impact on Food Security
High Flood Risk	45%	Areas most prone to frequent and severe flooding	Destruction of crops, disruption of food supply chains, and damage to infrastructure
Moderate Flood Risk	30%	Areas subject to occasional flooding	Periodic disruptions in local agriculture and transportation of food products
Low Flood Risk	25%	Areas with minimal flooding	Less frequent flooding but still subject to occasional disruptions

Source: Data compiled by the researcher based on the flood hazard index of Palembang, 2025.

From Table 1, it is evident that high flood risk areas, covering 45% of Palembang, are the most vulnerable to frequent and severe flooding. These areas experience significant crop destruction and damage to essential infrastructure, leading to disruptions in food supply chains and jeopardizing food

security. Moderate flood risk areas account for 30% of the city, where flooding is less frequent but still disrupts local agriculture and food transportation, resulting in temporary shortages and increased prices. Finally, low flood risk zones, comprising 25% of Palembang, are less affected by flooding, though they still face occasional disruptions that can cause minor fluctuations in food access.

These varying flood risks underscore the importance of targeted flood mitigation strategies and infrastructure improvements to ensure the resilience of the city's food systems, particularly in the high-risk areas where the most significant impacts are felt.

2. Food Security and the Impact of Floods

Floods pose a significant threat to food security in Palembang, particularly in areas with high flood risk. The disruption to agricultural production, damage to infrastructure, and difficulty in accessing food during and after flood events all contribute to food insecurity, especially for vulnerable populations. Based on the findings from interviews, focus group discussions, and the flood hazard index map, it is evident that the impact of floods on food security is multi-faceted and varies across different flood risk zones in the city.

As shown in the table above, areas of Palembang with high flood risks are directly threatened by the loss of agricultural land and disruption of the food supply chain, both of which significantly affect food security. In the interviews conducted, many local farmers and community members from high-risk zones reported that recurrent flooding has led to crop failure, loss of income, and increased food prices, particularly for rice, vegetables, and livestock.

One of the most significant impacts of flooding on food security is its effect on food availability. The following observations emerged from the focus group discussions:

- Farmers in high-risk areas mentioned that floods destroy crops during the planting season, leading to lower food production.
- Vulnerable households often face food scarcity due to decreased agricultural output and disruptions in food transport.

In contrast, areas with moderate to low flood risks experience less frequent disruptions in food supply but are still vulnerable to price spikes and reduced access to affordable food during major floods. In moderate flood zones, while agricultural production may be disrupted less frequently, transportation networks often face delays, resulting in higher food prices and increased difficulty in accessing fresh produce.

Here is the enhanced bar chart illustrating the Flood Risk Factors and their Percentage Contribution to food security impacts in Palembang. The chart uses a horizontal bar layout, with vibrant custom colors for each factor to make the data visually appealing.

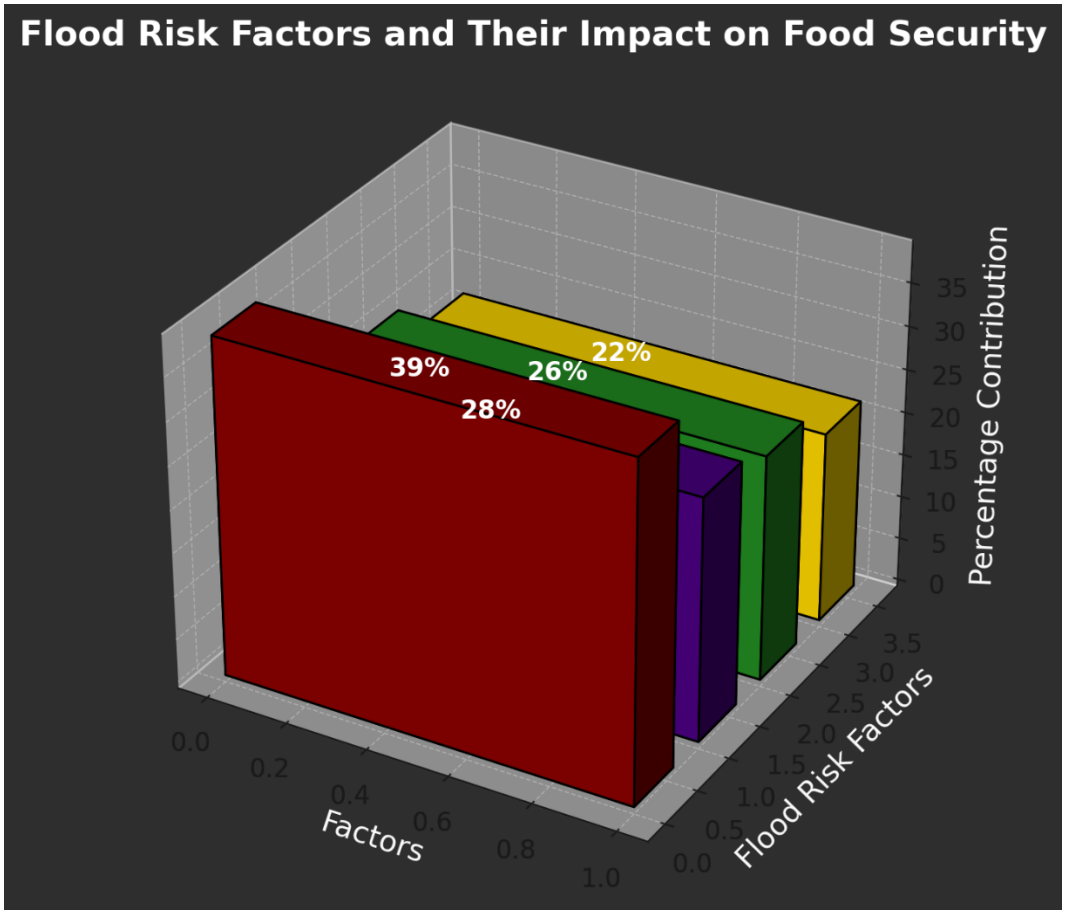

Figure 3. presentase the Flood Risk Factors and their Percentage Contribution to food security impacts in Palembang. Source: Processed by researchers, 2025

Here is Figure 3, which illustrates the Causes of Floods and Impact on Food Security in Palembang. Based on the data, the city faces a variety of challenges that contribute to its vulnerability to flooding. The pie chart highlights four primary factors: Urbanization (39%), Poor Infrastructure (28%), Socio-economic Inequalities (26%), and Climate Change (22%). These factors are intricately linked to the disruption of food systems, making flood mitigation and food security critical issues in Palembang.

The chart demonstrates how urban expansion, inadequate infrastructure, social inequalities, and the effects of climate change all contribute to the frequency and severity of flooding, which in turn affects local agriculture, food access, and food supply chains. This highlights the need for comprehensive flood management strategies to safeguard food security in the city.

From the interviews conducted with local farmers and community members in high-risk flood zones such as Ilir Timur, Ilir Barat, and Seberang Ulu, it was reported that recurrent flooding has led to crop failure, loss of income, and increased food prices. The loss of agricultural land in these areas results in lower food production, which directly affects food availability in the city. Key crops such as rice, vegetables, and livestock are particularly vulnerable to the floodwaters, with farmers noting that floods destroy crops during the planting season, leading to reduced harvests.

Focus group discussions with vulnerable households revealed that many are faced with food scarcity due to disruptions in food transport and decreased agricultural output. In high flood risk areas, local markets are often inundated, making it difficult for farmers to deliver produce to the

markets. The disruption of food supply chains exacerbates the situation, resulting in higher food prices and limited access to fresh produce, particularly for those who depend on local agriculture.

In contrast, areas with moderate to low flood risks experience less frequent disruptions, but still face challenges related to food access. In moderate flood zones, agricultural production may be disrupted less frequently, but delays in food transportation still lead to price increases and limited availability of fresh produce. The effects of flooding on transportation networks can result in delays in deliveries of essential food products, creating a temporary shortage of food in the markets.

The findings from the study clearly show that flooding disrupts local food systems, particularly in areas with high flood risk. The loss of agricultural land and damage to infrastructure in these regions are major contributors to food insecurity. According to the World Bank (2010), climate-related shocks, such as floods, negatively impact food production by destroying crops and reducing the availability of locally grown food. The disruption of food supply chains, especially in flood-prone regions, is a key concern, as it limits access to fresh food and increases food prices, which in turn affects vulnerable populations.

One significant concern raised in the interviews was the impact of floods on food availability. When agricultural lands are submerged or crops are destroyed, the local food supply is compromised, leading to increased reliance on external sources for food. This dependency on external food sources can make it more difficult to ensure that affordable and nutritious food is available to everyone, particularly for those in lower-income communities who are often the most affected by flooding. The disruptions to the food supply in high-risk zones lead to higher food prices, making it harder for vulnerable households to afford nutritious food, as food prices rise due to supply shortages.

Additionally, societal inequalities play a role in how flooding impacts food security. Low-income households in flood-prone areas often lack the resources to recover from floods, both in terms of agricultural losses and food access. As climate change continues to exacerbate extreme weather patterns, the vulnerable communities in Palembang will face increased challenges in securing consistent access to food.

Moreover, even in moderate flood risk areas, disruptions in food transport networks continue to affect food access. The flooding of roads and markets makes it harder to transport food to areas that need it, creating bottlenecks and leading to higher food prices. This has the potential to create food access issues even in areas that experience flooding less frequently, highlighting the need for comprehensive flood management strategies.

In conclusion, the impact of flooding on food security in Palembang is significant, particularly in high-risk flood zones where frequent flooding leads to crop destruction and disruptions in food supply chains. These disruptions reduce food availability, increase food prices, and create barriers to access, especially for low-income households. Moderate-risk zones face occasional disruptions, with increased food prices and transportation delays, while low-risk zones experience occasional flooding that can still affect food systems.

Addressing these challenges requires not only improving flood management infrastructure, but also integrating food security measures into urban planning and disaster management policies. It is essential to ensure that flood-prone communities have access to adaptive strategies, such as community-based farming initiatives, improved infrastructure, and better food distribution networks, to build resilience and safeguard food security during flood events. Furthermore, a hybrid governance model, which involves collaboration between government entities and local communities, will play a critical role in ensuring that food systems remain robust and sustainable in the face of increasing flood risks and climate-related disruptions.

3. Government and Community Collaboration

The study examined both government responses and community-led initiatives in Palembang to assess how collaborative efforts can contribute to building resilient food systems. The local

government in Palembang has implemented several strategies to mitigate flood risks. Infrastructure improvements, such as the construction of flood barriers, the enhancement of drainage systems, and the creation of flood shelters, were reported in interviews with local government officials. However, these measures alone are insufficient in reducing the long-term impact of floods on food systems. During interviews, many government officials acknowledged the lack of integration between flood management and food security policies.

In addition to government efforts, community-based initiatives have emerged as essential components of flood resilience. These include urban farming, floating food gardens, and local food banks. Community leaders highlighted the importance of these initiatives in providing localized solutions to food access challenges during floods. A case study from Ilir Timur demonstrated how community-run urban farms and floating gardens helped provide a steady food supply during flood events. These local solutions were more effective in ensuring access to food for low-income households than government-led top-down approaches. Local food banks, organized by NGOs, also play a critical role in ensuring emergency food supply to affected households during flood events.

Figure 4. below shows the success of these community-driven interventions, highlighting the increased access to food and reduced dependency on external food aid. Source: social media FB Dinas Pertanian dan Ketahanan Pangan Palembang (https://www.facebook.com/ForumPenyuluhPertanianKotaPalembang/ diakses tanggal 15 Juni 2025)

In Figure 4, these community-driven interventions are showcased through local agricultural efforts. The individuals in the image are involved in growing various plants and crops, a clear reflection of how these activities contribute to enhancing food security within the community. The collaboration between government bodies and local communities is evident, as they work together

to increase local food production. This helps mitigate the impacts of floods by ensuring a continuous food supply, reducing the reliance on external food aid. The image illustrates a practical example of how such collaborations can lead to greater resilience in food systems, emphasizing the success of initiatives that empower communities to sustain themselves even during challenging conditions like floods.

Figure 5. Community Based Urban Farming Initiatives in Palembang Source: social media FB Dinas Pertanian dan Ketahanan Pangan Palembang (https://www.facebook.com/ForumPenyuluhPertanianKotaPalembang/ diakses tanggal 15 Juni 2025)

Figure 5. Community Based Urban Farming Initiatives in Palembang illustrates the growing community-based urban farming initiatives in Palembang. This image showcases how local communities, with support from the government, engage in urban farming activities to enhance food security. Through these efforts, communities not only produce food independently but also reduce dependence on external supplies. Urban farming initiatives like the one depicted in this image play a crucial role in mitigating the impact of disasters such as floods by providing more stable local food sources. Additionally, these farming activities raise awareness among the community about the importance of food security and environmental sustainability in urban settings. Thus, this figure reflects the success of community-based farming models that support food resilience while offering solutions to challenges faced by disaster-prone cities.

In Palembang, the challenge of flood risk management and its impact on food security is a shared responsibility that requires collaboration between the government and local communities. The city's vulnerability to recurrent floods necessitates a multi-faceted approach, where both government policies and community-driven initiatives work in tandem to build resilience and ensure food security. This section explores the role of both actors in flood mitigation and their collaborative efforts to safeguard food systems.

a. Government Role in Flood Mitigation

The local government plays a critical role in addressing flood risks by implementing infrastructure improvements, regulatory measures, and disaster management protocols. In Palembang, the government has focused on improving flood control infrastructure, such as drainage systems, flood barriers, and flood shelters. These efforts aim to mitigate the impact of flooding by redirecting water flow, protecting residential and agricultural areas, and providing safe spaces for displaced populations during floods.

In addition, the government's flood risk management policies have included the development of early warning systems and emergency response plans to assist residents in flood-prone areas. These initiatives are designed to minimize the damage caused by floods, reduce risks to public health, and provide swift responses to food supply chain disruptions. However, despite these efforts, the implementation of flood prevention infrastructure has often been slow and inconsistent, particularly in densely populated areas like Ilir Timur and Seberang Ulu. Moreover, the government's initiatives alone cannot fully address the problem, as these interventions need to be supported by community involvement to be effective and sustainable.

b. Community-Driven Initiatives in Flood Mitigation

While government interventions are essential, community-based solutions have proven to be highly effective in building local resilience to floods. Community-led flood mitigation efforts include urban farming, floating gardens, and local food banks—innovative approaches that have allowed residents to adapt to the challenges posed by frequent flooding. For example, urban farming projects in flood-prone areas have enabled local populations to grow food on higher ground or even on elevated platforms, reducing their dependence on external food sources and providing a reliable source of fresh produce during floods.

Floating food gardens, a practice that has gained popularity in high-risk flood zones, involve planting crops on floating rafts that can withstand rising water levels. This adaptation allows farmers to continue cultivating food in areas that would otherwise be submerged during floods. In addition to these agricultural innovations, local food banks have been established by community organizations and NGOs to distribute food to vulnerable households during flood events, ensuring that those affected by the flooding have access to basic food supplies.

c. Government-Community Collaboration in Practice

The integration of community-based solutions with government strategies has been a significant factor in Palembang's flood mitigation efforts. Government policies are more effective when they are adapted to local needs and supported by community involvement. In areas like Seberang Ulu, local government officials have partnered with community groups to develop community flood risk maps, which provide a more accurate assessment of local flood risks based on firsthand knowledge. This participatory mapping process allows both the government and local communities to work together in identifying vulnerable areas and planning flood mitigation strategies that are tailored to the specific challenges faced by different neighborhoods.

The government has also provided financial and technical support to community-based initiatives, such as funding for floating gardens and urban farming projects, ensuring that these projects can be scaled up and have a long-term impact on food security. In return, local communities contribute valuable knowledge about their own environmental challenges, ensuring that flood mitigation efforts are better aligned with the realities on the ground.

d. Challenges and Recommendations for Strengthening Collaboration

Despite the positive impact of government-community collaboration in Palembang, several challenges remain. Coordination between government agencies and community groups can often be fragmented, leading to inefficiencies and delays in the implementation of flood mitigation projects. Additionally, some communities face barriers to fully participating in government-led initiatives, such as lack of awareness, insufficient training, and limited access to resources.

To overcome these challenges, improving communication and collaboration mechanisms between the government and local communities is essential. This can be achieved by:

1. Strengthening community engagement in the planning and implementation phases of flood mitigation projects.
2. Providing training and capacity building for local communities to enhance their participation in flood management efforts.
3. Establishing clearer lines of communication between government officials and community leaders to ensure that both parties understand each other's priorities and constraints.
4. Creating shared platforms for collaboration where government agencies, NGOs, and community groups can exchange knowledge and coordinate efforts in real-time.

In conclusion, government-community collaboration is critical to addressing the complex challenge of flood risk management and food security in Palembang. While the government's role in providing infrastructure and disaster management frameworks is vital, community-led initiatives offer innovative and sustainable solutions that enhance local resilience. Strengthening the partnership between government bodies and local communities will be key to creating a robust and resilient food system that can withstand the impacts of flooding and ensure equitable access to food during times of crisis. For Palembang, fostering this collaboration will be essential to achieving long-term flood resilience and food security in the face of growing flood risks and climate-related challenges.

4. Hybrid Governance Models and Integrated Approaches

The hybrid governance model—where state actors collaborate with community networkshas been identified as an effective means of improving flood resilience and food security. A growing body of research suggests that collaborative approaches that involve both the government and local communities are more successful than centralized disaster responses.

Based on the interviews and field observations, the hybrid model in Palembang has led to the integration of community innovations into official disaster management frameworks. In Seberang Ulu, for example, the local government partnered with community organizations to create a local flood risk map, combining community knowledge and geospatial tools like GIS (Geographic Information Systems) to identify high-risk areas and better allocate resources.

Hybrid governance models, combining state-led governance with community participation, are becoming increasingly recognized as effective frameworks for addressing complex issues such as flood risk management and food security in flood-prone urban areas like Palembang. These models integrate the strengths of both government-led initiatives and community-driven solutions, ensuring that the responses to floods are not only scientifically sound but also locally relevant and adaptive to specific needs.

a. What is a Hybrid Governance Model?

A hybrid governance model is a system in which state actors (government agencies and public sector institutions) collaborate with local communities, civil society organizations, and other stakeholders in decision-making processes and resource management. This model emphasizes inclusive participation, shared responsibility, and collaborative problem-solving, creating a governance structure that is flexible and capable of addressing local challenges, including those posed by climate change and frequent flooding.

In Palembang, the growing frequency and intensity of floods emphasize the need for such collaborative governance to effectively tackle both flood risk management and food security issues. By combining government resources and local knowledge, these models can provide tailored solutions that directly address the unique needs of the city's vulnerable communities.

b. Benefits of Hybrid Governance in Flood Risk Management

1. Hybrid models ensure that solutions are designed to fit the specific characteristics of each flood-prone area. Local communities provide valuable insights into their environmental vulnerabilities, while government officials bring technical expertise and resources. This partnership ensures that flood mitigation measures are scientifically robust and contextually relevant.
2. Community involvement in decision-making leads to greater ownership of flood mitigation projects. This is particularly important for low-income and marginalized communities, who are often the most vulnerable to floods. When these communities have a say in the planning and implementation of mitigation measures, they are more likely to support and engage with them, ensuring better long-term outcomes.
3. Hybrid governance facilitates resource-sharing between sectors. Governments can provide funding and technical expertise, while local communities can contribute through volunteer work, local knowledge, and grassroots initiatives like urban farming and floating gardens. This collaborative effort maximizes available resources, ensuring sustainable food systems and increasing resilience to flooding.
4. Communities often develop innovative flood mitigation solutions that may not be considered by traditional government approaches. Integrating these grassroots innovations into formal policies allows for greater creativity and flexibility in addressing the challenges posed by floods. Examples of such innovations include low-cost flood barriers, community-managed drainage systems, and alternative agricultural practices that maintain food production during floods.

c. Challenges in Implementing Hybrid Governance Models

Despite their potential, hybrid governance models face several challenges in implementation:

1. Coordination and Communication:
   Effective coordination between government agencies, community groups, and NGOs is essential. In Palembang, the division of responsibilities across various government agencies can lead to fragmented efforts. Establishing clear communication channels and collaboration frameworks will ensure more efficient flood mitigation and food security responses.
2. Capacity Building:
   Local communities may have valuable knowledge but may lack the skills or resources to implement flood mitigation projects. Capacity-building programs are crucial to empowering communities to take active roles in flood management and food security. This includes training in disaster risk management, sustainable agriculture, and emergency preparedness.
3. Balancing Power Dynamics:

Power imbalances between government entities and community groups may affect decision-making processes. Governments may prioritize large-scale infrastructure projects, while community-based solutions may be overlooked. Ensuring that both government and community voices are valued equally is essential for achieving equitable flood risk management and sustainable food systems.

d. Integrated Approaches in Palembang

In Palembang, the integration of various sectors, including land use planning, water management, and food security policies, offers a promising solution for addressing flood risk management and food insecurity. Successful integrated approaches should:

1. Promote sustainable urban development that reduces flood risk while preserving agricultural spaces.
2. Encourage community-driven solutions like flood forecasting systems, rainwater harvesting, and community-managed green spaces to improve food resilience.
3. Foster collaboration across sectors—agriculture, urban planning, water management, and public health—to address the multifaceted challenges of floods and food insecurity.

A key example of an integrated approach in Palembang is the implementation of floating food gardens. These gardens combine flood resilience and food production, providing a sustainable source of food during flood events. Developed through collaboration between local farmers and the government, floating gardens represent a model of integrated flood management that could be adapted to other flood-prone regions.

Hybrid governance models that combine government resources with community-based solutions offer a promising framework for addressing the challenges of flood risk management and food security in Palembang. By fostering inclusive decision-making, effective coordination, and resource mobilization, Palembang can build a more resilient food system and safeguard vulnerable populations from increasing flood risks and climate change impacts. For future success, expanding these collaborative efforts, focusing on capacity building and resource sharing, is essential to ensure long-term resilience in Palembang's food systems.

5. Recommendations for Enhancing Resilience

Based on the findings, several recommendations can be made to improve the resilience of Palembang’s food system in the face of future floods:

1. Strengthening flood mitigation infrastructure in high-risk zones through better urban planning and sustainable drainage systems.
2. Incorporating food security considerations into existing flood management policies, ensuring that food systems are safeguarded during floods.
3. Promoting community-based solutions, such as floating gardens and urban farming, to enhance local food resilience during emergencies.
4. Fostering collaboration between local communities, NGOs, and the government to create context-specific solutions for food access during flood events.
5. Utilizing GIS and climate mapping to enhance disaster preparedness and identify vulnerable populations, ensuring that resources are directed where they are needed most.

This study has highlighted the significant flood risks faced by Palembang, especially in areas like Ilir Timur and Seberang Ulu, which are vulnerable to frequent and severe flooding. The results suggest that while government initiatives are critical for flood mitigation, community-led initiatives have proven to be highly effective in ensuring food security and resilience during flood events. The hybrid governance model, combining government resources with community knowledge, offers a

promising approach to building a more resilient and sustainable food system. By integrating these efforts, Palembang can enhance its flood resilience and ensure equitable food access for its residents.

Conclusion

In conclusion, building resilient food systems in flood-prone cities like Palembang requires a multifaceted approach that integrates both government initiatives and community-driven solutions. The study has highlighted the significant flood risks faced by the city, with high-risk areas experiencing frequent and severe flooding that disrupts agriculture, food supply chains, and local infrastructure. These challenges are exacerbated by urbanization, inadequate infrastructure, and the compounded effects of climate change, all of which jeopardize food security and vulnerable populations' access to food.

While government-led flood mitigation efforts, such as infrastructure improvements and flood barriers, play an essential role, community-based initiatives, such as urban farming, floating food gardens, and local food banks, have proven to be effective in providing localized and flexible solutions to food access during floods. These grassroots responses often outperform centralized, top-down approaches in emergency contexts, as they are tailored to the specific needs and vulnerabilities of local communities.

Moreover, the hybrid governance model, which encourages collaboration between government bodies and community networks, is crucial for integrating community innovations into official disaster management frameworks. This collaborative model ensures that both policy implementation and local knowledge work in tandem to address the complex issue of food security during flood events.

To further enhance resilience, the study recommends investing in targeted flood mitigation measures, improving infrastructure resilience, and fostering cross-sectoral collaboration to ensure sustainable food systems. GIS tools, climate mapping, and community assessments offer powerful methods for planning and identifying vulnerable areas, thus enabling more effective resource allocation and risk management.

Ultimately, building resilience in Palembang's food systems involves not only improving the capacity to withstand and recover from floods but also ensuring equitable access to nutritious food for all residents, particularly those in vulnerable areas. This approach, rooted in inclusive governance and community participation, will contribute to the long-term sustainability of food systems and the well-being of urban populations in flood-prone regions.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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