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Determination Towards Decision of Public Response in Flood Situation: Case Study in Urban Flood Prone Area in Central Region in Thailand

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Abstract:

Public involvement has become a crucial part in increasing the efficiency of disaster management activities nowadays. In particular, collaboration between civil society and municipalities emerge in disaster situations because uncertainties in personal perception compel them to do so more than their own willingness to involved in disaster management activity. Since this appears to have occurred as a response to the 2011 flood situation in Thailand, the question is how a successful was this collaboration? The aim of this research is to identify factors influencing people's involvement in disaster management activity. The two study objectives are as follows: (1) to elucidate the characteristics of flood responses in the selected case study, and (2) to measure the level of involvement of community members in flood-prone urban areas during the flood situation in 2011. This study area is located in Pak Kret Municipality, Nonthaburi Province, which is considered as one area that was successful in its flood management efforts during the 2011 flood situation. This research utilized a questionnaire survey, which adopts and extends concepts relevant to willingness to pay for and take part in disaster management activities. Five factors were applied to the investigation: (1) Respondents' information; (2) Decision of respondents to take action, classified by flood inundation level; (3) Perception towards stakeholders in flood management activities; (4) Factors influencing respondents to become involved in flood management activity; and (5) Current preparation and response effort. The study found that external groups such as central and local government, community leaders and members have to take responsibility as first-tier respondents in disaster situations. In the case of collaboration, community members are willing to help government sector as volunteers, and the three most influential factors which led community members to become involved in disaster management activity are level of severity, duration of disaster, and expectation to avoid escalation of the situation.

Keywords: Public involvement; risk acceptability; risk management; flood

Introduction

The devastating 2011 floods in Thailand triggered collaboration among many stakeholders including government, non-profit organizations, the private sector and local communities. The effectiveness of flood management measures

and the increasing severity of the situation was limited, and the government had insufficient ability to provide basic emergency response to victims and affected communities. When this became increasingly apparent, local people became involved themselves to support the overall flood management effort. With respect to the concept of disaster management, the involvement of civil society and non-government agencies can increase the effectiveness of disaster responses. Although close coordination and collaboration are essential among all actors in Total Disaster Risk Management (TDRM), it is also important for both volunteers to take responsibility as first-hand respondents; the vital role of third-party groups in fund-raising and information-sharing information must also be recognized. Thus, a variety of factors related to individual perspectives, perceptions towards risk, social responsibility and sympathy all affect the level of involvement of stakeholders involved. Precisely, there a large number of number of factors which influence non-formal actors in deciding to take action as personal respondents or becoming involved in the collective response in disaster management activities.

According to the circumstances of collaboration among municipality and community members in the flood situation in 2011, this research explores how people reacted, and which level of flood risk acceptance triggered their direct engagement. The two research objectives are (1) to identify the characteristics of flood responses in the selected case study; and (2) to measure the level of involvement of community members in flood-prone urban areas during the 2011 inundation. This research was conducted by questionnaire survey in Pak Kret Municipality, Nonthaburi Province, a flood-prone urban area located in Thailand's central region.

Perception of risk management

Disaster management is a systematic process using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities to mitigate the impacts of hazards and possibility of disasters [1] which could defined as the organization and management of resources and responsibilities for dealing with all humanitarian aspects of emergencies, in particular preparedness, response and recovery in order to lessen the impact of disasters [2].

Disaster risk reduction is one component of disaster management which as the name suggests, is defined as the concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards and vulnerability [3]. These provide an important foundation for community-based disaster risk management aimed at minimizing loss of life, property or assets as well as environmental damage [4]. Acceptable risk is defined as the level of potential loss that society or community is willing to bear under given social, economic, political, cultural, technical and environmental parameters [5]. Risk acceptance can be articulated in various ways, for example in the form of ALARP (As Low As Reasonably Practicable), GAMAB (Comparison of a new system versus an existing accepted system) or in terms of MEM (Minimum Endogenous Mortality) [6].

Governments are the first-hand respondents in risk management which, providing a rationale and command hierarchy in disaster response. Since the 1960s the concept of disaster management has broadened significantly due to the increasing frequency and scale of natural disasters to include the engagement of multiple stakeholders [7]. State response systems have increasingly been bolstered by other stakeholders offering additional specialized

resources in risk and disaster management [8]. Concerning safe and healthy environment of people [9], there are two major roles of public administration (government and local government) in disaster management: these are technical measures and administrative measures (legal approach, command and control) [10].

As human settlements are predominantly located in lowland areas adjacent to convenient water resources such as canals and rivers, they are intrinsically vulnerable to flooding events. There are various definitions of risk, such as the combination of probability and its negative consequences, whose possible concerns in two contexts are the risk of an accident and potential losses. The risk could thus be described as: (1) the probability of an adverse event occurring. Multiplied by the magnitude of its consequences; or as (2) a situation or event where something of human value (including humans themselves) is at stake and where the outcome is uncertain [11]. Thus, risk can be represented as the likelihood of an (adverse) event occurring, shaped by its cultural, physical and social implications.

Moreover, perceptions of risk relate to psychological aspects of a personal and societal nature, due to involvement of unknown, possible and uncertain aspects. As stated in UNISDR with regard to acceptable risk, the acceptable risk is a representation of the level of potential losses that a society or community considers tolerable under given social, economic, political, cultural, technical and environmental conditions.

The ability to measure vulnerability is increasingly seen as a key step towards effective risk reduction and the promotion effort towards a culture of disaster resilience. Measuring vulnerability is a crucial task if science is to help support the transition to a more sustainable world. Vulnerability may be described in terms of its physical, social, economic or environmental dimensions [12]. On the internal side, this involves any activities relating to the capacity to anticipate, cope with, resist and recover from the impact of a hazard. On the external side, this involves matters such as exposure to external threats and the ability to cope with them. The external side also includes households and social groups.

Vulnerability can be considered as dynamic, adaptive and transformable with regard to time, situations, and contributing factors. According to the Pressure and Release Model, there are three main components: root causes (i.e., limited access to power, structure, political and economic resources, and demographics); dynamic pressures (e.g. lack of training, skills, investment and markets at local level, freedom of the press, ethical standards in public life, rapid population change, rapid urbanization, etc.); and unsafe conditions (i.e., physical environment, local economy, social relations, public action and institutions). The level of vulnerability could vary due to certain characteristics of individuals and society. Vulnerability could be primarily related to poverty, but with regard to the aspects of social vulnerability such as individual aspects, households, administrative community, cultural community, national and regional. Also, vulnerability could be separated into the general vulnerable (hazard-independent) and hazard-specific vulnerable [13].

The response decisions of individuals towards risk can be measured from their own vulnerability and coping capacity. To determine the efforts of people in disaster management issues, the complexity of individual, collective and societal perspectives, preferences and expectations, all help shape the sense of reducing vulnerability and increase coping capacity, which also relates to determination of risk acceptability based on decision theory [14]. Originally, the term ‘acceptable risk’ was applied in engineering terms to define

and assess structural and non-structural measures in order to minimize damage to humans, property, services and systems to an agreed tolerable level, based on an understanding of the probability of occurrence, hazard and other factors. The concept was later adopted in the field of industrial risk management, in connection with impact (personal, public safety, health, environment, and economic concerns) and acceptability (comparison among risk and activity, cost of avoiding risk and proportion of risk or accidents) [15].

Risks can be held as acceptable for several reasons, such as: (1) it falls below an arbitrary defined probability; (2) it falls below some level that is already tolerated in practice; (3) it falls below an arbitrary defined attributable fraction of total disease burden in the community; (4) the cost of reducing the risk would exceed the cost saved; (5) the cost of reducing the risk would exceed the costs saved when the "cost of suffering" is also factored in; (6) the opportunity costs are too high- the available budget would be better spent on other, more pressing public health problems; (7) public health professionals say it is acceptable; (8) the public says it is acceptable (or more likely, do not insist it is not); and (9) politicians say it is acceptable [16]. Thus, three main factors determine acceptable risk: (1) acceptable by regulation; (2) acceptable for economic reasons; and (3) acceptable according to the views of professsionals or decision-makers. In the public sphere, where access to information can influence the perception of acceptable risk, accurate information is essential in coming to an informed judgment. Therefore, public agencies must take responsibility for full and widespread disclosure and dissemination of relevant critical information so that communities and people have the means to interpret and come to a judgment on the acceptable level of risk, Thus, the aspects of acceptable risk are mentioning in executive organizations, emergency managers who act as decision makers in disaster or risk management. Moreover, determination of risk acceptability comes from the analysis of risk matrices, which considers the relationship between likelihood and consequences [17].

The work of Zonensein, who analyzed the Flood Risk Index, showed the possible damage resulting from flood inundation levels on urban features and life. The Flood Risk Index could focus on range (maximum and minimum extremes, comprising all the values the index can assume), formulation (the mathematical expression that represents the relationship between the set of indicators, which compose the index), constitution (the set of indicators that compose the index), and domain (the space sphere where the index is applicable) [18].

According to a 2008 study by Zhai and Ikeda on acceptable risk in flooding situations, acceptable flood risk can be assessed using eight categories of factors: (1) acceptability of above- and below-flood inundation; (2) characteristic of residents: age, income, number of people in household, occupation, residence, period and education; (3) flood-risk perceptions: flood disaster experience, perception towards frequency and consequence of flood risk; (4) perception of other risks: other kinds of disaster, disease risks, urban risk, and high-technology risks; (5) preparedness for disaster: insurance, evacuation kits, embankments; (6) social measures: evacuation, familiarity with disaster maps; (7) information provision: external effects of flood control, local budget for public facilities; and (8) regional features [19].

Methodology

This study used a questionnaire survey as a quantitative research tool, with a sample of 200 respondents in total. The questionnaire, which was distributed during July - August 2013, comprised five main topics: (1) Respondents'

information; (2) Decision of respondents to take action classified by flood inundation level; (3) Perception towards stakeholders in flood management activity; (4) Factors influencing respondents to become involved in flood management activities; and (5) Current preparations and response effort. The research framework in this study is shown in Figure 1.

Case study

Pak Kret Municipality is located in Nonthaburi province, which forms part of the Bangkok Metropolitan Region (BMR). It is an urbanized area and has expanded as a residential zone for commuters working in the Bangkok Metropolitan Area. Pak Kret municipality is located in low-flat land area adjacent to the banks of the Chao Phraya River; it is therefore highly vulnerable to risks of both river flood and excessive rainfall. According to runoff data which measured at the Royal Irrigation Department (RID) at station C.35 (Bang Ban Station, Phra Nakorn Si Ayutthaya), which is the nearest station close to Pak Kret Municipality, the approximate discharge volume from the Chao Phraya River is 3,000 cubic meters per second (CMS). Because this volume already exceeds the crisis level, it should be monitored by the Royal Irrigation Department (RID) and related authorities in order to minimize the potential hazards in advance and mitigate their impact. River flooding affects people living along the river banks or other inland areas connected by waterways to the river, especially in urban areas. Pak Kret Municipality was therefore highly vulnerable to the 2011 flood, but ultimately was not severely impacted. Pak Kret Municipality officers began their preparations in March 2011, when upstream areas in the north had already been affected. Pak Kret Municipality applied the Pak Kret Model as an operational approach, relying on an actual situation. As an operation for flood response, the Pak Kret Model concerns the coordination among municipality, communities and non-profit organizations in areas such as basic relief, confirming accuracy of information, technical support, and monitoring. Additional tasks are necessary in order to mount an effective response during the flood situation. Table 1 shows the tasks of divisions in Pak Kret Municipality as part of the overall flooding response in 2011.

The potential of the Pak Kret Model compared to other management strategies in other municipalities lies in the coordination among all actors in implementing the many critical tasks to accomplish a coherent disaster response, including various organs within the municipality. The Pak Kret Model was used during the disaster response in October 2011, with all organs on the municipal level responsible for their own tasks, as listed in Table 1. Regarding the success of management based on the Pak Kret Model, three elements are addressed. These are: 1) leadership of the community leaders – experience from leaders acting as effective factors for disaster confrontation, which include good management, problem solving, and preparation; 2) cooperation among communities, considered as consequences of the community network policy already launched under normal situation, providing a foundation of trust for cooperation between communities and municipalities to build effectively during the disaster phase; and 3) accuracy of information – widespread misinformation can cause misunderstanding and panic; to resolve this, the municipality encouraged local people to provide information on the actual situation at an on-site level. Consequently, the Flood Information Center initiated screening and established ordinances for better accuracy of information.

According to the potential of the Pak Kret Model, the importance of public involvement in the actual situation, cooperation among municipal officers concerning the potential of

the resources of each divisions, effective incident command, vision of the mayor, and the initial speed of mobilizing the response process before threats of disaster or hazards have reached their capacities, are all considered as key to the ultimate success of the response, in contrast to the ineffectiveness of wide-scale management apparent in other methods. Moreover, public participation was considered as the crucial part of the Pak Kret Model.

Table 1 Concept and details of the Pak Kret Model

Task	Measurement
On-site threat monitoring	Launch on-site monitoring headquarters in strategic point under supervision by mayor, activities related to monitoring and evaluation had been done at strategic locations to assess the actual situation.
Public relations unit	Establish a public relations team to communicate, coordinating between officers and the local community to distribute accurate and timely information.
Equipment support unit	Locate and prepare flood protection equipment, coordinate relief efforts with external groups such as volunteers, foundations and other unaffected municipalities.
Relief aid support unit	Dispatch survey team to affected communities and the primary health care service for controlling the spread of infectious diseases.
Refugee rehabilitation support unit	Established a dedicated relief team in case of the need for evacuation, and contact with local schools in the municipality to serve as temporary shelters.
Disaster emergency response unit	Evaluate and monitor the actual flooding situation in order to collaborate with the equipment support team and dispatch of flood protection equipment.
Community participation unit	Encourage local communities to join the flood protection efforts, both inside and outside the flood barrier communities.
Flood monitoring unit (daily update, recovery effort, immediate response, verifying information before announcement)	Daily monitoring of the flooding situation, issue of warnings and giver information to the local population in the municipality, and minimizing redundancy or duplication of relief efforts

Source: Pak Kret Municipality, 2012

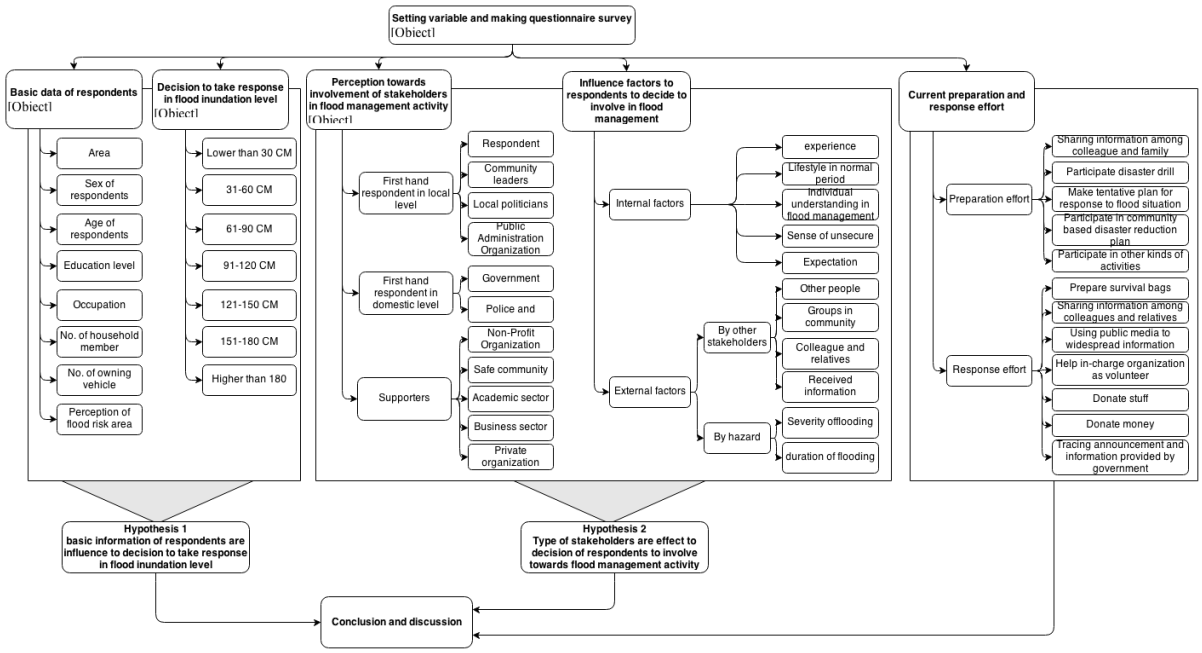

Figure 1 Research framework
Source: Author, 2013

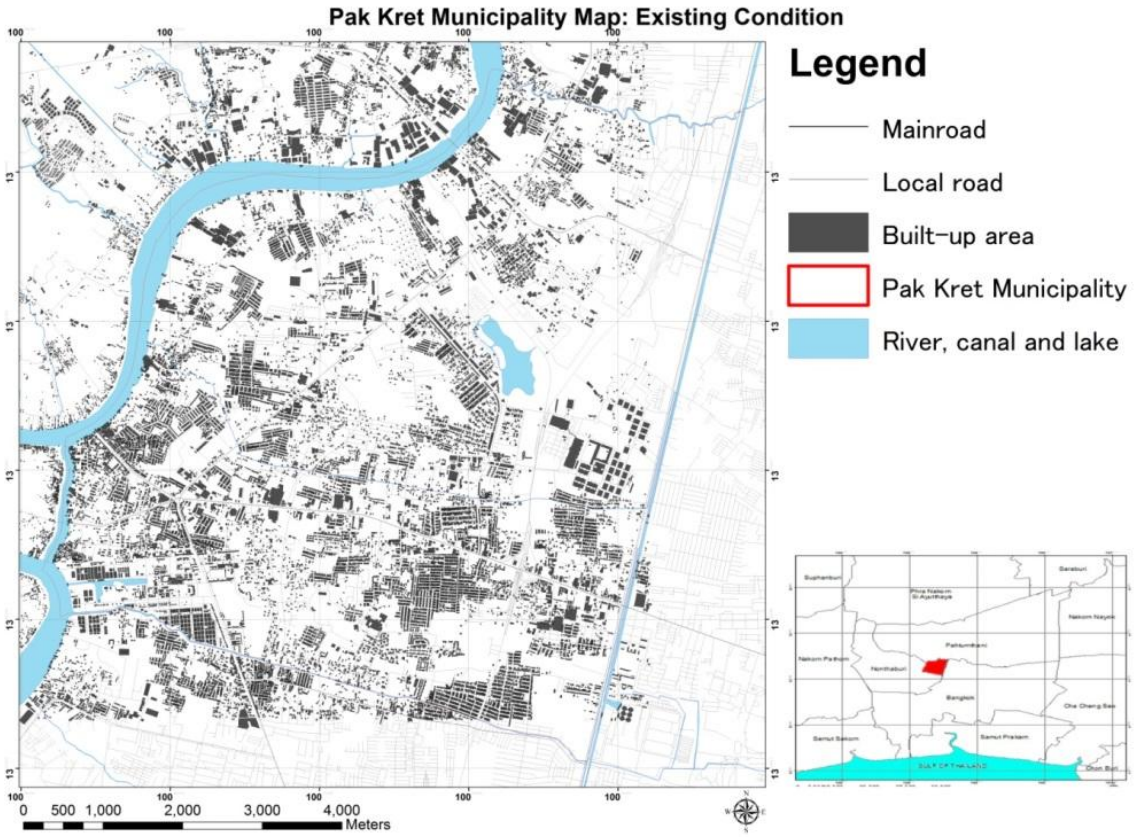

Figure 2 Thailand, Nonthaburi province, Pak Kret Municipality
Source: Pak Kret Municipality, 2012

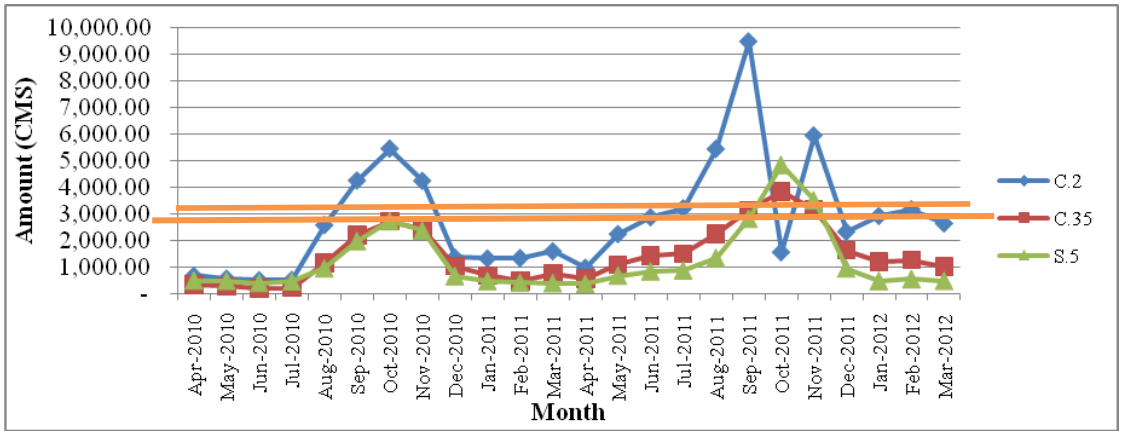

Figure 3 Amount of discharge volume at water station between April 2010 – March 2012

Remark
Sta. C.2 Ban Phai Lom Station, Nakorn Sawan province
Sta. C.35 Ban Pom Station, Phra Na korn Si Ayutthaya
Sta. S.5 Pranchama Thirat Hospital, Phra Na korn Si Ayutthaya
Maximum capacity of discharge volume (3,000 CMS)

Source: Royal Irrigation Department, 2013

Table 2 Main tasks for each organ under the local municipality

Division and office	Duties and tasks
Office of the Municipal Clerk	Serve as Municipality secretariat to facilitate collaboration among other organs within the municipality, execute legislation and basic public services, and serve as the lead agency in coordinating disaster prevention and relief strategies and activities.
Division of Plan and Policy Analysis	Responsible for establishing development guideline, analyze and evaluate plans, establish planning budget, public relations, and establish special ordinances for the municipality
Division of Finance	Manage the budget and its disbursement regarding to municipality activities, and collect taxes
Division of Public Works	Issue building permission within the municipality boundary, maintenance of municipality infrastructure
Division of Social Welfare	Activities related to social work, including increasing the capacity of the labour force to undertake community improvement activities.
Division of Public Health and Environment	Manage municipality utilities, public health-related activity, and control any outbreaks of infectious diseases
Division of Education	Planning related to school activities, improving school curriculum
Subdivision of Disaster Prevention and Mitigation, Office of the Municipality Clerk	Activities regarding to the disaster relief, and prevention activities for protect people in daily life

Source: Pak Kret Municipality, 2012

Organs	Task							
	1	2	3	4	5	6	7	8
Executive Division	●		●					●
Planning Division		●					●	●
Civil Engineering Division	●					●		●
Disaster Relief team Division		●				●		
Treasurer Division			●					
Social Welfare Division				●			●	
Public Health and Environment Division				●				
Education Support Division					●		●	

Tasks

1. On-site Threat Monitoring (24 hours)
2. Public Relation unit
3. Equipment support
4. Relief aid support team
5. Refugee rehabilitation Support team
6. Disaster Emergency Response unit
7. Community participation unit
8. Flood monitoring unit

Figure 4 Tasks for organs regards to Pak Kret Model
Source: Pak Kret Municipality, 2012

Results

1) Respondents' information

The results of the questionnaire survey included aspects such as sex, age, education level, occupation, number of household members, income, numbers of vehicles owned, and perception of flood-prone areas. The responses are tabulated in Table 3.

2) Decision of respondents to take action, classified by flood inundation level

According to the decisions of respondents to take action, classified by flood inundation level, respondents had similar perceptions of flood risk acceptability, regardless of the level of inundation. As shown in Figure 5, most respondents did not take flood response immediately when flooding began, and where the inundation level was less than 30 centimeters. The average number of days before respondents acted was approximately 5 days, but ranged widely from 2-7 days (Mean 0-30 cm = 5.81, SD = 3.71) after flooding first occurred. However, the average dates to taking response of people are regardless to level of flood inundation (Mean 31-60 cm = 6.08, SD = 3.27, Mean 61-90 cm = 5.88, SD = 2.29, Mean 91-120 cm = 6.07, SD = 4.79, Mean 121-150 cm = 5.60, SD = 2.39). The output of the average date of respondents towards decision to take response classified by level of flood inundation is shown in Figure 5.

3) Perceptions of stakeholders in flood management activity

There are three major groups of stakeholders in this study: there are (1) first-hand respondents at the local level; community leaders, local politicians, public administration organizations, and the at-risk community; (2) first-hand respondents at the domestic level, government, police and military; and (3) supporters, non-profit organizations, safe community, academic sector, business sector, and private organization. Respondents in Pak Kret Municipality expected that first-hand respondents at the local level should all be involved in flood management activity as their top priority (Mean $_{\text{local leve l}}$= 4.53). These activities include participation at public hearings, providing advice and consultation, and other activities related to flood management. The second group of stakeholders are categorized as supporters: non-profit organizations, safe communities, the academic and business sectors and private companies (Mean $_{\text{supporter}}$ = 3.89). Respondents felt that this group should be involved at only a low-to-moderate level (partially involved, or giving support, participate in public hearings, provide some advice and consultation), which was similar to first-hand respondents groups in domestic level; government, police and military groups, (Mean $_{\text{domestic}}$ = 3.68). The results are tabulated in Table 4.

Table 4 Comparison among stakeholders in flood management activities

Aspects	Pak Kret Municipality	
	Mean	SD
First hand respondents in local level		
Respondent	4.90	1.21
Community leaders	4.98	1.01
Local politicians	4.59	1.08
Public Administration Organization (PAO)	3.89	1.79
At-risk community	4.27	1.56
Average	*4.53*	0.45
First hand respondents in Domestic level		
Government	3.75	2.35
Police and military	3.60	1.95
Average	3.68	0.07
Supporter		
Non-profit organizations	3.49	1.34
Safe community	3.90	1.27
Academia	3.91	1.15
Business sector	4.08	2.31
Private organizations	4.09	1.04
Average	3.89	0.22

Note:
1 No involvement (Follow orders, manual and demonstration as guided by other stakeholders)
2 Lowest level of involvement (Giving support as a basic relief or first-aid)
3 Low level of involvement (Partially involved or giving limited support in some aspect)
4 Moderate level of involvement (Participate in public hearings, provide some advice and consultation)
5 High level of involvement (Mostly involved in disaster-related issues)
6 Highest level of involvement (Become the lead actor or first-hand respondent in flood management)

Source: Questionnaire survey data, August, 2013

4) Factors influencing involvement of respondents

According to the influencing factors to participate (IFP) in this study, the two major factors identified in this study are: (1) internal factors: experience, lifestyle in non-disaster period, understanding towards flood management, sense of insecurity, and expectation; and (2) external factors: groups a local or community levels, colleagues or relatives, and received information, duration and severity. As shown in Table 5, normally, internal factors such as experience of respondents, normal lifestyles of respondents and their own understanding towards flood management did not influence them to participate towards flood management activity. These two influent factors such as sense of insecurity and expectations, influenced the respondents to take action ($N_{IFP\ unsecure}$ = 93, 46.50%; $N_{IFP\ expectation}$ = 162, 81.00%). The most important external factors influencing respondents to take action are severity of flood situation ($N_{IFP\ severity}$ = 148, 74.00%), duration of flooding ($N_{IFP\ duration}$ = 137, 68.84%), influence from received information ($N_{IFP\ information}$ = 122, 61.00%), and influence from colleague ($N_{IFP\ colleague\ e}$ = 109, 54.50%).

5) Current preparation and response effort

5.1) Preparation activities

Six types of preparation activity were considered in this survey, including sharing information among colleagues and family, participating in disaster drill activities, making tentative plans for flood response, participating in community-based disaster reduction plans, studying about disaster preparation, and checking survival kits. The results indicated that most respondents in Pak Kret municipality had decided not to take any preparatory actions for floods. Of the few respondents who did, their action was at a low level. The results for preparation activities are shown in Figure 6.

Table 5 comparison between influences factors toward decision of involvement

Factors	Type of influence approach	Quantity	Percentage	Mean	SD
Experience	Influence to participate	60	30.15	2.12	0.761
	Influence not to participate	*86*	*43.22*	2.63	0.614
	Not influence	53	26.63		
Lifestyle in normal period	Influence to participate	28	14.07	1.43	0.573
	Influence not to participate	*87*	*43.72*	1.36	0.610
	Not influence	84	42.21		
Understanding towards flood management	Influence to participate	55	27.64	1.38	0.561
	Influence not to participate	56	28.14	1.21	0.456
	Not influence	*88*	*44.22*		
Sense of unsecure	*Influence to participate*	*93*	*46.50*	1.85	0.846
	Influence not to participate	48	24.00	1.27	0.494
	Not influence	59	29.50		
Influence from other people	*Influence to participate*	*95*	*47.74*	1.28	0.559
	Influence not to participate	39	19.60	1.23	0.485
	Not influence	65	32.66		
Influence from groups in local level	*Influence to participate*	*94*	*47.00*	1.21	0.505
	Influence not to participate	40	20.00	1.20	0.405
	Not influence	66	33.00		
Influence from colleague	*Influence to participate*	*109*	*54.50*	1.27	0.503
	Influence not to participate	34	17.00	1.29	0.524
	Not influence	57	28.50		
Influence from received information	*Influence to participate*	*122*	*61.00*	1.35	0.513
	Influence not to participate	27	13.50	1.48	0.643
	Not influence	51	25.50		
Duration of flooding	*Influence to participate*	*137*	*68.84*	1.69	0.705
	Influence not to participate	28	14.07	1.29	0.460
	Not influence	34	17.09		
Flood severity	*Influence to participate*	*148*	*74.00*	1.86	0.774
	Influence not to participate	24	12.00	1.25	0.442
	Not influence	28	14.00		
Expectation	*Influence to participate*	*162*	*81.00*	2.02	0.764
	Influence not to participate	16	8.00	1.63	0.719
	Not influence	22	11.00		

Source: Questionnaire survey data, August, 2013

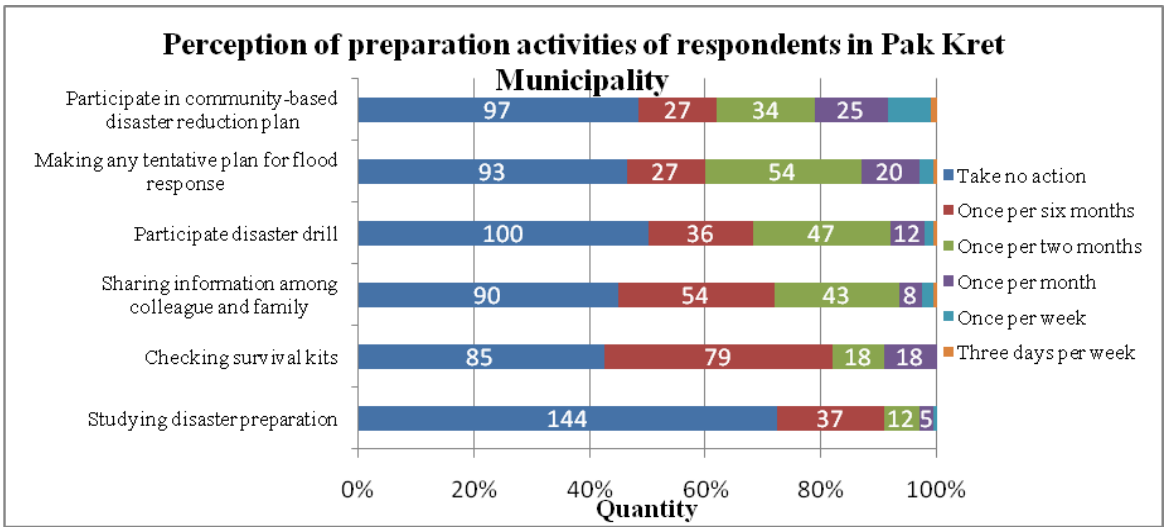

Figure 6 Perception of flood preparation activities of respondents in Pak Kret Municipality
Source: Questionnaire survey data, August, 2013

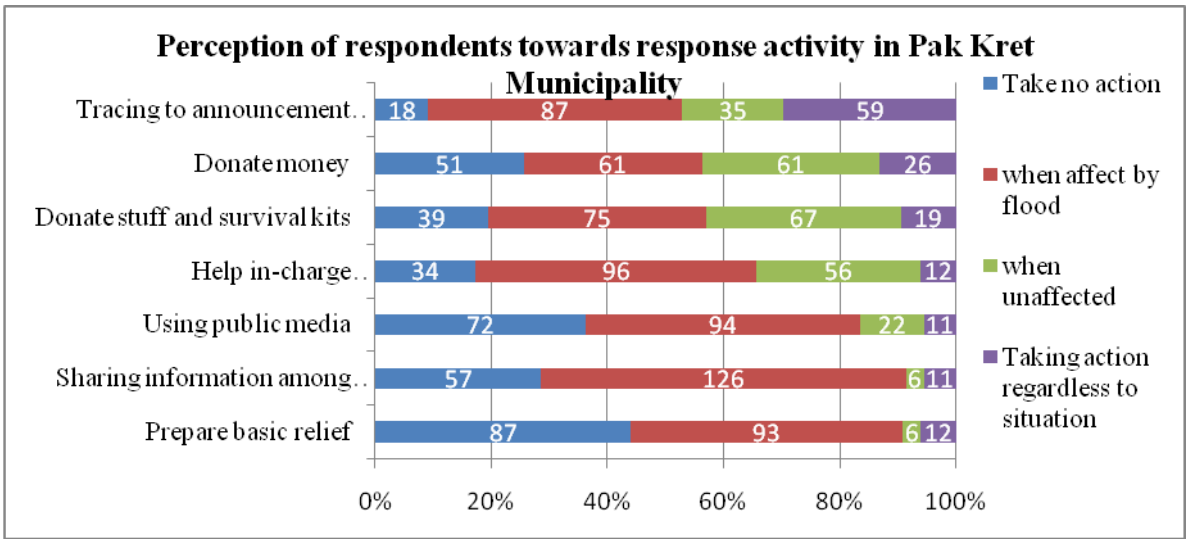

Figure 7 Perception of flood response activities of respondents in Pak Kret Municipality
Source: Questionnaire survey data, August, 2013

5.2) Response activities

Seven categories of response activity were considered in this survey (preparation for basic relief, sharing information among colleagues or friends, using public media to disseminate information widely, help or support lead agencies as a volunteer, donate money, donate material and survival kits, and tracking of government announcements). The results indicate that respondents took action once they are already affected by flood or they perceive that they are about to be affected. Most activities that respondents decided to take up were related to information (e.g. sharing information and using public media) and preparing themselves to tackle the flood situation.

Analysis

In order to define how personal characteristics influence the decision to take action, this study applied two kinds of analysis: (1) personal characteristics and the decision to

take action towards different levels of flood inundation; and (2) type of stakeholders who should become involved in flood management activity and influence factors which lead respondents to decide to become involved in flood response activity. These two analyses are discussed below.

1) Personal characteristics and the decision to take response

This section analyzes how personal factors could affect the decision to take response towards the flood situation. This study applied the correlation analysis between personal characteristics (i.e., sex, age, education level, income, occupation, number of household members, number of vehicles, and perception of living place of respondent) and flood inundation level. Table 6 shows the findings of the correlation analysis between personal characteristics and respondent's decision to take action.

The correlation analysis indicates that factors such as age, occupation and perception of respondents towards flood-prone area have a negative correlation to the decision to become involved. However, this correlation depended on inundation level. In case of age, increasing age correlated with the respondent's decision not to participate in flood response activities (Age <30 CM = -0.233, Sig. 0.001; Age 31-60 CM = -0.241, Sig. 0.001; Age 61-90 CM = -0.213, Sig. 0.003). In contrast, the number of household persons and number of vehicles that correlated positively with the decision to participate in flood response activities, as classified by level of inundation level (Household < 30CM = 0.204, Sig. 0.004; Vehicle < 30 CM = 0.238, Sig. 0.004, Vehicle 31-60 CM = 0.202, Sig.0.016). The result of the analysis shows that although these factors are correlated with the level of flood inundation, the degree of correlation depends on the level of inundation. Moreover, some personal characteristics are negatively correlated to the decision to take part in flood response activities. According to the correlation analysis, factors such as the age of respondents, occupation, and perception of respondents that they are living in a flood-prone area have a negative correlation to the decision to take response in each inundation level.

2) Type of stakeholders and decision to involved in flood response activity

According to the output of correlation analysis between influencing factors and flood inundation level, the degree of correlation depends is dependent on inundation level. There are two major sources of influence factors. These are: (1) internal factors (e.g., experience, lifestyle in a normal period, understanding of respondent towards water management, sense of insecurity, and expectation); and (2) external factors (e.g., actions from other people, peer pressure, groups of people in the community, information, situation and duration of flooding). According to Table 7, internal factors such as experience and normal lifestyle are negatively correlated to the decision to participate in flood response activities, according to the inundation level (Experience $_{<30CM}$ = -0.254 Sig. 0.00, Experience $_{31\text{-}60CM}$ = -0.203 Sig. 0.004; Lifestyle $_{<30CM}$ = -0.225 Sig. 0.001, Lifestyle $_{31\text{-}60CM}$ = -0.226, Sig. 0.001). In contrast, respondents' understanding of flood management and sense of insecurity were positively correlated to the decision to take action, classified by inundation level (Understanding $_{<30CM}$ = 0.143, Sig. 0.044, Understanding $_{31\text{-}60CM}$ = 0.149, Sig. 0.036; Unsecure $_{<30CM}$ = 0.0279,Sig. 0.000, Unsecure $_{31\text{-}60CM}$ = 0.282, Sig. 0.000, Unsecure $_{61\text{-}90CM}$ = 0.0265, Sig. 0.000). In case of external factors such as peer pressure, the influence of other community groups, received information, duration and severity of flooding, are positively correlated to taking action where inundation reached 121-150 cm. (Other people $_{121\text{-}150CM}$ =

0.228, Sig. 0.001, Colleague $_{121\text{-}150CM}$ = 0.187, Sig. 0.008, Severity of flooding 121-150CM = 0.144, Sig. 0.042). The correlation output in this study is shown in Table 7.

Conclusion

Disaster management entails coordination of a diverse range of activities in order to prevent or mitigate damage and loss to life and property caused by disasters and consequential hazards. Effective collaboration and coordination are essential to effective disaster management and relief work at all levels. When the capacities of local government and community members to manage the disaster have reached their limits, a collective response becomes crucial in disaster management, especially in the response or emergency phase.

The analysis in this study shows that personal characteristics and influencing factors are correlated to respondents' participation in flood response activities. It is also classified by the level of inundation. According to the analysis, some personal characteristics correlate with the decision to take action, according to inundation level. Factors such as numbers of persons per household and numbers of vehicles per household are positively correlated to respondents' decision to take up flood response actions. In contrast, respondent occupation, personal perception of the flood prone area and respondent age were negatively correlated to the decision to participate. Factors such as experience and lifestyle of respondents influence them not to become involved in flood management activities, while a sense of insecurity, peer pressure, influence of other groups, received information, characteristic of the flood situation and expectation of respondents tend to influence them to become involved in response activities. However, an understanding of respondents of flood management does not influence them to participate. Although personal characteristics and risk perception are related to vulnerability in personal and influence to personal risk acceptability, this is dependent on the specific risk situation- the level of inundation in this case. Some personal characteristics such as sex and education level did not correlate with respondent actions, as classified by inundation level.

Future studies of public involvement should explore acceptability based on other perceptions such as the characteristics of the living place, lifestyles and other threats posed by consequential hazards (e.g. epidemics and poor living conditions). The impact of disaster policy and performance of emergency managers (governments, authorities, the legal system, and operational procedures in disaster response) also contributes to public perceptions and their readiness to participate in disaster management activities. Further work is also needed on the factors influencing the decision to become involved in flood response. The influence of factors such as existing flood disaster management policy, current performance of other first-hand respondents, and openness to become involved in a collective response, investigation is also needed, as is the role and potential of all stakeholders, including non-profit organizations, businesses, and the research community. In order to find out how to coordinate those facilitator groups to work coherently and effectively together with first-hand respondents (government, the Public Administration Organization, and local communities and individuals) to achieve an effective standard of flood disaster management.

Table 6 Correlation between flood inundation level and personal characteristics

Personal characteristic		Flood inundation level				
		less than 30 centimeter	31-60 centimeter	61-90 centimeter	91-120 centimeter	121-150 centimeter
Sex of respondent	Pearson R.	0.008	0.038	0.014	-0.056	-0.049
	Sig. (2-tailed)	0.911	0.598	0.842	0.436	0.496
	N	198	199	198	199	199
Age of respondent	Pearson R.	**-.233(**)**	**-.241(**)**	**-.213(**)**	0.075	0.022
	Sig. (2-tailed)	**0.001**	**0.001**	**0.003**	0.295	0.762
	N	**197**	**198**	**198**	198	198
Education level of respondents	Pearson R.	0.049	0.017	0.078	0.073	-0.050
	Sig. (2-tailed)	0.499	0.818	0.275	0.307	0.484
	N	196	197	196	197	197
Income of respondents	Pearson R.	-0.022	-0.055	-0.080	**.170(*)**	-0.085
	Sig. (2-tailed)	0.762	0.452	0.271	**0.018**	0.243
	N	191	192	191	**192**	192
Number of household person	Pearson R.	**.204(**)**	0.138	0.007	-0.015	**-.216(**)**
	Sig. (2-tailed)	**0.004**	0.054	0.927	0.834	**0.002**
	N	**194**	195	194	195	**195**
Number of vehicles	Pearson R.	**.238(**)**	**.202(*)**	0.123	0.019	**-.171(*)**
	Sig. (2-tailed)	**0.004**	**0.016**	0.145	0.820	**0.042**
	N	**142**	**142**	142	142	**142**
Occupation of respondents	Pearson R.	**-.180(*)**	**-.158(*)**	-0.102	0.075	0.041
	Sig. (2-tailed)	**0.012**	**0.026**	0.153	0.294	0.568
	N	**196**	**197**	196	197	197
In your idea, do you living in flood prone area?	Pearson R.	**-.243(**)**	**-.280(**)**	**-.273(**)**	**-.160(*)**	-0.020
	Sig. (2-tailed)	**0.001**	**0.000**	**0.000**	**0.026**	0.781
	N	**191**	**192**	**191**	**192**	192

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Questionnaire survey data, August, 2013

Table 7 Correlation between influencing factors and flood inundation level

Influence factor		Flood inundation level				
		0-30 centimeter	31-60 centimeter	61-90 centimeter	91-120 centimeter	121-150 centimeter
Experience	Pearson R.	**-0.254****	**-0.203****	-0.023	0.092	**0.250****
	Sig. (2-tailed)	**0.000**	**0.004**	0.748	0.196	**0.000**
	N	**198**	**199**	198	199	**199**
Lifestyle in normal period	Pearson R.	**-0.225****	**-0.226****	-0.097	0.061	0.130
	Sig. (2-tailed)	**0.001**	**0.001**	0.176	0.391	0.066
	N	**198**	**199**	198	199	199
Understanding of respondent towards water management	Pearson R.	**0.143***	**0.149***	0.065	0.049	-0.094
	Sig. (2-tailed)	**0.044**	**0.036**	0.362	0.493	0.188
	N	**198**	**199**	198	199	199
Unsecure of respondent towards flood situation	Pearson R.	**0.0279****	**0.282****	**0.265****	0.112	0.020
	Sig. (2-tailed)	**0.000**	**0.000**	**0.000**	0.114	0.776
	N	**199**	**200**	**199**	200	200
Other people action	Pearson R.	0.034	0.066	**0.152***	0.115	**0.228****
	Sig. (2-tailed)	0.629	0.352	**0.032**	0.106	**0.001**
	N	199	200	**199**	200	**200**
Influence of groups in local level or community	Pearson R.	0.025	0.034	0.091	0.079	0.114
	Sig. (2-tailed)	0.724	0.637	0.200	0.269	0.107
	N	199	200	199	200	200
Influence by colleague and relatives	Pearson R.	-0.029	0.002	0.070	0.081	**0.187****
	Sig. (2-tailed)	0.686	0.979	0.326	0.257	**0.008**
	N	199	200	199	200	**200**
Influence by received information	Pearson R.	-0.011	-0.014	0.016	-0.139	0.008
	Sig. (2-tailed)	0.879	0.846	0.827	0.050	0.914
	N	199	200	199	200	200
Influence by flood duration	Pearson R.	-0.021	0.036	0.069	0.074	0.127
	Sig. (2-tailed)	0.768	0.617	0.331	0.298	0.073
	N	199	200	199	200	200
Influence by severity of flooding	Pearson R.	0.027	0.072	0.125	0.081	**0.144***
	Sig. (2-tailed)	0.710	0.312	0.079	0.255	**0.042**
	N	199	200	199	200	**200**
Influence by expectation	Pearson R.	0.004	0.038	0.066	0.078	**0.142***
	Sig. (2-tailed)	0.044	0.036	0.362	0.493	**0.188**
	N	198	199	198	199	**199**

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Questionnaire survey data, August, 2013

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