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Research Article

A Participatory and Integrated Urgent Flood Management Plan for Chiang Rai Municipality

Nawin Promjisa[1], Tongrak Jitbantao[2*], Jamaree Prasunin[1], Ranida Pingmoung[1], Jumrus Klinhnu[3]
[1] *Faculty of Social Sciences, Chiang Rai Rajabhat University, Chiang Rai, Thailand*
[2] *Faculty of Education, Chiang Rai Rajabhat University, Chiang Rai, Thailand*
[3] *Faculty of Digital Technology, Chiang Rai Rajabhat University, Chiang Rai, Thailand*
* Corresponding Author: tongrak.jit@crru.ac.th

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ABSTRACT

This study aimed to investigate the management of local organizations regarding flood effects in Chiang Rai Municipality. The stakeholders of the participatory integrated management plan included a total of 500 supervisors or staff from government agencies concerned with fundamental information and development of Chiang Rai province, community leaders, relevant agencies and organizations, religious leaders, philosophers (folk philosophers), volunteer mainstays for flood management, and representatives of local people who had flood effects. A questionnaire was used as the research tool. Collected data were analyzed with mean and Standard Deviation (S.D.). The research results found that the management of local organizations regarding the impact of flooding in Chiang Rai Municipality, the research results were moderately demanding after the flood (M=3.33 and SD=0.83). They recommended that the participatory operations within the Chiang Rai Municipality area, the action and mitigation plan, and the restoration phases integrate the execution in multiple dimensions to drive the area-based mechanism to handle problems and cope with all risks.

Keywords: Flood effects management, management of local organizations, participatory process

INTRODUCTION

In 2024, several provinces in Thailand experienced severe flooding, with one of the major causes being global climate change. For Thailand, there is a trend of increasing rainfall volume and storm intensity. With a temperature increase of approximately 1.0–1.5 degrees Celsius over the past 50 years [4], one of the provinces that was severely affected unexpectedly last year was Chiang Rai. This phenomenon was partly due to climate change, population expansion, and urbanization. Chiang Rai is the northernmost province of Thailand, bordering the Republic of the Union of Myanmar and the Lao People's Democratic Republic. In recent years, the province has undergone social changes driven by population growth, policies promoting Chiang Rai as a tourist destination, cross-border trade and investment, and physical transformations to accommodate urban development, all of which have exacerbated flooding issues. Additionally, the lack of public awareness regarding natural resources and environmental conservation has intensified and complicated the problem.

Thailand has continuously implemented water resource management policies and strategies to enhance the security and sustainability of the country's water use. There was a 20-year Groundwater Resource Management Strategy (2017-2036). This strategy focuses on sustainable groundwater management to develop an information system and plan for effective groundwater use [8], as well as driving the 20-year water resource management master plan, which focuses on the integration and participation of all sectors in water resource management for maximum sustainability and efficiency [10], In the northern region of Thailand, especially in Chiang Rai province, water resources are a policy necessity in terms of management, utilization, and ongoing droughts and floods. To enhance stability and sustainability in dealing with disasters, including the drought response plan for 2023-2024. In terms of floods, after the flood crisis in 2024, an urgent plan (1 year) was developed to increase the efficiency of water flow in the river to

cope with floods. The medium-term plan of 1-3 years includes the analysis of bank erosion risk points and the construction of flood and bank protection structures along the riverbank.

The flooding in Chiang Rai Province in September 2024 caused extensive damage in economic and community aspects, along with health impacts. The effects of migration were expected to increase public health expenditures and social costs in the long term. Economic losses stemmed from declining incomes, property damage, health deterioration, reduced quality of life, and the slowdown of economic, social, environmental, and public health activities, affecting the population's overall well-being. According to a report from Chiang Rai Province, 52 communities comprising 12,000 households within Chiang Rai Municipality were declared emergency disaster zones. An Emergency Operations Center for flood and landslide relief was established at the Chiang Rai Municipality Fire and Rescue Station, along with eight shelters to accommodate affected residents. Additionally, a report from the Geo-Informatics and Space Technology Development Agency (GISTDA), which monitored the flooding through RADARSAT-2 satellite imagery on September 12, 2024, at 06:12 AM, indicated widespread flooding in seven districts of Chiang Rai Province. The most severely affected areas included Mae Sai (25,204 rai), Chiang Saen (15,214 rai), Mueang Chiang Rai (14,408 rai), Mae Chan (12,726 rai), Doi Luang (6,205 rai), Wiang Chiang Rung (3,342 rai), and Wiang Chai (927 rai).

The disaster in Chiang Rai was caused by heavy rainfall, reaching 220 millimeters per day in the area, along with additional water from rains in Myanmar, which measured 400 millimeters per day at the headwaters of the Kok River. The water flow in Chiang Rai Province originates from the Sai River, which flows from Myanmar and inundates Mae Sai District as the area's capacity to absorb water was exceeded before the floodwaters continued into the Kok River and reached Mueang Chiang Rai District. Despite warnings from the Department of Disaster Prevention and Mitigation, alerts for heavy rainfall from the Meteorological Department, discharge warnings from the Royal Irrigation Department, landslide warnings from the Department of Mineral Resources due to flash floods, and daily flood monitoring reports from the National Water Resources Office (NWRO), heavy rainfall and flooding persisted throughout August and September 2024. Thailand experienced severe flooding in many areas of the northern region. The Department of Disaster Prevention and Mitigation reported flooding in 10 provinces, influenced by Typhoon Yagi, which had downgraded from a super typhoon to a depression. This event was a major factor contributing to the severe flooding in September, particularly in Chiang Rai and Chiang Mai, as well as some provinces along the Mekong River in other northeastern regions. Similarly, in August 2024, heavy rainfall in several northern provinces also caused widespread flooding. Beyond natural factors, disaster preparedness—especially early warning systems—is crucial.

Thailand had more than 30 agencies involved in water management and a disaster prevention mechanism under the administrative authorities in every province. This raises an essential issue for reflection and learning from this flood disaster. This situation has inspired this research initiative. The inability to promptly respond and the significant losses incurred are key lessons for relevant agencies to improve their preparedness. This will involve brainstorming with experts and stakeholders in a participatory research approach, assessing damage and post-disaster needs, and analyzing local agency data on flood roles and impacts. Chiang Rai Province focuses on innovation development and community participation in disaster management, with management proposals that increase the role of communities, aiming to create Chiang Rai as a model for spatial disaster management that connects people, technology, and nature.

Additionally, the research will focus on developing an integrated emergency flood management plan by engaging community volunteers and regional organizations in collaboration with higher education institutions. The goal was to establish a cooperative disaster management mechanism for flood response and recovery in Chiang Rai Municipality. This research [3], [5], [9] aims to contribute to building a safer and more sustainable urban model. Socially, it will foster participatory processes that drive cities toward self-reliant and effective disaster management.

OBJECTIVES

This research aimed to investigate local organizations' management systems regarding flood effects in Chiang Rai Municipality.

METHODS

This research was part of the "Participatory and Integrated Urgent Flood Management Plan in Chiang Rai Municipality Area" study funded by the Program Management Unit on Area Based Development (PMUA). The

research ensures the protection of the rights of the sample group without revealing personal information. It has been approved for ethical exemption (Exemption Protocol) by the Human Research Ethics Committee of Chiang Rai Rajabhat University, under number COE.003/2568, research project number 003-2568-Exe.

I. POPULATION

The population affected by the flood in Chiang Rai Municipality consists of 73,838 people across four districts and 65 communities, with 52 communities directly impacted by the disaster.

II. SAMPLE GROUP

The researchers used a sample size table (Yamane) to select 500 households, using a multistage random sampling method in the 52 flood-affected communities. The sampling criteria were: 1) Number of people aged 20 years and over, living in and in 52 flood-affected communities, who could provide information, were representatives from various sectors and community leaders, specifically representatives from relevant government and private sectors, and community leaders in affected areas. There were 50 participants in total, consisting of:
1) 10 officials from relevant government agencies
2) 10 community leaders
3) 10 experts or persons recognized in flood impact data
4) 15 leaders or volunteers with experience in flood management
5) 5 general public

III. RESEARCH INSTRUMENT

The research tool used was a questionnaire consisting (1) a general information questionnaire that asks for basic details about the sample group, including multiple-choice questions and open-ended questions such as gender, age, education level, occupation, and average monthly income, (2) a questionnaire for studying the damage and appropriate needs after a disaster, using a rating scale (Likert scale) with five levels: most, more, moderate, less, and least, along with open-ended questions, (3) a questionnaire for studying the information management system of local agencies regarding their roles and impacts in facing, mitigating, and recovering from the flood disaster in Chiang Rai Municipality. This also used a rating scale (Likert scale) with five levels: most, more, moderate, less, and least, along with open-ended questions. The reliability analysis of the questionnaire was tested in a non-sample group aged 20 years and over living in Chiang Rai Province, totaling 30 people. Statistical analysis was performed to prove the reliability of the questionnaire. The Cronbach's alpha coefficient for studying damage and appropriate needs after a disaster was 0.86. The reliability of the management information system was 0.79.

IV. DATA ANALYSIS

The researcher conducted descriptive statistical analysis, including percentage, mean, and standard deviation, for the questionnaire on the damage and appropriate needs after the disaster, as well as for the study of the information management system of local agencies regarding their roles and impacts in facing, mitigating, and recovering from the flood disaster in Chiang Rai municipality. Additionally, content analysis was used to study the management of local agencies regarding their roles and impacts in facing, mitigating, and recovering from the flood, and the management of community leaders and representatives in self-management in terms of their roles and effects in facing, mitigating, and recovering from the flood. The aim was to develop an integrated urgent flood management plan with participatory approaches and local volunteer mechanisms.

RESULTS

I. POST-FLOOD NEEDS

Table 1 Mean and standard deviation of post-flood needs (n=500)

Post-flood Needs	M	SD	Level
Assistance with house repairs and vehicle repairs	3.20	1.12	Moderate

Support for consumables and household items provided by the government	3.43	1.14	Moderate
Repairing or constructing internal community roads	2.94	1.20	Moderate
Healthcare for the public	3.26	1.21	Moderate
Management of obstructions, household waste, and flood debris	3.49	1.28	Moderate
Warning systems from responsible agencies	3.37	1.35	Moderate
Legal education regarding rights and entitlements of disaster victims	3.13	1.23	Moderate
Assistance with life and property from rescue units	3.60	1.21	More
Support and social group integration within the community	3.75	0.95	More
Support in technology and innovations in disaster situations	3.13	1.39	Moderate
Overall post-flood needs	**3.33**	**0.83**	**Moderate**

Table 1 shows the average post-flood needs of the people in Chiang Rai municipality were 3.33, with a standard deviation of 0.83, considered a moderate level. When examined by individual item, the highest average score was a support and social group integration within the community (M=3.75, SD=0.95), followed by assistance with life and property from rescue units (M=3.60, SD=1.21), management of obstructions, household waste, and flood debris (M=3.49, SD=1.28), support for consumables and household items provided by the government (M=3.43, SD=1.14), warning systems from responsible agencies (M=3.37, SD=1.35), healthcare for the public (M=3.26, SD=1.21), and assistance with house repairs and vehicle repairs (M=3.20, SD=1.12). Legal education regarding the rights and entitlements of disaster victims and support in technology and innovations in disaster situations scored (M=3.13, SD=1.23, 1.39). The lowest average score was for repairing or constructing internal community roads (M=2.94, SD=1.20).

II. RISK AREA ANALYSIS

Table 2 Mean and standard deviation of risk area analysis (N=500)

Risk Area Analysis	M	SD	Level
Do you think the agencies responsible have analyzed risk areas?	3.33	1.12	Moderate
Do you think the analysis is accurate?	3.17	1.11	Moderate
Do you think the information analyzed has been communicated to the public?	3.34	1.18	Moderate
Do you think the analysis has led to a preventive plan?	3.38	1.12	Moderate
Do you think the analysis has been managed in advance?	2.86	1.12	Moderate
Do you think the analysis has been communicated to relevant agencies?	3.32	1.14	Moderate
Do you think the analysis has been followed up on?	3.35	1.07	Moderate
Overall Risk Area Analysis	**3.25**	**0.82**	**Moderate**

Table 2 shows that the average score for risk area analysis in the Chiang Rai Municipality area was 3.25, with a standard deviation of 0.82, indicating a moderate level. When examining each item individually, it was found that the statement “Do you think the analysis led to a preventive plan?” had the highest average score (M=3.38, SD=1.12). This was followed by “Do you think the analysis has been followed up on?” (M=3.35, SD=1.07), “Do you think the analyzed information has been communicated to the public?” (M=3.34, SD=1.18), “Do you think the responsible agencies have analyzed risk areas?” (M=3.33, SD=1.12), “Do you think the analyzed information has been communicated to relevant agencies?” (M=3.32, SD=1.14), and “Do you think the analysis is accurate?” (M=3.17, SD=1.11). The statement “Do you think the analysis has been managed in advance?” had the lowest average score (M=2.86, SD=1.12).

III. PROBLEM ENCOUNTERED IN MANAGEMENT BEFORE THE FLOOD EVENT

Table 3 Mean and standard deviation of problems encountered in management before the flood event (N=500)

Problems Encountered in Management Before the Flood Event	M	SD	Level
Do you think there were gaps in management before the flood event?	3.65	1.14	More
Do you think there was integration in management work before the flood event?	3.16	1.21	Moderate
Do you think the public was involved in management before the flood event?	3.20	1.14	Moderate
Do you think other agencies participated in management before the flood event?	3.13	1.16	Moderate
Do you think the relevant agencies held planned meetings before the flood event?	2.87	1.23	Moderate
Do you think the agencies responsible were involved in managing flood-related issues before the flood event?	2.93	1.24	Moderate
Do you think some agencies neglected flood management before the flood event?	3.27	1.25	Moderate
Overall, management encountered problems before the flood event.	**3.17**	**0.78**	**Moderate**

From Table 3, it was found that the average score for the problems encountered in flood management before the event in Chiang Rai Municipality was 3.17, with a standard deviation of 0.78, indicating a moderate level. When considering each item individually, it was found that the highest average score was for the item "Do you think there were gaps in management before the flood event?" (M = 3.65, SD = 1.14). This was followed by "Do you think some agencies neglected management before the flood event?" (M = 3.27, SD = 1.14), "Do you think the public was involved in flood management before the event?" (M = 3.20, SD = 1.14), "Do you think there was integration in flood management work before the event?" (M = 3.16, SD = 1.21), "Do you think other agencies participated in flood management before the event?" (M = 3.13, SD = 1.16), and "Do you think the responsible agencies were involved in managing flood-related issues before the event?" (M = 2.87, SD = 1.23). The lowest average score was for "Do you think there were planning meetings held by the relevant agencies before the event?" (M = 2.87, SD = 1.23).

IV. MECHANISMS FOR PARTICIPATION

Table 4 Mean and standard deviation of participation mechanisms (N=500)

Mechanisms for Participation	M	SD	Level
Do you think that before the flood, all sectors had the opportunity to participate in water management?	3.31	1.32	Moderate
Do you think that before the flood, all sectors had the opportunity to participate in planning water management?	3.23	1.23	Moderate
Do you think that before the flood, there were clear channels for participation in water management?	3.08	1.26	Moderate
Do you think that before the flood, there were periodic meetings for planning water management?	2.92	1.25	Moderate
Do you think that before the flood, there was a process for hearing the opinions of all sectors regarding water management?	3.05	1.24	Moderate
Do you think that before the flood, the responsible agencies invited all sectors to have the opportunity to participate in water management?	3.22	1.22	Moderate
Overall Mechanisms for Participation	**3.14**	**1.01**	**Moderate**

From Table 4, it was found that the average overall participation mechanism in Chiang Rai Municipal Area was 3.14, with a standard deviation of 1.01, indicating a moderate level. When considering each item individually, it was found that the highest average was for the statement "Before the flood, all sectors had the opportunity to participate in water

management" (M = 3.31, SD = 1.32). This was followed by the statement, "Before the flood, all sectors had the opportunity to participate in joint water management planning" (M = 3.23, SD = 1.23). Next was "Before the flood, the responsible agency invited all sectors to participate in water management" (M = 3.22, SD = 1.22). "Before the flood, there were clear channels for participation in water management" (M = 3.08, SD = 1.26). The lowest average was the statement, "Before the flood, there were regular meetings to plan water management" (M = 2.92, SD = 1.25).

DISCUSSION

The study results revealed that the residents of Chiang Rai Municipality have a moderate demand for assistance and support in various areas following the flood disaster (M=3.33, SD=0.83). The highest demand was for community support and social group mobilization (M=3.75, SD=0.95). Furthermore, the community's needs reflect the damage caused by the flooding, where, in terms of recovery after the incident and initial assistance, the essential factor for continued survival and managing damage to property, homes, livelihoods, or even health, is prompt and sincere rehabilitation. Support for life and property from rescue units was also crucial (M=3.60, SD=1.21). Regarding the issue of the local management information system and the roles and impacts of agencies, it was found that the analysis of disaster-prone areas is at a moderate level (M=3.25, SD=0.82). This includes factors such as the responsibility of agencies, the accuracy of the analysis, communication of information to the public, prevention plans, advance management, notification to responsible agencies, and adherence to procedures. However, the problems identified in flood management before the occurrence of the event were also at a moderate level (M=3.17, SD=0.78), including issues such as management gaps, work integration, public participation, planning meetings of relevant agencies, direct responsibility, and negligence in management. When considering the participation mechanism, it was also at a moderate level (M=3.14, SD=1.01). This reflects that the overall demand for assistance and support from local agencies by the flood-affected population in Chiang Rai Province is not very high. However, the key areas that local agencies need to prioritize are support, community social integration, and rescue agencies' assistance with life and property.

Nevertheless, even though the public does not demand much assistance, local agencies must prepare to manage the disaster management information system for potential future floods. Therefore, participation is the heart of working when facing a disaster. It can promote a higher level of participation in all sectors, which is consistent with the results of this research, which found a moderate level of participation (M=3.14). In flood monitoring, important things include correct and reliable information and preparation. When facing an event, participation will help alleviate the situation and lead to public, government, and private recovery.

As the Department of Disaster Prevention and Mitigation has focused on disaster management (Disaster Management: DM), including emergency response, providing relief to disaster victims, and post-disaster recovery, there has been an increasing emphasis on proactive measures for disaster risk management (Disaster Risk Management: DRM). This approach addresses the factors contributing to risk through various measures to reduce the potential impacts of disasters as much as possible [7],[8]. Overall, the risk analysis of vulnerable areas is still inadequate. The local population is not well-prepared to cope with potential disasters. Additionally, the public should be more involved in managing flood risks collaboratively. It can be observed that, regardless of the area in Thailand, the community's engagement in disaster management should be strengthened to improve preparedness and response effectiveness.

A significant weakness remains in the management information system, which aligns with the study by Meesiriphan and Wongwattanapong [12], who stated that participation in flood management and problem-solving between community organizations, the public sector, and the private sector was essential. These groups must work together to set goals and directions and create integrated action plans to manage local resources. This includes establishing joint working committees, organizing collaborative activities, and offering mutual support through visits to boost morale. The cooperative efforts can effectively address and manage future flooding issues by ensuring clarity in participation through a structured management mechanism with a shared goal. Similarly, in the study by Yongpanitchai [13], it was revealed that municipalities must raise awareness among the public about the importance of participation and create citizens with the capacity to manage flooding independently.

Stakeholders also emphasized that information is essential, and continuous monitoring and staying updated on the news are necessary. If residences are in flood-prone areas, it is advised to follow information from reliable sources or consult relevant authorities. Even if a self-assessment suggests that a home is not in a risk area, keeping up with news

updates is still necessary. For example, during the 2024 Chiang Rai flood, several places that hadn't experienced flooding in 50 years were suddenly flooded by more than one meter of water. Additionally, authorities should analyze the risk of flash floods in northern border areas of Thailand and propose risk reduction strategies through cross-border cooperation [2]. Therefore, the key to managing the impacts of flooding is an effective information management system so authorities can respond to flooding events and plan, prepare, and promptly communicate with the public. However, Thailand's information management system still has many gaps. Despite repeated flooding events, management has not been effective enough, resulting in significant losses of both property and lives.

Additionally, there is a lack of education on the legal rights of flood victims and support for technology and innovation during disasters [6],[11]. This research aims to highlight the needs of the public and past issues, catalyzing local authorities to become more proactive and explore methods of improving the information management system to better prepare for potential flooding events in the future. The research results should be studied for continuous impact analysis to analyze and link the future picture after the flood in Chiang Rai Province, which needs to integrate many dimensions, including the economy, society, and health. The recovery should be carried out systematically and integrated so that the province can return to a stable and sustainable state after the flood, whether it is an economic recovery approach, local businesses, tourism opportunities, or welfare that restores society in all, including the health of the people, both essential health and mental health.

Recommendations for implementing this research in the future are recommendations to evaluate the effectiveness of strategies in implementing the flood management plan in the dimensions of human-environmental relationships that learn, receive, and adapt sustainably.

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