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Mediation Analysis of Factors that Influence Household Flood Mitigation Behavior in Developing Countries: Evidence from the Mekong Delta, Vietnam

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

MEDIATION ANALYSIS OF FACTORS THAT INFLUENCE HOUSEHOLD FLOOD MITIGATION BEHAVIOR IN DEVELOPING COUNTRIES: EVIDENCE FROM THE MEKONG DELTA, VIETNAM

Phung Thanh Binh, Xueqin Zhu, Rolf Groeneveld, and Ekko van Ierland

ABSTRACT

This study used the Protection Motivation Theory and mediation analysis to investigate mitigation behavior in response to flood hazards. A household survey and a flood-risk communication experiment with 480 households in selected flood-prone areas in Vietnam's Mekong Delta were conducted. The results indicated that self-efficacy (i.e., one's ability to take actions that will reduce flood risks) and response efficacy (i.e., the effectiveness of the action to be undertaken) were consistently good predictors of flood mitigation behavior and important mediators in the relationships between mitigation behavior and its individual determinants. Vicarious experiences from flood-risk training programs and focus group discussions increased people's motivation to undertake protective action. The effect of focus group discussions on mitigation behavior was fully mediated via self-efficacy and response efficacy while the effect of training was partially mediated via response efficacy. In addition, the indirect effects of most of the independent variables were statistically significant. This implies that ignorance or omission of indirect effects could lead to an incorrect explanation of the factors that influence flood mitigation behavior.

1.0 INTRODUCTION

Floods are one of the most frequent and destructive water-related natural disasters (CEA 2007; Guha-Sapir *et al.* 2012; Botzen and van den Bergh 2012). Their costs are mainly borne by low-income countries (Linnerooth-Bayer *et al.* 2009). The combined effect of increased population, property values, land use, concentration of assets, and impacts of climate change will likely enhance catastrophic flood events in flood-prone areas (Aerts and Botzen 2011; de Moel *et al.* 2011; Michel-Kerjan and Kunreuther 2011). This has motivated the search for protective measures against flood risks. Traditionally, flood management policies have primarily depended on the construction of large-scale infrastructure that will reduce the probability and impact of flooding (Bubeck *et al.* 2012a; Bubeck *et al.* 2012b). Nevertheless, this approach has either failed in European countries (Bubeck *et al*. 2012b) or led to mixed successes in developing countries (Brouwer *et al.* 2007; Few 2003; Gupta *et al.* 2003).

In recent years, the trend has gradually shifted towards a more integrated flood-risk management approach that concentrates not only on public structural measures and relief, but also on private protective measures (i.e., mitigation, preparedness, and recovery) to reduce flood risks (Bubeck *et al.* 2012a; ADPC 2005). In developing countries, where financial resources are too scarce to cover the huge costs of flood protection investments, integrated flood-risk management could be an appropriate approach to alleviate the impacts of flooding (Few 2003). This shift requires the special involvement of individual households in terms of mitigation implementation (Bubeck *et al.* 2012a; Dawson *et al.* 2011; Kellens *et al.* 2013; Meyer *et al.* 2012). Most people who are at risk of flood, however, do not automatically take mitigation measures (Siegrist and Gutscher 2006; Aerts and Botzen 2011; Lo 2013). This has led to a large number of studies on the factors that influence mitigation behavior so as to provide insights into how to design flood management and communication policies effectively (Botzen and van den Bergh 2012; Kellens *et al.* 2011; Terpstra 2011).

Among the various socio-demographic and psychological factors studied, risk perception has dominated the literature on mitigation behavior because of the motivational hypothesis which assumes that households with higher risk perception are more likely to carry out mitigation measures than others (Weinstein *et al.* 1998). However, this hypothesis is not consistently supported by the majority of studies. Specifically, most empirical studies such as Bubeck *et al.* (2012a; 2013), Miceli *et al.* (2008), and Lindell and Hwang (2008) find no relationship or only a statistically weak one between risk perception and mitigation

behavior. Reasons for these unexpected findings could be the methodological aspects of risk perception research (i.e., ignorance of the feedback effect of already-adopted mitigation measures on risk perception) (Bubeck *et al.* 2012a; Bubeck *et al.* 2012b); the operational definitions of risk perception (i.e., ignorance of affective processes) (Loewenstein *et al.* 2001; Miceli *et al.* 2008); or the neglect of coping appraisal elements (Bubeck *et al.* 2013; Grothmann and Reusswig 2006; Zaalberg *et al.* 2009). Some recent studies (e.g., Bubeck *et al.* 2013; Zaalberg *et al.* 2009) have included elements of flood-coping appraisal and found them to be good predictors of mitigation behavior. However, three fundamental problems have not been investigated yet, especially in the context of developing countries.

Firstly, although flood-coping appraisal is an essential determinant of mitigation behavior, most studies treat it as a composite variable. A few studies that investigated the influence of different coping appraisal elements on mitigation behavior were predominantly conducted in developed countries (Bubeck *et al.* 2013; Zaalberg *et al.* 2009). It is not appropriate to apply the findings on flood policies from developed countries to developing countries due to marked differences in the social environment and physical infrastructure.

Secondly, many past studies implicitly assumed that most socio-economic and geographical factors had only direct effects on mitigation behavior, and psychological factors were treated as normal explanatory variables in the behavioral equation. In fact, risk perception and coping appraisal are themselves influenced by the same set of factors that explain mitigation behavior such as experiences, physical exposure, and socio-economic characteristics (Baan and Klijn 2004; Botzen *et al.* 2009; Keller *et al.* 2006; Slovic *et al.* 2004; Wachinger *et al.* 2013). In other words, risk perception and coping appraisal could play the role of mediating variables. Some studies have recently taken a step forward on this issue (Lindell and Hwang 2008; Lo 2013; Terpstra 2011; Zaalberg *et al.* 2009). For example, Zaalberg *et al.* (2009) examined how the relationship between subjective experiences and flood coping behavior was mediated via risk perception, coping appraisal, and fear. Unfortunately, studies on the indirect effects of flood experiences, especially vicarious experiences and other factors on mitigation behavior, are not available in the context of developing countries.

Thirdly, the existing literature on flood mitigation behavior just explains that the risk perceptions of an individual household that has implemented a mitigation measure are likely to decrease after the measure is installed, so the relationship between initial high-risk perceptions and already-adopted mitigation behavior can no longer be detected (Grothmann and Reusswig 2006; Weinstein *et al.* 1998). This is because the cross-sectional study design does not account for the feedback of an already adopted mitigation measure on risk perception (Weinstein *et al.* 1998). To our knowledge, there is no study that has empirically examined the effect of feedback of an already adopted mitigation measure on risk perception and coping appraisal, and then on the intention to undertake another recommended mitigation measure.

Therefore, the novelty of this study is that we contribute to the literature on flood mitigation behavior by investigating which aspects of coping appraisal should be paid special attention in flood-risk communication strategies in developing countries and providing empirical evidence of feedback effects through a mediation analysis. The specific objectives of this study were:

a) To investigate whether risk perception and coping appraisal play the role of mediating variables in mitigation behavior models;

b) To examine the indirect effects of flood experiences and other influential factors on mitigation behavior; and

c) To test whether already adopted mitigation behavior has a feedback effect on risk perception and coping appraisal.

The remainder of this paper proceeds as follows. The next section discusses the literature review and theoretical framework of this study while in Section 3, we present the methods for the flood-risk experiment and data collection. The estimation results and discussions are provided in Section 4. Finally, Section 5 concludes and discusses the implications for flood-risk communication, policies and management which aim to stimulate mitigation behavior in developing countries.

2.0 LITERATURE REVIEW

2.1 Protection Motivation Theory

In order to investigate the factors that influence flood mitigation behavior, we employed the Protection Motivation Theory (PMT). Originating from the work of Hovland *et al.* (1953), PMT was first developed by Rogers (1975) in order to explain the impact of fear appeals. Maddux and Rogers (1983) used this theory to evaluate the effect of persuasive communication on protective health behavior. This model has been recently applied in flood-risk reduction behavior (Bubeck *et al.* 2012a).

Basically, there are two cognitive processes in managing the risk that people go through: evaluating the threat, also referred to as threat appraisal; and selecting the most appropriate coping alternative, also referred to as coping appraisal (Becker *et al.* 2013). The joint effect of the threat appraisal and coping appraisal processes is postulated to motivate people to take mitigation measures if the threat is serious and the measures are appraised as effective and feasible (Bubeck *et al.* 2012a; Bubeck *et al.* 2013).

Threat appraisal consists of the cognitive and affective aspects of risks (Becker *et al.* 2013). The first element is referred to as risk perception. It is empirically operationalized in various constructs such as awareness, likelihood, and impact (Kellens *et al.* 2013). In their review articles, Bubeck *et al.* (2012a) and Kellens *et al.* (2013) reported a weak or missing link between risk perception and flood mitigation behavior. The second element is the affective heuristic aspect such as fear of future flooding (Kellens *et al.* 2013). Existing literature suggests that a positive relationship exists between fear and the adoption of flood mitigation measures (Bubeck *et al.* 2012a; Miceli *et al.* 2008; Siegrist and Gutscher 2008).

Coping appraisal is defined as another cognitive process that an individual experiences when evaluating the effectiveness of coping actions, and the ability to cope with risks (Becker *et al.* 2013; Bubeck *et al.* 2013). It has three elements, namely self-efficacy, response efficacy, and response cost (Floyd *et al.* 2000; Rogers and Prentice-Dunn 1997). Self-efficacy indicates whether an individual feels able to actually adopt a recommended measure. Response efficacy refers to the effectiveness in risk reduction if such a measure is implemented. Response cost describes whether an individual is able to cover the costs of implementation (Bubeck *et al.* 2012a). Coping appraisal is consistently considered as a good predictor of mitigation behavior (Grothmann and Reusswig 2006; Zaalberg *et al.* 2009). If the appraisal of threat is high, but a recommended measure is considered to be ineffective or unfeasible, an individual will not adopt such a measure (Bubeck *et al.* 2012a; Bubeck *et al.* 2013).

2.2 Flood Experiences

Flood experience has been an important variable in previous studies on mitigation behavior (Bubeck *et al.* 2012a). It is often measured as the amount of damage caused by a flood, and the times and/or duration one has experienced a flood. However, this way of conceptualization is not convincing. In the PMT framework, experiences (which include direct and vicarious experiences) initiate cognitive processes that in turn motivate coping responses (Floyd *et al.* 2000; Norman *et al.* 2005; Rogers and Prentice-Dunn 1997). Direct experience is defined as the recency and frequency of casualties experienced. Vicarious experience, on the other hand, refers to social communication, i.e., hearing or reading about flood impacts that were suffered by friends, relatives, or neighbors (Kellens *et al.* 2011; Lindell and Hwang 2008). In addition, Lindell and Perry (2004) and Zaalberg *et al.* (2009) also refer flood experiences to subjective experiences, which consist of negative and positive emotions, and social support experienced from past flood hazards.

Empirical studies provide conflicting evidence on the relationship between flood mitigation behavior and direct experience (Bubeck *et al.* 2012a). A possible explanation is that the influence of direct experience may be mediated through risk perception (Lindell and Hwang 2008; Zaalberg *et al.* 2009) and coping appraisal (Bubeck *et al.* 2013; Zaalberg *et al.* 2009). Households at risk of flood are also affected by vicarious experiences because the provision of flood-risk information could arouse latent experiences[1], and

[1] Hearing about other people's flood experiences from risk experts or neighbors could revive memories of their own forgotten past experiences with floods.

then influence behavior through either risk perception (Sjöberg 2000) or coping appraisal (Kellens *et al.* 2013).

Among the subjective experience components, negative emotion[2] is the most influential determinant of mitigation behavior. For example, people with negative emotions are more likely to perceive themselves as more vulnerable to future flood risks and have stronger protection motivation (Burns and Slovic 2012; Roeser 2012; Siegrist and Gutscher 2006). Negative emotion is also an important factor which influences risk perception, fear (Keller *et al.* 2006; Slovic *et al.* 2004) and coping appraisal (Zaalberg *et al.* 2009). However, its relationship with coping behavior may be fully mediated via response efficacy and risk perception (Zaalberg *et al.* 2009).

2.3 Other Influential Factors

In addition to psychological factors (i.e., threat appraisal and coping appraisal) and flood experiences, mitigation behavior can be influenced by additional factors such as knowledge about flood hazards, socio-economic and geographical characteristics, social environment, and other barriers (Bubeck *et al.* 2012a; Bubeck *et al.* 2013; Grothmann and Reusswig 2006; Kellens *et al.* 2013). In the same manner as flood experiences, these factors have been found to have conflicting effects on mitigation behavior (Bubeck *et al.* 2012a; Kellens *et al.* 2013), which could be due to the neglect of their indirect effects on mitigation behavior via psychological factors.

All the factors described in this section appear in Figure 1.

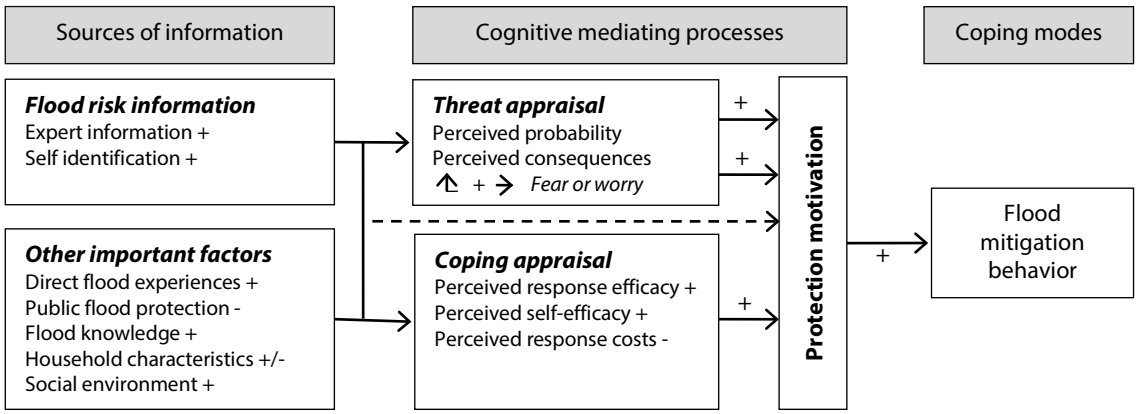

Figure 1. Extended framework of protection motivation theory
Source: Adapted from Poussin *et al.* (2014), Bubeck *et al.* (2012a), and Grothmann and Reusswig (2006)

In Figure 1, we expect that the effect of flood-risk information derived from communication exchanges and other important factors on mitigation behavior could be either direct or indirect via psychological factors, or both. In order to investigate this effect mechanism, this study employed mediation analysis methods developed by Judd and Kenny (1981) and Baron and Kenny (1986).

2.4 Mediating Effect Models

Previous studies on flood mitigation behavior have often ignored the mediation effect of cognitive and affective factors on mitigation behavior. In this study, we hypothesized that each of these factors might have indirect effects via risk perception, fear of future flooding, or components of coping appraisal. In addition, we paid special attention to differences between two vicarious experience creation methods, namely, flood-risk training and focus group discussions (FGDs). For a flood-prone population in a developing

[2] Zaalberg *et al.* (2009) divides 'subjective experience' into negative emotion, positive emotion, and social support. Negative emotion, in this study, would imply a feeling of fear, threat, uncertainty, panic, sadness, or stress when an individual thinks about past flood hazards.

country like Vietnam with a low level of education and lack of access to public information, we expected that flood-risk training would likely have a stronger impact on perceptions and mitigation behavior.

We employed the Causal-Steps Model proposed by Judd and Kenny (1981) and Baron and Kenny (1986) to test the above research hypothesis. This model estimates and tests the indirect effect of the 'target' independent variable *X* on the dependent variable *Y* via one or more mediating variable(s) of interest *M*. Figure 2 depicts the path diagram for a Single-Mediator Model, where risk perception, self-efficacy, response efficacy, response cost, fear, and subjective experience are mediating variables; direct experience is the target independent variable; and mitigation behavior is the dependent variable. To avoid estimation bias due to omitted variables, we included *Z* as covariates. The covariates were assumed to be independent with *X*, but would affect both *M* and *Y* (Judd and Kenny 1981).

Figure 2 is described as follows. Path *C* indicates the total effect of *X* on *Y*, given other *Z* variables. Path *C'* is the direct effect of *X* on *Y*, given other *Z* variables. The indirect effect of *X* on *Y*, given other variables *Z,* is defined as the product of Path A and Path B (i.e., the effect of *X* on *M* and the effect of *M* on *Y*). Equations corresponding to this Single-Mediator Model, modified from Judd and Kenny (1981) and MacKinnon and Dwyer (1993), are as follows:

$$Y = \alpha_1 + cX + dZ + \varepsilon_1 \quad \text{(Equation 1)}$$
$$M = \alpha_1 + aX + dZ + \varepsilon_2 \quad \text{(Equation 2)}$$
$$Y = \alpha_3 + c'X + bM + dZ + \varepsilon_3 \quad \text{(Equation 3)}$$

Equation (1) estimates the total effect while equations (2) and (3) combine to define the direct and indirect effects. We first ran these in the Single-Mediator Model (Figure 2) to find out which mediators should be used in the Multiple-Mediator Model (Figure 3).

Accordingly, coefficient *c* denotes the *total effect* of *X* on *Y,* holding *Z* constant. Coefficient *a* describes the effect of *X* on *M* given *Z* while coefficient *c* represents the *direct effect* of *X* on *Y*, and coefficient *b* is the effect of *M* on *Y,* holding *X* and *Z* constant. The coefficients α_1, α_2, and α_3 denote intercepts, and the terms ε_1, ε_2, and ε_3 represent the residuals.

The *indirect effect* of *X* on *Y* that is transmitted through *M* is measured by the product of two coefficients, *ab*. The direct effect, *c'*, is the effect of *X* on *Y* after removing the transmission through *M* (MacKinnon and Fairchild 2009; MacKinnon and Dwyer 1993).

In order to test the significance of the indirect effect, the most popular statistic is the Sobel test statistic, which is defined as the ratio of *ab* to the standard error of indirect effect s_{ab}. s_{ab} is defined by Sobel (1982) as the square root of $(b^2s^2_a + a^2s^2_b)$, where s_a and s_b are the standard errors of coefficients *a* and *b* respectively (MacKinnon and Fairchild 2009; MacKinnon *et al.* 2007). In practice, mediation can exist even in the absence of the significant total effect relationship between *X* and *Y* (MacKinnon and Fairchild 2009).

The extended mediation model for the case of multiple mediators is presented in Figure 3 (Multiple-Mediator Model). Here, all statistically significant mediators found in the single-mediator models act as mediating variables. Figure 3 shows that the effect of the target independent variable on mitigation behavior may be simultaneously mediated via four mediators such as risk perception, fear, self-efficacy, and response efficacy. The Multiple-Mediator Model has several advantages over the Single-Mediator Model such as comparison of mediated effects (MacKinnon *et al.* 2007), and avoidance of estimation bias (Hayes 2009).

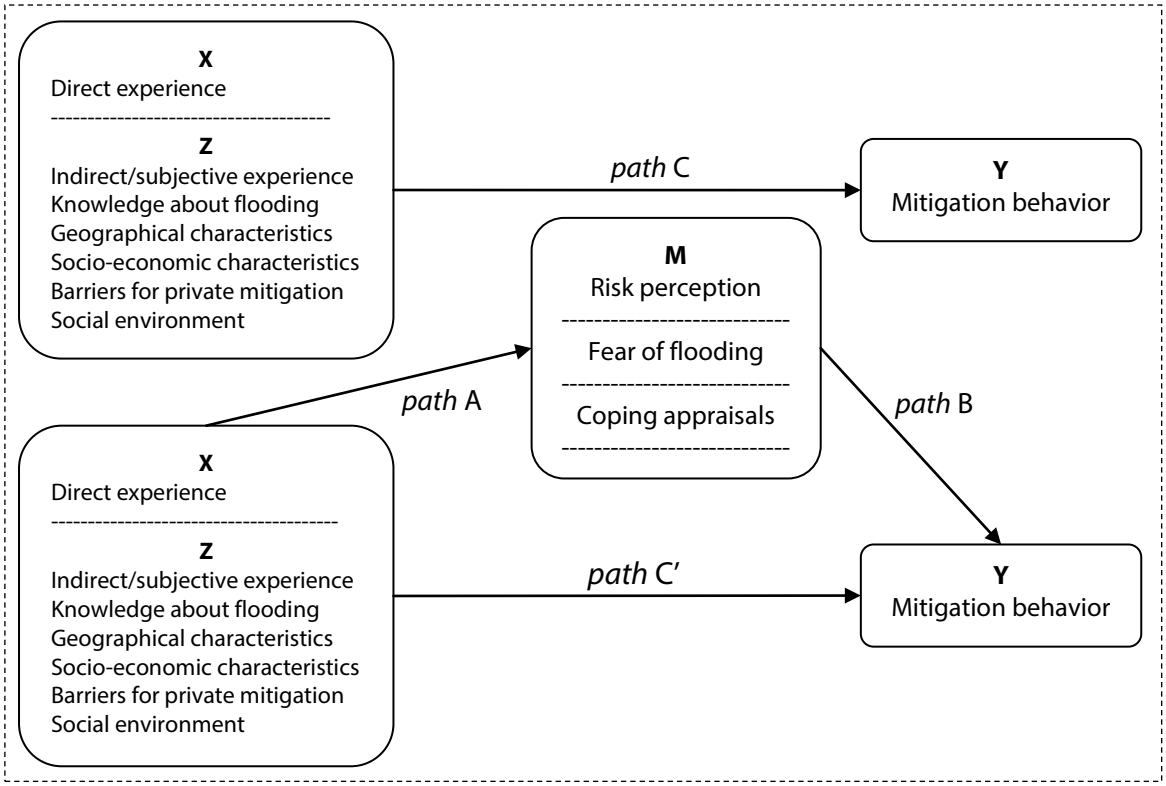

Figure 2. Single-Mediator Model
Source: Based on Judd and Kenny (1981) and Martin *et al.* (2009)

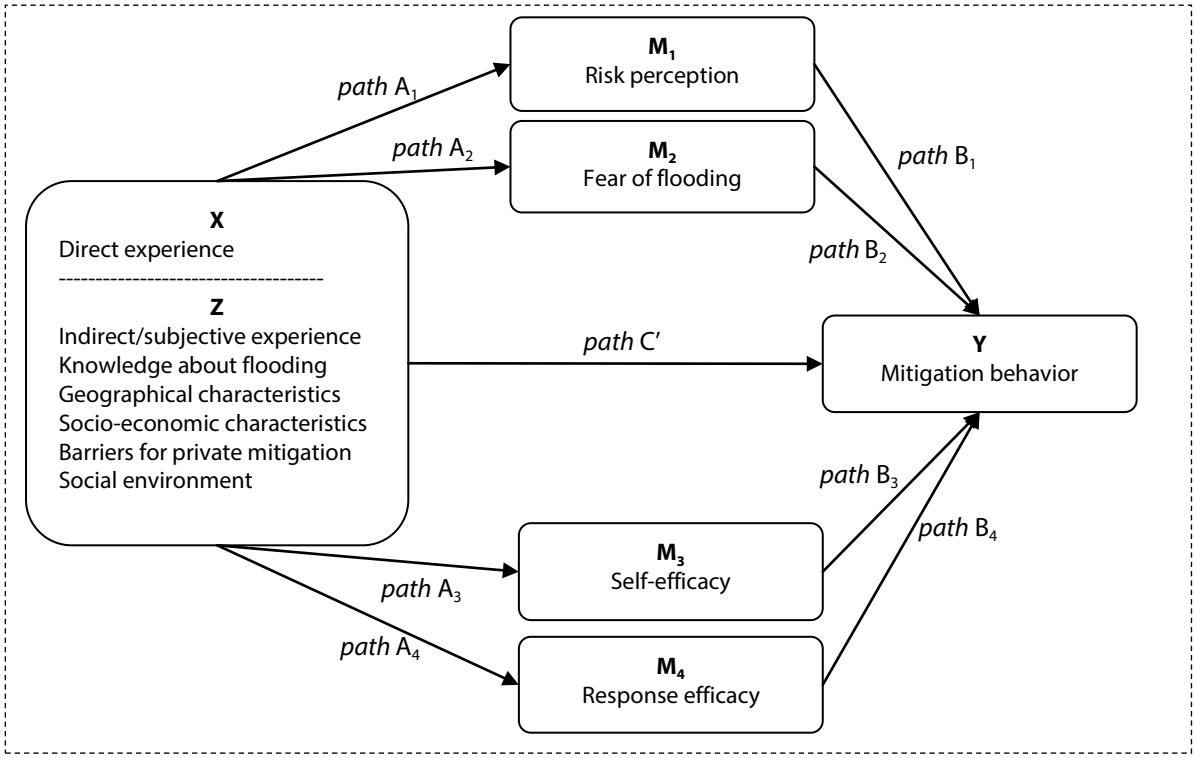

Figure 2. Multiple-Mediator Model
Source: Based on Judd and Kenny (1981) and Stone-Romero and Rosopa (2008)

3.0 RESEARCH METHODOLOGY

The data for this study was collected through an inter-related risk communication experiment and face-to-face household survey with a sample size of 480 respondent households living in flood-prone areas of Vietnam's Mekong Delta. In this section, we first describe the flood-risk communication experiment and questionnaire structure, and then define the variables.

3.1 Flood-risk Experiment

The flood-risk communication experiment followed a five-step procedure, which was carried out from March to April 2013. First of all, the research team had a talk with university professors and provincial government officers from the Mekong Delta to select the most applicable modes of communication with the community. The traditional one-way channels of communication such, as TV, radio, and community-wide broadcasting, were beyond the research team's ability to carry out while printed information and media approaches were found to be not really effective in rural areas. The selected preferred channels were flood-risk training (i.e., sharing expert information on flood-risks) and flood-risk FGDs (for the people's 'self-identification' of flood risks).

The training was given by a senior water management expert, who was a professor of Can Tho University's School of Environmental Management. Interactive discussions between the professor and participants were highly encouraged during the training. The FGDs, on the other hand, were led by a facilitator from Can Tho University's Institute of Climate Change. The facilitator's role was to initiate and encourage discussion, raise questions, and keep up a free exchange of ideas among the participants.

Secondly, we worked with the mentioned two resource people to design the communication agenda, which aimed to give the participants additional knowledge on floods and flood hazard adjustments, and to persuade them to take protective action against future flooding under more extreme flood scenarios. The contents of the flood-risk communication training program consisted of five issues: causes of flooding, past flood experiences, public flood protection investments, private mitigation measures, and the impact of floods on vulnerable groups such as the poor, women, and children. The trainer used various visual aids such as a thirty-minute video about a catastrophic flood in 2011, a PowerPoint presentation, a flood map, and a description of the current dike system in the Mekong Delta.

Meanwhile, the FGDs focused on small group presentations, discussions, and games. The FGD participants were encouraged to recommend initiatives that were good for protecting their communities and families against future flood hazards. For the FGDs, we awarded prizes to the groups that performed best. The training sessions were held at either the secondary school or the public hall of the respective communes, and the FGDs took place at the village cultural house. The average duration for each training session and FGD was about two hours.

Thirdly, we selected the study sites according to typical flood-risk characteristics and experts' suggestions. The three selected districts were Tan Hong (high risk), Thanh Binh (low risk), and Chau Phu (low risk). Two low-risk districts were selected because they were different in terms of quality of the current dike systems. Chau Phu (An Giang Province) was characterised by the full-dike system while semi-full dikes were typical in Thanh Binh (Dong Thap Province). With a full-dike system, farmers can produce three crops per year and people may be reluctant to take precautionary action. For the high-risk areas, the experts said that the flood probability was the same between Dong Thap Province and An Giang Province, so we only chose one representative district, i.e., Tan Hong from Dong Thap Province.

In each district, the two most representative communes in terms of location (i.e., located less than 5 km and more than 10 km from the centre) were selected. Then the two most representative villages in terms of economic development (i.e., rich and not rich) were selected from each commune.

Fourthly, in each village, six groups of random households were selected: two controls, and four treatments. Each group was given an extensive baseline survey to establish their knowledge about flood risks and actions taken to mitigate flood damage. The 'controls' included groups *with and without* 'wife's

participation'. The 'treatments' consisted of two training groups *with and without* 'wife's participation', and two FGD groups *with and without* 'wife's participation'.

We first worked with each village head to explain the purpose of the study, outline the map of the village, and select six self-management units (SMUs) in terms of the distance from the village center. We then worked with the SMU leader to create three lists of households in each SMU according to income classification. In each income group, we randomly selected two poor, four average, and two rich households. From the three lists of households in a village (12 poor, 24 average, 12 rich), we randomly marked the sampled households in each income group in the order of 1 – 2 – 3 – 4 – 5 – 6, where 1 denoted the control group without wife's participation, 2 was the training group without wife's participation, 3 was the FGD group without wife's participation, 4 was the control group with wife's participation, 5 was the training group with wife's participation, and 6 was the FGD group with wife's participation.

The fifth step was to carry out a baseline survey at the respondents' homes. For the control groups, each respondent was asked to complete the whole questionnaire. For the treatment groups, we did not ask the respondents the questions on *threat appraisal*, *coping appraisal*, *mitigation behavior,* and *attitudes towards flood protection responsibility*. Having finished face-to-face interviews at home, we invited household heads with numbers 2 (alone) and 5 (with wife) to attend the training, and household heads with number 3 (alone) and 6 (with wife) to attend the FGD a week after the household survey. Immediately after the training and FGD, we asked the participants questions about *threat appraisal, coping appraisal, mitigation behavior,* and *attitudes towards flood protection responsibility*. Households with numbers 1 and 3 were considered as the control groups (without vicarious experiences).

3.2 Definitions of Variables

The measure we used for risk perception was a composite index derived from five questions with a Likert scale about likelihood and impact. We also created a composite index for the affective component from six questions regarding fear of future flooding. We identified a total of 15 individual mitigation measures that people in flood-prone areas were likely to undertake before the rainy season. We asked respondents to evaluate each of these fifteen measures using a five-point Likert scale in terms of likelihood of adoption, effectiveness in reducing damages if implemented, belief about ability of the family to take the measure, and the ability of the family to cover the set-up costs. The composite indices were developed to create four variables: mitigation behavior, response efficacy, self-efficacy, and response cost. To reiterate, flood mitigation behavior was the dependent variable.

The proxies for vicarious experiences were dummy variables regarding flood-risk training (1 if the respondent attended training and 0 if he did not) and FGD (1 if the respondent attended FGD and 0 if he did not). The direct experiences were defined as past experiences with flood itself and any flood adjustments[3]. In particular, direct experiences were measured as the status of inundation (1 if farm was inundated for more than three months during the flood in the year 2000 and 0 if it was not), awareness of the most devastating disaster in the region in the last decade (1 if the respondent ranked flood was the most devastating disaster and 0 if he did not), and the number of already-adopted mitigation measures that the household had undertaken the previous year.

Subjective experiences components were emotions and social support (five-point Likert scale questions concerning levels of support received from others during the catastrophic flood). Emotions were measured using the same method proposed by Zaalberg *et al.* (2009). From the 15 five-point Likert scale questions concerning emotions about past floods, we constructed two composite variables for negative and positive emotions using principle-component factors. The preliminary analysis indicated that positive emotions and social support were not statistically significant, so we removed these variables from the final models.

Knowledge about flood hazards was measured by 'cause of flooding' and 'frequency of access to flood information'. The former was derived from Likert-scale questions concerning the judgement of respondents about upstream uses of water and impacts of climate change. The latter was structured from

[3] Flood adjustments refer to how households had coped with flood risk in the past.

questions about how frequently the respondent read newspapers and accessed the internet to look for flood information.

We used two composite variables for attitudes about flood risk reduction responsibility: government responsibility and private responsibility. The respondents were also asked to give their judgement on the quality and availability of flood control facilities. We were interested in flood support services such as compensation, relief, and child-caring centers. We called this variable 'support service'. Along with 'wishful thinking', 'support service' and 'public responsibility' were considered as barriers to private flood mitigation.

There were three variables for social environment. The first was the community's efforts in flood mitigation. This variable was measured by asking respondents about the public mitigation situation. The second variable was 'ability to get loans' (1 if the neighbours were willing to lend money or rice if the respondent was in need and 0 if they were not). The third variable was the number of social groups that the household members belonged to.

We also included variables of socio-economic characteristics such as household income, age of household head, education of household head, and geographical characteristics (i.e., dike system status and objective risk). In addition to the variable 'wife's participation' (1 if respondent attended the experiment or answered the questionnaire with his wife and 0 if he did not), we used another proxy for the gender aspect, namely, the role of women in household decision-making. This variable was quantified by a composite variable derived from 15 questions asking the household head whether and how much he consulted his wife when making decisions on certain recommended mitigation measures.

A description of the variables used in this study is presented in Table 1.

Table 1. List of variables used in the analysis

Variables	Measurement	Description
Mitigation behavior	Composite	15 Likert-scale questions about the likelihood of undertaking each of fifteen individual mitigation measures.
Threat appraisal		
Risk perception	Composite	5 Likert-scale questions about likelihood and impact of future flooding: • *How likely is it that you would personally experience a flood that damages your property or affects your family?* • *How high or low do you estimate the probability that you will experience a flood that damages your property and affects your family?* • *How small or large do you expect the negative consequences would be of a flood that damages your property or affects your family?* • *How serious do you feel the negative consequences of a flood like the one in 2000 are to you and your family?* • *How vulnerable do you feel about the possibility of a catastrophic flood physically affecting you and your family?*
Fear of future flooding	Composite	6 Likert-scale questions about affective appraisal of future flooding: • *To what extent do you feel concerned about the effect of flood on your property and family before the rainy season?* • *Do you agree with the following statement: "When I think of floods, I feel concerned"?* • *Do you agree with the following statement: I'm worried about the danger of a flood during the rainy season"?* • *To what extent are you worried about your property and family when you think about future flooding?* • *How much do you fear future flood damage?* • *How much do you fear future flood returns?*
Coping appraisal		
Self-efficacy	Composite	15 Likert-scale questions about the ability to undertake each of fifteen individual mitigation measures.
Response efficacy	Composite	15 Likert-scale questions about the effectiveness of undertaking each of fifteen individual mitigation measures.
Response cost	Composite	15 Likert-scale questions about the ability to cover the costs of undertaking each of fifteen individual mitigation measures.

Table 1 continued

Variables	Measurement	Description
Direct experiences		
Flood inundation	Dummy	= 1 if farm was inundated for more than three months during the catastrophic flood in the year 2000; = 0 otherwise.
Flood awareness	Dummy	= 1 if flood was ranked the most devastating disaster in the past decade; = 0 otherwise.
Past mitigation	Continuous	Number of flood mitigation measures adopted before the rainy season in 2013.
Vicarious experiences		
Training	Dummy	= 1 if respondent attended flood-risk training; = 0 otherwise.
Focus group discussion	Dummy	= 1 if respondent attended FGD; = 0 otherwise.
Subjective experiences	Composite	*To what extent did you experience the following emotions as a consequence of flooding in the Mekong Delta?* Likert-scale questions about 8 different emotions: fear, worry, threat, sadness, stress, uncertainty, poverty, and panic.
Flood knowledge		
Public information	Composite	2 Likert-scale questions: *Do you often ____. about flood-risks and other natural disasters?* • *read the newspapers* • *access the internet*
Cause of flooding	Likert scale	*Do you agree with the following statement: "Water use upstream of the Mekong River will present potential flood risks to my area"?*
Household characteristics		
Annual income	Continuous	Farm and non-farm income
Age	Continuous	Age of the household head
Education	Continuous	Years of schooling of the household head
Wife's participation	Dummy	= 1 if both husband and wife answered the questionnaire; = 0 otherwise.
Role of women	Composite	15 Likert-scale questions about the involvement of women in undertaking each individual mitigation measure.
Geographical characteristics		
Objective risk	Dummy	= 1 if household lives in the high flood-risk areas (Tan Hong District); = 0 otherwise.
Unprotected areas	Dummy	= 1 if household lives in unprotected areas (no dike systems); = 0 otherwise.
Barriers for flood mitigation		
Private responsibility	Composite	4 Likert-scale questions: • *My family is responsible for undertaking private flood mitigation/protection measures.* • *My family is responsible for undertaking public (community-based) flood mitigation/protection measures.* • *The role of households in flood-risk management has become increasingly important in the Mekong Delta.* • *Are you satisfied with your family's current level of mitigation/protection against flood risks?*
Government responsibility	Composite	2 Likert-scale questions: • *How much do you trust in the ability of the government in flood-risk reduction?* • *The government is mainly responsible for flood protection.*
Disaster support services	Likert	Likert-scale question: *How do you rate the flood disaster support services in the Mekong Delta?*
Wishful thinking	Likert	Likert-scale question: *I hope future floods will happen elsewhere and not affect my family.*
Social environment		
Ability to get loans	Dummy	Yes/No question: *Is there anyone to lend you money or rice during the flood season if you need these things in an emergency?*
Community's mitigation	Likert	Likert-scale question: *Are you satisfied with the current level of protection against flood risks in your community?*
Social network	Continuous	Number of social groups that your family is a member of

4.0 RESULTS AND DISCUSSION

In this section, we first present the matrix of correlations and auxiliary regressions to determine if there is any evidence of multicollinearity between the variables, especially between the mediators. The results indicated the presence of multicollinearity caused by response cost because its correlation with self-efficacy was high ($r = 0.855$) and the variance inflation factors of self-efficacy with and without response cost were 5.84 and 2.50, respectively. In addition, the coefficient of response cost in most regressions was not statistically significant. Thus, it was excluded from the mediation models.

Secondly, we ran a set of regressions on the total effect model and Single-Mediator Models where risk perception, self-efficacy, response efficacy, fear of future flooding, and subjective experience were mediators in turn. Subjective experience was, however, found not to act as a mediator because the Sobel statistics on this were not statistically significant for all the equations. Therefore, it was treated as an independent variable in the mediation analysis.

We then ran a series of Multiple-Mediator Models where risk perception, fear, self-efficacy, and response efficacy were concurrent mediators. Finally, we employed the bootstrapping method to test if the indirect effects were statistically significant (i.e., if zero was not in the interval or the indirect effect was statistically different from zero). However, our sample was sufficiently large ($n > 400$), so the bootstrapping provided consistent results with the Sobel test results presented in Appendices 1 and 2.

4.1 Total Effect Model

The second column in Appendix 1 contains the coefficients of the total effect model (coefficient *c* of Equation 1). The results showed that 'experienced mitigation', 'subjective experience', 'public flood information', and 'cause of flooding' were statistically significant at 0.1%; 'flood inundation', 'flood-risk training', 'flood-risk FGD', 'role of women', 'ability to get loans', and 'community's mitigation' were statistically significant at 1%; and 'experienced awareness', 'income', 'objective risk', and 'support service' were statistically significant at 5%. These significant variables, except 'household income' and 'objective risk', have the expected signs. In contrast, the variables 'unprotected areas', 'private responsibility', and 'social networks' were less statistically significant. Other variables such as 'age', 'education', 'wife's participation', 'public responsibility', and 'wishful thinking' were not statistically significant.

The results show that flood-risk information from experts and self-identification (from the FGDs) could be useful for flood-prone households in the Mekong Delta because it promotes motivation for them to undertake mitigation measures. This change in mitigation behavior after the short communication experiment can imply two things. First, rural households in Vietnam are badly in need of flood-risk information. Second, if such information is available, its quality could be very poor. From our discussions with the local people during the survey, it seemed that they had received notice of the imminent disaster immediately before the event and there was no advice or instructions on how to better prepare or cope with such events.

There was no difference in the overall effect of flood-risk training and FGDs on mitigation behavior because their coefficients and significance were very similar. However, this model did not tell us how these flood-risk communication methods influenced mitigation behavior. Besides, we found that direct and subjective experiences had a powerful impact on mitigation behavior, consistent with previous studies (Bubeck *et al.* 2012a; Bubeck *et al.* 2013). The results suggest that flood-risk communication practitioners should focus on emotional aspects and illustrate successful examples of flood adjustments in designing future communication policies.

The negative sign for 'objective risk' can be explained by the problem of charity hazard (i.e., "people at risk do not protect themselves against flood hazards because they expect to receive help from others") (Browne and Hoyt 2000) and the levee effect (i.e., people think that full-dike systems are strong enough to protect them from all future floods) (Baan and Klijn 2004; Stefanovic 2003). The significant and positive coefficient of 'community's mitigation' supports the judgement of Kunreuther and Michel-Kerjan (2009) that households are likely to imitate each other in adopting mitigation adjustments against flood hazards. The

significance of the variable 'ability to get loans' indicates that trust in neighbors influences mitigation behavior.

Our total effects model provided consistent results with previous studies (e.g., Bubeck *et al.* 2012a) that socio-economic characteristics are rather poor predictors of mitigation behavior. Surprisingly, we found that higher income reduced motivation to undertake additional mitigation measures. This could be because the rich could either live and farm in areas with better flood protection or adopt better mitigation measures such as building concrete houses and moving properties to safe places, so they did not have the motivation to invest in additional mitigation measures. Subjective knowledge such as access to public flood information and understanding the causes of flooding was found to encourage households to protect themselves against floods. For this model, the presence of wives in the experiment and their role in mitigation decision-making did not seem to have any effect on mitigation behavior.

4.2 Single-Mediator Model

Columns 2 to 9 in Appendix 1 provide the coefficients of direct and indirect effects for each individual independent variable in four single-mediator models in which risk perception, fear of future flooding, self-efficacy, and response efficacy are in turn the mediating variables (coefficient *c* for direct effects, and the product of two coefficients, *ab,* for indirect effects). The key findings are summarized in the succeeding paragraphs.

Firstly, coping appraisal was found to have a stronger impact on flood mitigation behavior than threat appraisal because of higher estimated coefficients, higher significance of the Sobel statistics, and higher adjusted R^2. Secondly, at 5% level of significance, we observed that fear of future flooding, response efficacy, and especially self-efficacy acted as mediators in the relationships between mitigation behavior and its influential factors. Thirdly, by looking at the significance level of the Sobel test statistics and the number of independent variables that were mediated via self-efficacy and response efficacy in comparison with risk perception and fear, we concluded that coping appraisal played a more important mediating role than threat appraisal.

Fourthly, the indirect effect models[4] explained the effect of each individual factor on mitigation behavior better than the total effect model. They showed how each individual factor affected mitigation behavior; directly, indirectly or both. For example, the total effect model only showed that 'flood inundation' and 'experienced mitigation' had significant influence on mitigation behavior, but the indirect effect models revealed additional information in that 'flood inundation' only had a direct effect on mitigation behavior while 'experienced mitigation' had both direct and indirect effects through self-efficacy and response efficacy.

Fifthly, the way independent variables each influenced mitigation behavior was not the same. For instance, 'subjective experience' was mediated via both threat appraisal and coping appraisal. 'Experienced mitigation', 'public information', 'role of women', 'objective risk', and 'ability to get loans' were only mediated via coping appraisal. 'Cause of flooding' and 'public responsibility' were mediated via fear; and 'flood-risk FGD', 'income', education', and 'private responsibility' via self-efficacy. Finally, 'flood inundation', 'experienced awareness', 'flood-risk training', 'community's mitigation', and 'social networks' had only a direct effect on mitigation behavior.

These results are consistent with findings from previous studies in developed countries (Bubeck *et al.* 2013; Grothmann and Reusswig 2006; Zaalberg *et al.* 2009), and confirm that risk perception is a rather weak predictor (Bubeck *et al.* 2012a; Bubeck *et al.* 2013; Miceli *et al.* 2008; Wachinger *et al.* 2013) while coping appraisal is a consistently good indicator of mitigation behavior in developing countries. This implies that future risk communication policies should: a) provide more practical instructions (to improve self-efficacy); b) improve the effectiveness of recommended mitigation measures (to improve response efficacy); and c) consider the emotional aspects of flood risks, for example, by incorporating images of previous flood events in communication to flood-prone communities to arouse their latent experiences instead of just relying on

[4] The four indirect effect models, associated with four different mediators (i.e., risk perception, fear of future flooding, self-efficacy, and response efficacy), are presented in Appendix 1.

the usual way of focusing on the risk perceptions of the communities, which this study found does not really affect mitigation behavior.

In terms of vicarious experience, we recognized that there was a difference in 'effective mechanisms' (i.e., the way information from flood-risk training and flood-risk FGDs affected mitigation behavior) between risk information from experts and self-identification. Specifically, training seemed to create an instant and direct impact on mitigation behavior while FGDs tended to have an indirect effect through changes in self-efficacy. Thus, the choice of communication methods will depend on policy context and purpose. For example, if it is urgent to get households to protect themselves against flood hazards, training could be a good choice of outreach. In addition, the effect of subjective experience on mitigation behavior was partially mediated through both threat appraisal and coping appraisal. So, communication of flood risks should arouse negative emotions of past floods.

4.3 Multiple-Mediator Model

In the total effect model, there is no mediator on the right-hand side of the regression. In the multiple-mediator model, all potential mediators are simultaneously present in the regression in order to investigate the role of each potential mediator in the relationship between variable *X* (say, direct experience) and variable *Y* (say, mitigation behavior). The multiple-mediator model is better than the single-mediator model in addressing the problem of omitting variable bias.

Although the Single-Mediator Model provides useful insights into the relationships between mitigation behavior and its individual determinants, it does not explain the whole picture about interaction. Therefore, we conducted multiple mediation regressions and the results are presented in Appendix 2. In these regressions, risk perception, fear of future flooding, self-efficacy, and response efficacy were simultaneously treated as mediators in the relationships between each independent variable and mitigation behavior. The total indirect effect is the sum of indirect effects via these four mediating variables. The Multiple-Mediator Model produced the following results.

First, coping appraisal had a stronger impact on mitigation behavior than threat appraisal. In particular, the coefficients of self-efficacy and response efficacy were 0.3738 ($p < 0.1\%$) and 0.2750 ($p < 0.1\%$) respectively while the coefficient of fear was 0.0601 ($p < 1\%$). Risk perception did not significantly influence mitigation behavior. Accordingly, we could again confirm that risk perception per se was not a good predictor of mitigation behavior in developing countries. Our findings were in accordance with most previous studies (Bubeck *et al.* 2013; Grothmann and Reusswig 2006; Zaalberg *et al.* 2009). In addition, risk perception did not act as a mediator in the relationship between mitigation behavior and its individual determinants. Most independent variables produced a high percentage of indirect effects on mitigation behavior. The results indicated that indirect effects were mediated mostly via self-efficacy and response efficacy.

Secondly, we found a sharp difference between the effects of training and FGDs on mitigation behavior. In particular, while FGDs were fully mediated via fear, response efficacy, and especially self-efficacy at 5% level of significance, training had only a small partial mediation effect through response efficacy. In other words, FGDs were found not to change mitigation behavior directly, but indirectly via changes in the two elements of coping appraisal and fear of future flood hazards. In FGDs, households can learn from each other on how to undertake flood mitigation measures that are compatible with their existing circumstances. In contrast, training directly influenced mitigation behavior. This could be because farmers tend to trust experts more than their peers in learning how to manage flood risks.

Thirdly, the results from running the Multiple-Mediator Model did not support the problem of charity hazard. For example, variables 'public responsibility' and 'support service' had significantly positive indirect effects on mitigation behavior via fear, self-efficacy, and response efficacy at 5% significance level. Speaking differently, flood protection systems and support services provided by the government could arouse fear, improve a household's ability to undertake mitigation measures, and increase the effectiveness of mitigation measures if they are undertaken. These increased perceptions would in turn motivate households to get involved in mitigation actions. The results also show that although 'private responsibility' had a negative direct effect on mitigation behavior, its total effect was positively significant thanks to the

larger indirect effects via self-efficacy, response efficacy, and fear. In addition, non-protective responses could be a barrier to mitigation because 'wishful thinking' had a negative indirect effect via coping appraisal.

Fourthly, there were interesting findings about the influence of socio-economic and geographical characteristics on mitigation behavior. In particular, income had a direct effect, but education and the role of women had only indirect effects on mitigation behavior. We also found that although richer households had the advantage in protecting themselves against flood hazards thanks to better self-efficacy, they were less likely to undertake mitigation measures. Better education will promote mitigation behavior through its influence on self-efficacy. The insignificance of the variable 'wife's participation' and strongly significant indirect effect of the 'role of women' indicated that the voice of women in rural areas was weak, but if they are given the chance to get involved in decision-making, their role is more likely to increase motivation for flood mitigation.

Fifthly, all indirect coefficients of 'social environment' were significant at the 0.1% level. Moreover, the absolute values and significance of the indirect effects were higher than the direct effects on mitigation behavior. These results reveal that social environments are good predictors for mitigation behavior in developing countries because they are likely to enhance a household's ability to select appropriate coping alternatives.

Finally, 'subjective experience' was found to be an important determinant of mitigation behavior. Specifically, its effect was substantially mediated via fear and coping appraisal. Already adopted mitigation measures had both direct and indirect effects (through coping appraisal) on mitigation behavior. This indicates that there exists a feedback effect of already adopted mitigation measures on the intention to take up other mitigation measures mediated through coping appraisal rather than risk perception.

5.0 CONCLUSIONS

Previous studies reported conflicting evidence about factors that explained mitigation behavior. Several explanations have been offered such as the omission of important psychological variables, methodological differences, and the neglect of mediating effects. Besides, these studies were mostly conducted in developed countries. However, under the increasing impact of climate change and socio-economic development, many developing countries have become the victims of flood disasters. Although there are interesting policy insights from previous studies in developed countries, it is inappropriate for policymakers in developing countries to rely on these implications when designing their own risk communication and management policies. Therefore, this study attempted to investigate how flood experiences and other factors affected household mitigation behavior in a developing country context through mediation analysis. The key findings from this study are as follows.

First, we found no statistically significant relationship between risk perception and mitigation behavior. Second, our results suggest that self-efficacy and response-efficacy are important predictors in explaining mitigation behavior. Third, self-efficacy and response efficacy are the main mediating variables in the relationships between mitigation behavior and its individual determinants. Fourth, we found significant feedback of already adopted mitigation measures on coping appraisal but not on risk perception. Fifth, experience with floods can directly affect and motivate people to adopt mitigation measures. The experience with flood adjustments, however, was found to have both direct and indirect effects on mitigation behavior. In addition, we also found that subjective experiences indirectly increased mitigation incentive through its positive effects on self-efficacy and response efficacy.

Sixth, although there was no significant difference in the total effect of flood-risk training and flood-risk FGDs, their effect mechanisms turned out to be totally different. FGDs were fully mediated via self-efficacy, response efficacy, and fear whereas training had just a small mediating effect via response efficacy. Seventh, women's participation in the household survey and experiment did not have any effect on mitigation behavior. However, we found that although their role in household decision-making had a significant negative direct effect, it had a positive total effect on mitigation behavior due to a stronger indirect effect via coping appraisal elements. Finally, the results showed that public flood protection and support services can stimulate mitigation behavior through positive indirect effects on coping appraisal and

fear of flooding. Therefore, the problem of charity hazard might not exist in flood-prone areas in a developing country like Vietnam.

In order to successfully shift towards more integrated flood-risk management, future policies in developing countries that aim to promote mitigation behavior should focus on the feasibility and effectiveness of proposed mitigation measures rather than just raising flood-risk awareness. Specifically, households at flood risk should be provided more practical instructions on how to implement cost-effective mitigation measures and more detailed advice on which measures are effective in reducing potential damage.

As flood insurance is still not easily available in Vietnam, an effective flood risk reduction strategy should be based on small FGDs among household heads within villages. Furthermore, since fear of flooding was found to be a mediating variable, it should be taken into account when designing flood-risk communication policies. For example, flood-risk communications should emphasize not only the risk of future flooding, but should also focus on subjective fear and make households aware of the catastrophic impacts of a flood. Along with subjective fear, subjective experience was also an influential factor in flood mitigation behavior. The contents of flood-risk communication should, therefore, evoke negative emotions in flood-prone communities so as to prompt mitigation action.

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Appendix 1. Determinants of flood mitigation behavior (single mediation analysis)

In dependent variable	Total Effect (coefficient *c*)	Risk Perception (coefficient *c'* and *ab*)		Fear (coefficient *c'* and *ab*)		Self-Efficacy (coefficient *c'* and *ab*)		Response Efficacy (coefficient *c'* and *ab*)	
		Direct	*Indirect*	*Direct*	*Indirect*	*Direct*	*Indirect*	*Direct*	*Indirect*
Risk perceptions		0.0250							
Fear of future flooding				0.0741***					
Self-efficacy						0.5049****			
Response efficacy								0.4567****	
Flood inundation	0.1188***	0.1161***	0.0016	0.1122***	0.0066	0.1238****	0.0006	0.1146***	0.0058
Experienced awareness	0.1329**	0.1301**	0.0036	0.1364**	-0.0036	0.1092**	0.0254	0.1499***	-0.0191
Experienced mitigation	0.1403****	0.1390****	0.0008	0.1386****	0.0017	0.0913****	0.0510^{++++}	0.1071****	0.0352^{++++}
Flood-risk training	0.1568***	0.1563***	0.0035	0.1529***	0.0039	0.1195**	0.0194	0.1369***	0.0113
Flood-risk FGD	0.1582***	0.1560***	0.0063	0.1416**	0.0166^{+}	0.0870*	0.0717^{++}	0.1438***	0.0145
Subjective experience	0.1573****	0.1504****	0.0059	0.1306****	0.0266^{+++}	0.1214****	0.0329^{+++}	0.0864****	0.0716^{++++}
Public flood information	0.1300****	0.1307****	-0.0005	0.1361****	-0.0061	0.0853****	0.0503^{++++}	0.0966****	0.0342^{+++}
Cause of flooding	0.0974****	0.0973****	0.0015	0.0867****	0.0107^{++}	0.0936****	0.0072	0.0973****	0.0003
Household income	-0.7317**	-0.7347**	-0.0393	-0.6652**	-0.0665	-1.176****	0.4016^{++}	-0.4969*	-0.2898^{+}
Age of household head	-0.0017	-0.0015	-0.0002	-0.0019	0.0001	-0.0021	0.0004	-0.0015	-0.0002
Education of household head	0.0069	0.0080	-0.0008	0.0059	0.0010	-0.0020	0.0092^{++}	0.0064	0.0012
Wife's participation	-0.0084	-0.0144	0.0030	-0.0188	0.0103	0.0264	-0.0211	-0.0018	0.0004
Role of women	0.1296***	0.1331***	-0.0002	0.1249***	0.0047	0.0060	0.1188^{++++}	0.0341	0.1015^{++++}
Objective risk	-0.1196**	-0.1213***	0.0134	-0.1259***	0.0064	-0.0318	-0.0718^{+++}	-0.0078	-0.0998^{++++}
Unprotected areas	0.1099*	0.1105*	-0.0001	0.0927	0.0172^{+}	0.1042**	0.0067	0.0918*	0.0272
Private responsibility	-0.0486*	-0.0507*	0.0006	-0.0558**	0.0073	-0.0849****	0.0328^{++}	-0.0692***	0.0193
Public responsibility	-0.0211	-0.0206	0.0015	-0.0303	0.0092^{++}	-0.0070	-0.0081	-0.0175	-0.0025
Support service	-0.0580**	-0.0586**	-0.0011	-0.0628***	0.0050	-0.0409**	-0.0139	-0.0498**	-0.0052
Wishful thinking	-0.0294	0.0305*	0.0003	-0.0278	-0.0017	-0.0159	-0.0159^{+}	-0.0034	-0.0257^{+++}
Ability to get loans	0.1590***	0.1586***	0.0004	0.1631***	-0.0031	0.0920*	0.0684^{++}	0.1090**	0.0530^{++}
Community's mitigation	0.0808***	0.0798***	-0.0004	0.0860***	-0.0052	0.0694***	0.0192	0.0651***	0.0158
Social networks	0.0125*	0.0120*	0.0005	0.0114*	0.0011	0.0124**	0.0000	0.0097*	0.0027
Intercept	1.6153****	1.6230****		1.697****		0.3029		0.1362	
Adjusted R^2	0.5663	0.5676		0.5742		0.6838		0.6644	

Note: t – statistic: * *p*-value < 0.1, ** *p*-value < 0.05, *** *p*-value < 0.01, **** *p*-value < 0.001.
Sobel statistic: + *p*-value < 0.1, ++ *p*-value < 0.05, +++ *p*-value < 0.01, +++ *p*-value < 0.001.

Appendix 2. Determinants of flood mitigation behavior (multiple mediation analysis)

Independent variable	Total Effect		Indirect Effect via Each Mediator			
	Direct	*Total Indirect*	*Risk Perception*	*Fear*	*Self-Efficacy*	*Response Efficacy*
Risk perception	0.0197					
Fear of future flooding	0.0601***					
Self-efficacy	0.3738****					
Response efficacy	0.2750****					
Flood inundation	0.1152****	0.0003	0.0010	0.0083	-0.0126	0.0037
Experienced awareness	0.1274***	-0.0610	0.0024	-0.0038	-0.0270	-0.0326
Experienced mitigation	0.0815****	0.0850++++	0.0015	0.0044++	0.0504++++	0.0288++++
Flood-risk training	0.1128**	0.0909++	0.0012	0.0071	0.0381	0.0444++
Flood-risk FGD	0.0798*	0.1869++++	0.0073	0.0259++	0.1020++++	0.0518+++
Subjective experience	0.0607***	0.1516++++	0.0068	0.0268+++	0.0528++++	0.0652++++
Public flood information	0.0825****	0.1222++++	0.0011	0.0037	0.0773++++	0.0402++++
Cause of flooding	0.0877****	0.0725++++	0.0026	0.0133++	0.0388+++	0.0178++
Household income	-0.8175***	0.3529	-0.0384	-0.0724	0.5739++++	-0.1102
Age of household head	-0.0019	-0.0026+	-0.0002	-0.0002	-0.0012	-0.0010
Education of household head	0.00001	0.0141++	-0.0005	-0.0002	0.0129++++	0.0019
Wife's participation	0.0101	0.0101	0.0032	0.0114	-0.0177	0.0133
Role of women	-0.0273	0.2677++++	0.0023	0.0141+	0.1475++++	0.1037++++
Objective risk	-0.0069	-0.0649	0.0099	0.0023	-0.0278	-0.0493+++
Unprotected areas	0.0755	0.0028	-0.0002	-0.0069	-0.0132	-0.0093
Private responsibility	-0.0957****	0.1257++++	0.0022	0.0152++	0.0693++++	0.0391++++
Public responsibility	-0.0157	0.0583+++	0.0021	0.0147++	0.0234++	0.0181++
Support service	-0.0425**	0.0560+++	0.0001	0.0089++	0.0263++	0.0208++
Wishful thinking	-0.0033	-0.0378++	-0.0003	-0.0024	-0.0155+	-0.0196+++
Ability to get loans	0.0798*	0.2213++++	0.0021	0.0098	0.1282++++	0.0812++++
Community's mitigation	0.0676***	0.0870++++	0.0012	0.0077+	0.0459++++	0.0322+++
Social networks	0.0093*	0.0333++++	0.0009	0.0031++	0.0174++++	0.0121++++

Note: t – statistic: * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01, **** p-value < 0.001.
Sobel statistic: + p-value < 0.1, ++ p-value < 0.05, +++ p-value < 0.01, +++ p-value < 0.001.

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