



Perception and Communication of Flood Risk: Lessons Learned about Thailand's Flood Crisis of 2011

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Abstract

Flooding remains a common environmental hazard worldwide, causing some of the most devastating natural disasters of the last century. This is why understanding public perception has become such an important topic for policy makers concerned with flood risk management. This study investigated public perception of flooding events through analysis of risk communication for Thailand's flood crisis in 2011. An online questionnaire was electronically distributed to residents potentially affected by flooding in Bangkok. Results from 437 returned surveys indicate that Thai residents tend to display both cognitive and affective biases in their perceptions of flood risk. The majority of respondents believed the great flood of Thailand 2011 was directly caused by government mismanagement and negative impacts of climate variability. These biases might occur because of difficulty in evaluating flood probability and lack of adequate information. Floods and related topics mainly evoked feelings of stress, anxiety, boredom, powerlessness and fear. The majority of Thai respondents distrusted any information provided by the central government, while rumors and misinformation could have affected public perceptions and responses to the flood. The general failure of preventive action and poor risk communication have been reported. Further implications (i.e. Cognitive-Affective Interference in Protective Anticipatory Adaptation; CAIPAA model) and further recommendations are discussed.

Keywords: Flood; perception; risk communication; Thai flood crisis

Introduction

Disaster statistics suggest that flood catastrophes are becoming more frequent and more severe over time. According to the Centre for Research on the Epidemiology of Disasters (CRED), in 2010, flooding affected approximately 178 million people worldwide, and the occurrence of floods is the most frequent of all natural disasters [1]. Extreme flood events have significant impacts upon ecosystem functioning, human wellbeing and economic development. Globally, at least one third of all losses due to natural forces are attributed to floods [2]. As in countries such as India, China, Pakistan and Australia, several parts of Thailand suffer from heavy monsoon rains that trigger both flash floods and riverine floods, spreading through the provinces of northern and central regions of Thailand along the Chao Phraya river basin.

In November 2011, more than ten million people in 65 of Thailand's 77 provinces were affected by severe flooding. The flood was ranked as the world's fourth costliest disaster over the period 1995 to 2011 [3]. Thus, understanding public perception of natural hazards is a crucial aspect in risk management, as it steers the development of effective and meaningful mitigation strategies. Furthermore, while the frequency of great floods and other disaster events has increased substantially in the past century, existing research on the perception of risks is, however, in its early stages [4], particularly in Thailand.

The main objective of this study is to gain insight into public perceptions of flooding events, and the interpretation of risk communication during Thailand's flood crisis of 2011. An online survey was electronically distributed to residents in flood prone areas with Bangkok and surrounding provinces considered as the target population. A total of 437 responses were received in this survey. This paper provides a brief review of global flood

trends, flood characteristics, the flood situation in Thailand in 2011, and flood disaster management responses.

Background and literature review

1) Global flood trends

Damage caused by flooding has been extremely severe in recent decades. Both the frequency and intensity of floods are steadily increasing worldwide [5], and is a leading cause of losses from natural events [6]. From 1950 to 2010, flood disasters accounted for approximately a quarter of all natural catastrophes (by numbers and economic losses), as shown in Figure 1a. Specifically, when compared with other continents, Asia experienced the greatest number of flood disasters (755), or circa 40% of all flood events worldwide, during the period 2000-2009 (Figure 1b) [7].

2) Flood characteristics

The extent of a flood event is commonly driven by a combination of meteorological and hydrological extremes as well as influenced by human factors. On the ground, the World Meteorological Organization proposed a typology of four categories of urban floods: local, riverine, coastal and flash floods [8]. A detailed description is shown in Table 1.

3) Flood situation in Thailand in 2011

Beginning in late July 2011, intense typhoons, monsoon rains and tropical storms had caused localized flooding and major devastation across Southeast Asian countries, including Thailand, the Lao People's Democratic Republic, Cambodia, the Philippines and Vietnam [9]. In Thailand, floods first became prevalent in the northern region during the start of the monsoon season. The arrival of tropical storms (namely *Nock-ten*) and heavy monsoons between July and October 2011 triggered heavy rainfall, landslides, flash floods and river flooding [10].

As heavy rains continued, waters from overloaded reservoirs together with excess rainwater drained into the Chao Phraya River and its tributaries (e.g. Ping, Wang, Yom, Nan). The

river swelled and broke its banks while flowing southward into the northeastern and central regions, including Bangkok - the capital of Thailand.

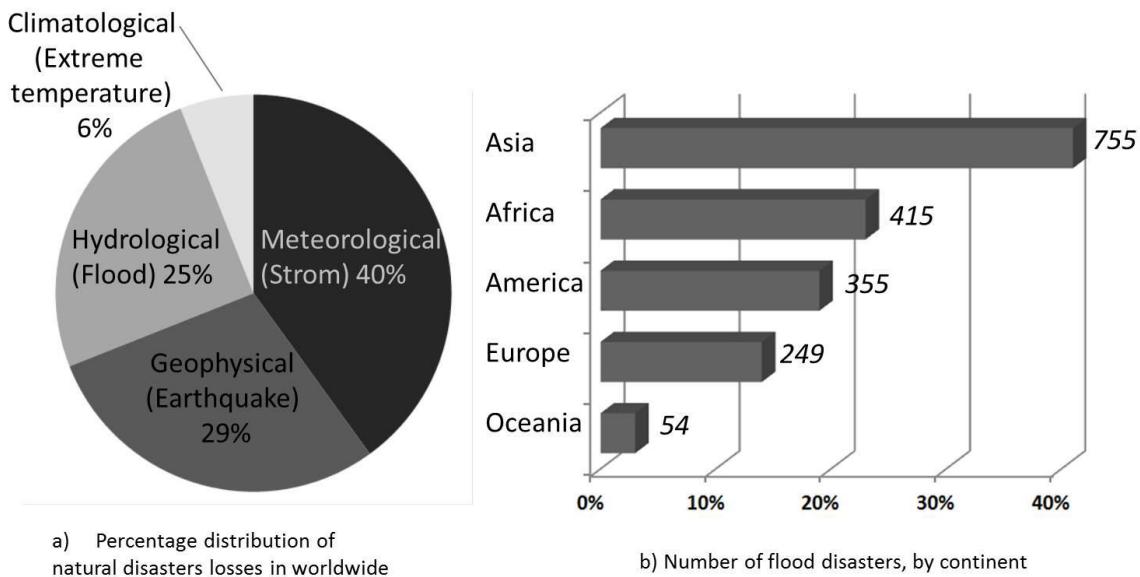


Figure 1 a) Percentage distribution of natural disaster losses worldwide, 1950 to 2010.
b) Number of flood events reported by continent, 2000 to 2009 [7].

Table 1 Typology of urban floods

Typology of floods	Characteristics
Local floods	<ul style="list-style-type: none"> During rainy season, very high rainfall intensity and duration, sometimes caused by heavy storms and seasonal depressions. Occurs when the public sewer system has insufficient capacity to reduce the amount of surface runoff entering the system from river or flash flooding.
Riverine floods	<ul style="list-style-type: none"> Generally caused by prolonged and extensive flooding of the river outside its regular boundaries (e.g., heavy rainfall or snow melt upstream, or tidal influences from downstream areas).
Coastal floods	<ul style="list-style-type: none"> Storm surges and other extreme weather conditions combined with high tides can cause sea levels to rise above normal, force seawater onto land and usually cause coastal flooding.
Flash floods	<ul style="list-style-type: none"> Most flash flooding is caused by the accumulation and release of runoff waters from upstream mountainous areas. There is a practical limit to the time available to predict flash floods in advance. Severe rainfall on the flood location might be commonly used as an indicator of this flood type.

4) Flood impacts

The impacts felt from flooding were widespread, and were felt across most of the country. Floods hit at least 65 out of the country's 77 provinces, and affected almost 14 million people; more than 800 people died in the flooding [11]. In addition, as Thailand plays an important role in agriculture, industry and global commerce, the impact of the flood crisis would be felt in food, electronics and automobile stores around the world. Transportation and agricultural infrastructure also suffered severe impacts; more than 1.92 million hectares (4.74 million acres) of land, including 1.35 million hectares (3.3 million acres) of rice paddy fields, were damaged. According to the World Bank, total economic losses were estimated to be at least THB 1,440 billion (USD 45 billion), making it, in all probability, the world's fourth costliest disaster as of 2011, surpassed only by: the 2011 earthquake and tsunami in Japan, the 1995 Kobe earthquake in Japan, and the 2005 hurricane Katrina in the USA [3]. Flooding posed a major threat not only to local people and the national economy, but also to the country's cultural heritage. For example, Buddhist temples in Ayutthaya province dating back to the 16th century were submerged in floodwaters for months - one important reason why Thailand's 2011 flooding was such a very serious issue for the country.

5) Flood disaster management

An integrated risk-based approach for flood management has received increasing attention in recent years from both academics and practitioners. As emphasized by Loster [12], a considerable incentive for re-thinking disaster risks as an integral part of the development process comes directly from the aim of achieving the goals laid out in the Millennium Declaration. As noted, the term 'risk' is often defined as the probability (chance) of exposure to an event, or the expectation value of the losses

that would be caused by such a hazard [13]. The composition of risk can help address not only efforts towards adaptive flood risk management but also improvement in people's livelihoods, wellbeing and their own disaster resilience. In response to these issues, systematic flood risk management should follow all stages of a risk cycle, through preparedness, response and recovery [8]. First, preparedness is the state of being ready to react promptly and effectively in emergency situations and prevent potential threats turning into disasters both at the individual and societal level. Second, response-related activities are implemented during, immediately and/or directly after a flooding incident to provide emergency assistance to disaster victims as well as reduce the likelihood of secondary damage. Recovery is the final stage of the emergency management cycle.

6) Risk perception and communication

Previous research [14] defines the study of risk perception as the investigation of people's awareness, emotions and related behavior in response to any hazard. Risk perception has become widely used in many disciplines. One of these applications is in flood risk management, which comprises a comprehensive set of main tasks for considering both natural and social processes related to flood hazards. Risk communication targeting all stakeholders is vital for effective flood management, since limited knowledge about flood risk perception might hamper communication and cooperation in implementation of mitigation measures [15]. It seems that national authorities should engage in a public long-term coordinated dialogue through a variety of channels, prior, during and post-disaster, based upon the four states of the disaster management cycle [16]. Table 2 provides a summary of different factors identified in the literature that may shape perceptions and/or intentions to take a more proactive approach to flood risk management [17, 18, 19].

Methodology

The main objective of this research is to gain insight into the perceptions and the interpretation of risk communication during Thailand's flood crisis of 2011. An online survey was distributed to Thai residents in flood prone areas with Bangkok and surrounding provinces considered as the target population. A questionnaire survey was used as the research tool, and is described below.

1) Questionnaire survey

An online questionnaire was designed and electronically distributed from February to April 2012 to residents potentially affected by flooding in late 2011. It comprised three parts: 1) general background information, 2) perceptions of flood risk and flooding related issues, and 3) recommendations. Respondents were asked to use a Likert scale numerical rating, from 1 (strongly disagree) to 5 (strongly agree) to respond to each statement. Descriptive statistics were further performed in order to illustrate basic features of the data.

2) Target population

This study was undertaken for households which had been flooded and households located within flood risk areas (Figure 2). Specifically, the Bangkok Metropolitan Region (including Bangkok and five surrounding provinces: Nonthaburi, Pathum Thani, Nakhon Pathom, Samut Sakhon and Samut Prakarn) and Ayutthaya province were considered as the target population (Figure 2). A total of 437 responses were received in this survey.

Results and discussion

1) Demographic profile

Based upon the questionnaire results, the respondents consisted of 53% males and 47% females. Approximately 68% were aged between 20 and 39 years. Over one-third of respondents (34%) had a four-year Bachelor's degree, and almost a quarter of respondents had achieved a

postgraduate degree followed by those with a secondary education, at 22% and 20% respectively. The main occupations at the time of survey were largely office employees (39%), government officers (19%) and freelancers (15%), while only 1% were farmers. Most survey respondents resided in Bangkok (55%), Nonthaburi (18%) and Pathum Thani (14%).

2) Knowledge of the leading causes of flood

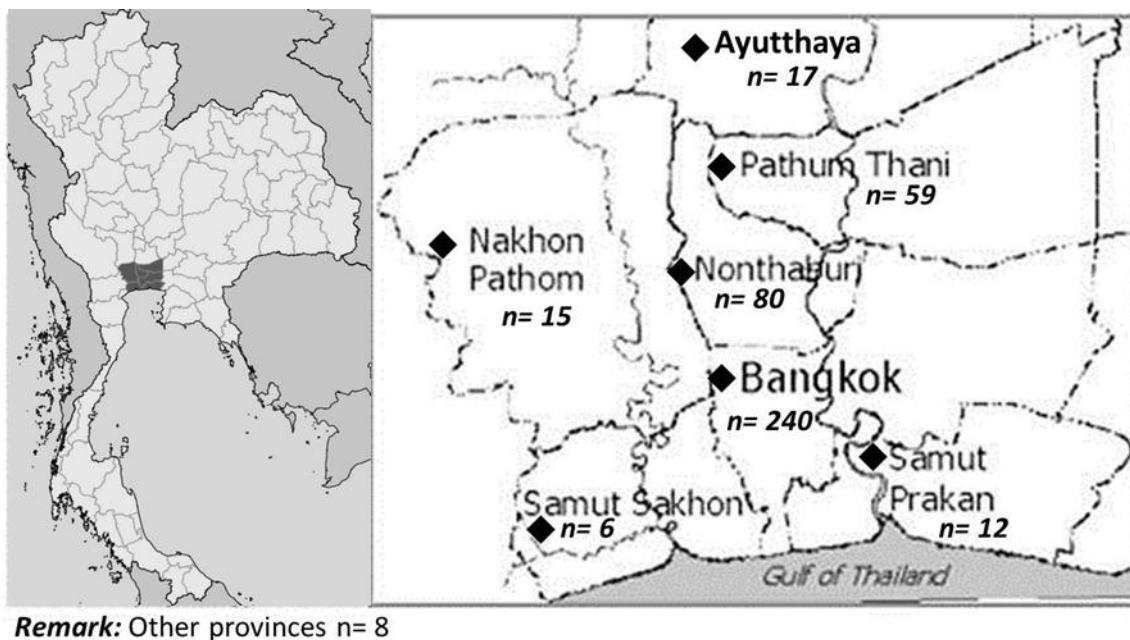
As shown in Figure 3a, three quarters of respondents agreed or strongly agreed that the great flood of Thailand 2011 was directly caused by government mismanagement (75%) and the negative impacts of climate variability (71%). One possible reason is that there are allegations of mismanagement, centering perhaps on i) government's failure to release water from the dams early enough, in a season where rainfall was not much above normal, ii) the government's perceived failure to prepare for the expected surge in river flow, iii) political interference and cronyism in diversion of floods to protect areas owned or controlled by politicians. Beyond this, most people acknowledged that even though a government can do little about heavy rainfall, it can manage the water levels in a major dam effectively.

2.1) Personal experience and perceived flood risks in the community

Of the 437 respondents, 80% (n = 347) stated that they have often experienced flooding (including Thailand's 2001 flood) in their homes and communal areas. The respondents were then asked to rate flood risk in their living area on a qualitative scale, with the options 'very high', 'high', 'neutral', 'low', and 'I do not face any flood risks'. The results showed that relatively few respondents rated flooding as a major risk (13%) or no risk (14%). Whereas, around 19% of respondents perceived flooding as a minor risk, 27% as a moderate risk, and 27% as a neutral risk (Figure 3b).

Table 2 Factors shaping flood risk perceptions

<i>Knowledge</i>	- Knowledge of the main cause of flooding
<i>Experience</i>	- Previous experience with flooding
<i>Psychological factors (attitude and emotions)</i>	- Awareness of local flood hazards - Feelings towards hazards, such as concern and anxiety
<i>Perceived probability</i>	- Perception of flood probability or likelihood
<i>Perceived self-efficacy</i>	- Perceived ability to actually perform or carry out adaptive/proactive responses to the event
<i>Source of information</i>	- Perception and communication of flood risk - Satisfaction with flood risk communication

**Figure 2** Number of respondents by survey location [20].

2.2) Perceived likelihood of being flooded in future

Respondents were also asked to rate the likelihood of a flood event occurring in the next 5-10 years. Over half of respondents (63%) agreed that floods are likely to occur again. Notably, only 9% neglected the likelihood of being flooded in the near future (Figure 3c). A typical bias, either in under- or over-estimating flood risk, may occur because of the difficulty in objectively evaluating the probability of infrequent flood hazards. Moreover, individuals may lack adequate information about flood risks [21], and tend to perceive flood disasters as a periodic, rather than a probable phenomenon. To this extent, we suspect that flood risk judge-

ments can influence adaptive behaviors (e.g. immediate and/or delayed action).

2.3) Feelings towards flood hazards

Floods and related topics mainly evoked feelings of stress, anxiety (56%) and interest in the problem (54%). As would be expected, the level of concern and stress rises during any disaster (see Figure 4a). People tend to pay little attention to natural catastrophes in a normal situation. The results showed that nearly one-third of respondents reported feelings of boredom (34%), powerlessness (32%) and fear (31%). At the same time, only a few respondents felt guilty (11%) when they took no action to address the recurrent flood problem. It seems, then, that a belief in fatalism can be a possible barrier that hinders

proactive and adaptive behaviors. Correspondingly, in line with the conclusions of Slovic et al [22], feelings should be considered important in the process of risk judgment. Most people tend to have a higher risk perception if the flood risk is associated with the strength of negative feelings, which might have been reinforced by previous flooding experiences or evacuation in response to a flood disaster [23].

2.4) Perceived self-efficacy

When asked where responsibility to manage the risk of flooding lies, over half of respondents (49%) did not accept their individual responsibility. Most assigned the main responsibility to the government and Prime Minister, followed

by the Department of Disaster Prevention and Mitigation (DDPM), the Flood Relief Operation Centre (FROC), local authorities and community leaders, with fewer than 10% identifying a role for the private sector, academia and media. In fact, local communities tend to take a step back, assuming that central government has prime responsibility for flood alleviation interventions. Most respondents tend to leave the disaster preparedness initiatives to the authorities, and wait to receive information from them before taking immediate action when the flood arrives. To some extent, they also place the blame on government and local authorities for alleged failings, both during and after floods.

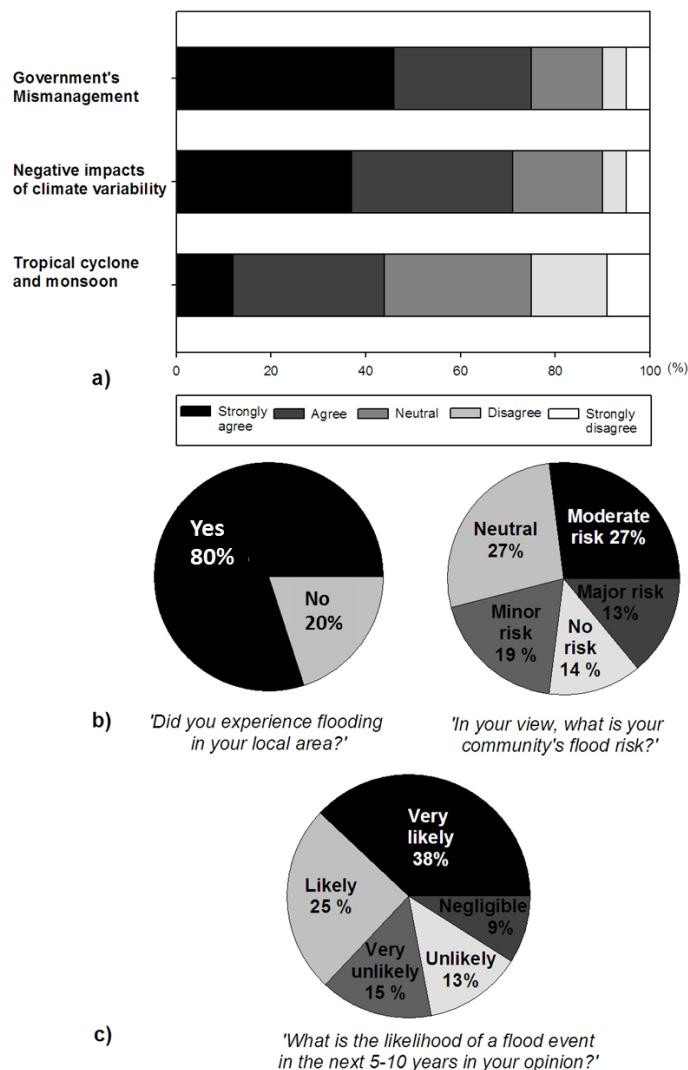


Figure 3 Survey questionnaire results: a) knowledge of the main cause of flooding in Thailand, in 2011, b) flood experiences and perceived flood risk, c) perceived likelihood of future flooding [20].

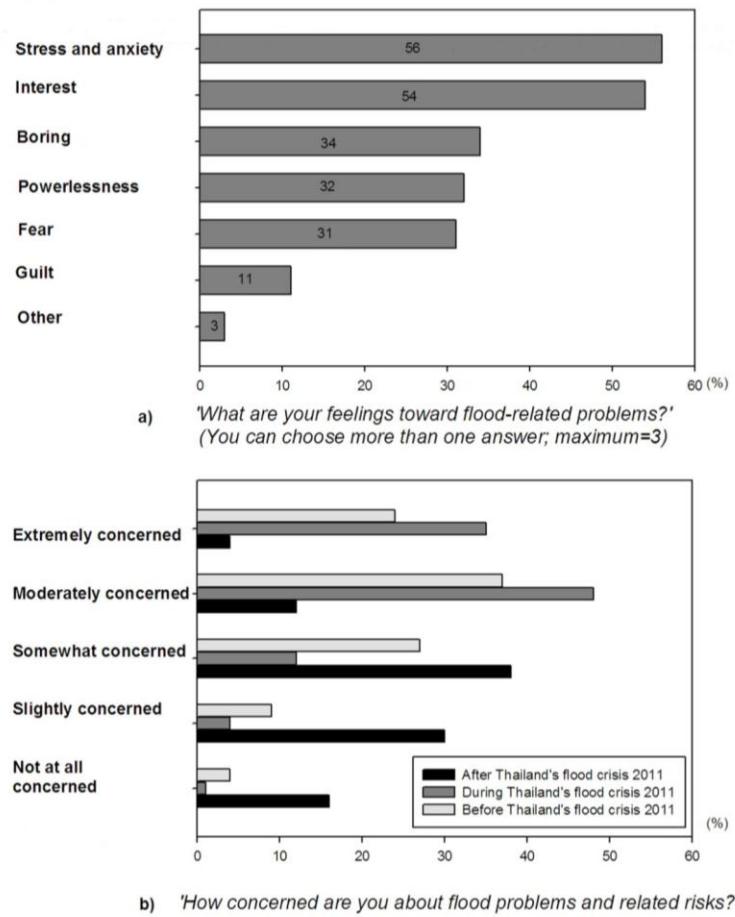


Figure 4 Survey questionnaire results: a) feelings towards flood-related problems, b) levels of concern about flooding [20].

3) Risk communication and perception

3.1) Source of flood related information

A majority of respondents (70%) stated that they would prefer to receive more information about flooding, with almost all respondents (89%) agreeing that all Thai people, not only those at risk, should receive information about flood related risks and/or disaster preparedness. Information on flood risk is acquired from television (95%), newspapers (51%), the Internet (50%), and radio (23%). Television was considered one of the most reliable channels, compared with other information sources (Figure 5).

The majority of respondents (>90%) did not trust any information sources from central government, with many reporting confusion (63%) and false rumors (70%) about flood risk information during the 2011 flood crisis. This

evidence suggests that current information sources remain insufficient to meet the public's needs (both quality and quantity perspectives).

3.2) Warning information

With regard to flood warnings, most respondents (60%) reported they did not receive any warning, while 40% reported received a warning, 65% of these in less than one hour and 24% at least three hours before the flood arrived. Information that respondents received prior to the flood comprised: recommendations to move their possessions to an upper floor, evacuate members of the household to a safe area, move vehicles to higher ground and deploy sandbags or flood guards around their home (Figure 6). It is believed that during Thailand's flood crisis of 2011, there were general failures in early warning systems, typically occurring

in the communication and preparedness elements. Waiting until the emergency or disaster was fully upon them means that the consequences of inaction are borne by the vulnerable people themselves [24]. Finally, the respondents were asked to rate their overall opinion on flood risk communication and management by the authorities. The results indicate low levels of satisfaction concerning central government, FROC and local authorities. Providing effective flood warnings to the community remains a critical challenge.

4) Implications: Cognitive-affective interference in proactive anticipatory adaptation to flood risks

Drawing from this empirical study and the literature review of aspects of social psycho-

logy and risk perception, this research examined the conceptual model of Cognitive-Affective Interference in Protective Anticipatory Adaptation (CAIPAA) concerning flood risk. CAIPAA is basically modified based upon 'Protection Motivation Theory' (PMT) [17], and the previously published 'Private Proactive Adaptation to Climate Change' [18]. Theoretically, PMT aims to understand how affective arousal can lead to changes in attitude and, subsequently, to changes in adaptive behaviors. However, to date, PMT provides a widely adopted psychological model to explain decision making in relation to health threats, but it has hitherto not been extensively used in the context of adaptation to environmental hazards, climate change and their impacts.

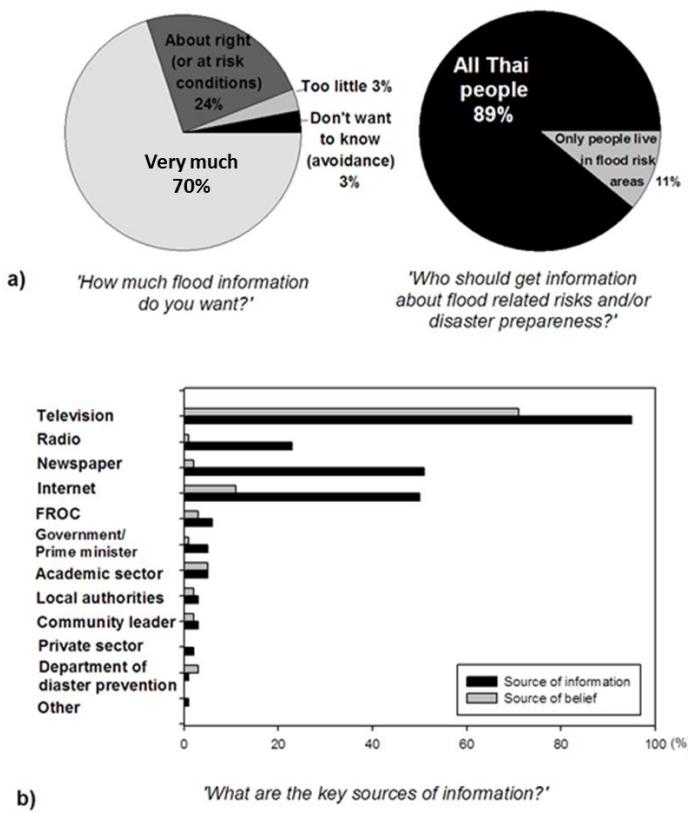


Figure 5 Survey questionnaire results: a) information requirement
b) source of flood information [20].

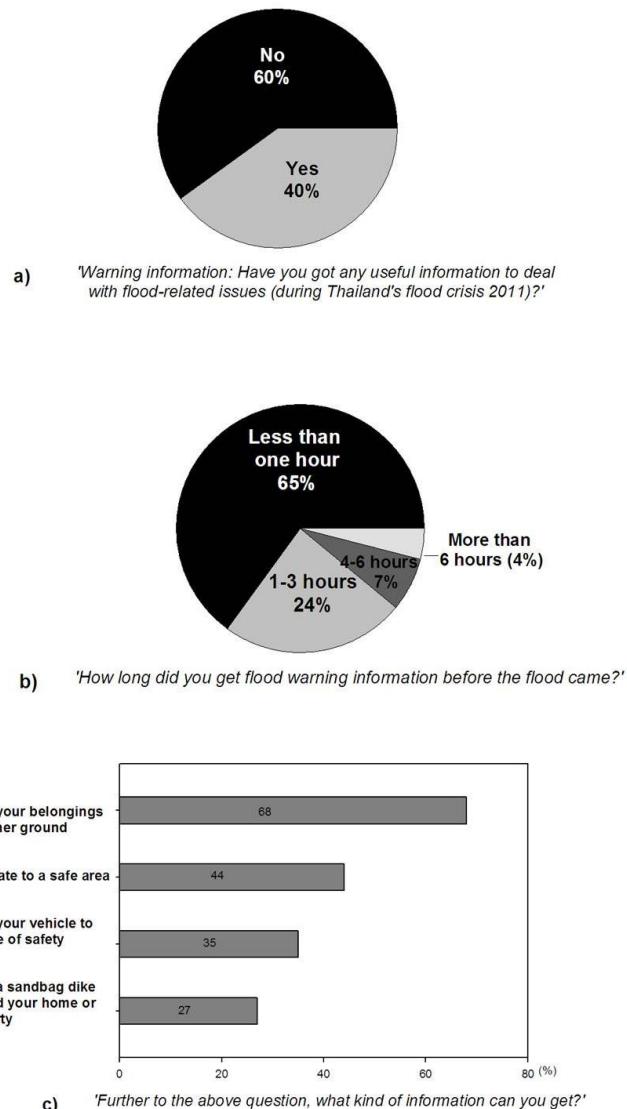


Figure 6 Survey questionnaire results: flood warning information
Perceived satisfaction in flood risk communication and management [20].

To explain the adaptive capacity of people and communities to flooding, the CAIPAA model attempts to reflect the main cognitive and affective processes that lead to protective adaptation in response to a specific threat. At the most basic level, two major perceptual processes are distinguished, namely: risk appraisal and coping/adapting appraisal. First, flood risk appraisal describes how a person evaluates the probability of a threat and the severity of a flood event. The second process (flood coping appraisal) refers to how a person assesses his or her ability to avert being harmed by a flood hazard, as

self- and response-efficacy. Again, in this empirical study, both cognitive and affective biases may have caused a tendency for maladaptive responses, including avoidance reactions (e.g. denial of flood risk and proactive disengagement).

Cognitive biases, which may be associated with personal, situational and communication variables, will subsequently lead to over or underestimation of flood risks in particular. It seems, then, that the source of information related to a risk affects how the information is received, in terms of the amount of attention given and its

perceived accuracy and reliability. In most situations, Thai society depends on an information and communication platform that the government and media establish. Ineffective communication can lead to inappropriate decision-making and confusion in risk assessment. False rumors and misinformation, spread during Thailand's flood crisis in 2011, could also have affected people's probability judgements and the actions they were prepared to take to reduce and/or remove the risk of flood hazards.

Meanwhile, affective interference may be directly involved in the processes of flood risk appraisal and coping/adapting appraisal. On the ground, affect is defined as the positive (like) or negative evaluation (dislike) of a person and their emotional state associated with an external object, idea or image [25]. As in all previous surveys, affective interference in the context of flood disaster includes: cognitive dissonance, cultural bias of fatalism, helplessness and externalizing responsibility. Based on ease of understanding, the majority of Thai respondents who believed they were less at risk of floods compared with others tended to externalize their feelings that responsibility lies with the central government and related authorities (a so-called 'unrealistic' or 'optimistic bias') [26]. In line with this argument, some adopt a fatalist stance ('everyone will die any- way') and claim they do not have the capacity to bring about any change individually. Obviously, people work to distance themselves from information about natural disasters to maintain desirable emotional states and terminate undesirable or negative feelings such as fear, anxiety and sadness.

Recently, several cognitive and affective interference barriers have been shown to influence people's perception and intentions in taking adaptive action in response to a flood hazard (i.e. disaster preparedness based upon wishful thinking). An effective solution to dealing with these key barriers is the most critical challenge facing developing countries such as Thailand.

Conclusions

Flood hazards are one of the most common and destructive of all natural disasters. Each year, extreme flood events cause tremendous loss of life, property damage and social disruption worldwide. In 2011, Thailand was inundated by the worst flood in half a century. This study aimed to investigate the perception of flooding events and interpretation of risk communication in Thailand's flood crisis of 2011. As one of the flood affected areas, Bangkok's metropolitan region was selected for the target survey. Survey results for 437 respondents showed that Thai people suffer from cognitive and affective biases in dealing with probabilistic flood information (regarding the CAIPAA conceptual model). A typical bias in flood risk might occur because people are unfamiliar with estimating probability of flooding (under- or over-estimates) and may lack adequate access to information. Finally, this research suggests that all stakeholders play a central role in establishing priorities for effective flood risk communication in times of need. In addition and, perhaps most importantly, potential solutions to deal with cognitive and affective biases (e.g. a sense of helplessness, fatalistic thinking and self-externalization) must be more rigorously investigated.

The study leads to a number of recommendations and opportunities for further research, as follows:

- Policy makers and communicators should determine ways to facilitate public access to information on flood risk, by explaining how risk information from multiple sources fits together. They also need to clarify where people can go to get whatever information they need. Thus, people who have experienced floods should share their experiences with those who have not, in order to improve perception of probabilities in situations of flood risk and, hopefully, to act better to deal with it.

- Policy makers, communicators and related stakeholders must participate in minimizing both cognitive and affective biases (e.g. a diminished

sense of personal responsibility, fatalism, negative feelings of helplessness and powerlessness) which can affect perception of flood risk in several ways. One possible solution is to create safe spaces in communities where lay people can share their ideas and feelings about flood hazards and their hope for its mitigation in a public forum.

- Significant sources of flood rumors must be more targeted and better clarified. Building trust and confidence among local people is an essential component of flood risk perception and management. Flood risk information should be communicated in an 'open' and 'transparent' way. Two-way communication, or feedback (e.g. open and ongoing dialogue), can be used to resolve conflict and promote mutual understanding between the communicator and general public.

- The role of mass media, especially television and newspapers, in shaping discourse on the problem of flood risk should be investigated further. There must be more focus on the reliability of available forecasts and amount of time the public would need to respond effectively to a flood warning. An early warning system should address not only technological efforts but also the issue of disseminating the warning to lay people who are endangered by flood hazards.

- Local authorities should initiate a community strategy for flood risk management in their local area. Risk management and flood risk reduction must be an integral part of both an *immediate emergency response* and *long-term development program*. A combination between structural, or engineered measures, and non-structural, or management measures, is most likely to be successful in reducing flood risk.

- Further research is needed to investigate the influence of psychological and socio-cultural factors concerning the perception of flood risk (e.g. perceived probability and consequences) and perceived adaptive capacity (e.g. perceived self-efficacy) for community disaster preparedness.

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