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REGULAR RESEARCH ARTICLE

How government-public collaboration affects individual mitigation responses to flooding: A case study in Yellow River Delta area, China

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ABSTRACT

In the top-down Chinese political system, flood management has traditionally been led by the government, with the general public playing a supporting role. Within this context, individual-level disaster prevention behaviors are strongly interacted with the government-public collaboration during the government-led flood management processes. This study aims to provide a comprehensive understanding of how government-public collaboration affects individuals' flood mitigation responses in China. An online survey data with 550 respondents from the Yellow River Delta area was examined with regard to the individuals' willingness to take positive mitigation actions, and ordinal logistic regression models were constructed to explore the influence of the government-public collaboration factors, which are digested into three aspects: public involvement, public awareness and political trust, that motivate individuals to take flood mitigation measures. The results demonstrate that public involvement and political trust are positively correlated with the likelihood of individuals' adopting positive mitigation actions, while public awareness and self-reported preparedness were also positively correlated, although to a less significant degree. This study contributes to the current literature by increasing the understanding of how government-public collaboration determines individual mitigation actions in the Chinese collectivist cultural environment. The results of this study reveal that involving the public effectively and earnestly through various forms of community engagement are likely to promote individual-level disaster prevention behaviors, from this point of view, can help policymakers to guide local residents towards taking responsible flood risk management and preventative actions.

KEYWORDS

Flooding management; Public involvement; Public awareness; Political trust; Disaster mitigation; Risk governance; Yellow River.

1. INTRODUCTION

Since flooding is among the most economically and socially destructive of all natural disasters, the issue of flood management has become a driving force in academic debates and policy discussions (Kuhlicke et al., 2020; Mees et al., 2016). Flood management refers to activities and operations that aim to prevent or mitigate the impacts of flood disasters when responding to such events. It is a multi-dimensional issue, complicated by the involvement of multiple actors interacting at different governing scales. Within this process, it is widely agreed that individuals, when faced with flood risks, may or may not act responsibly as private citizens (Raška et al., 2019; Adger et al., 2016). Scholarly work highlights that individuals' willingness to act responsibly is contested and affected by various factors, including the attributes of protective actions (e.g., efficacy) (Bubeck et al., 2013; Adger et al., 2016), the features of natural hazards (e.g., disaster risk perception) (Heitz et al., 2009), and individuals' characteristics (e.g., gender, educational level) (Cannon et al., 2020).

Another key feature in effective flood risk management is government-public collaboration, which is an important factor affecting how individuals respond to flooding (Kuhlicke et al., 2020; Wachinger et al., 2013). Some research has indicated that public involvement in risk management, public awareness communication, and trust toward risk management authorities are all important features of effective government-public collaboration in this area (Marschütz et al. 2020). Crucially, these things are shaped by the local social and cultural contexts where flood management takes place: hence government-public collaboration can be seen to differ from society to society in relation to local socio-cultural factors (Adger et al. 2013a).

Under China's government-led flood management system, the following features of government-public collaboration over flood risk management have developed:

a) Government has a tendency to involve the public in flood management at the decision-implementation stage. The central government is responsible for the planning, management and communication of flood risks, as well as post-disaster relief, hence China's participatory flood management is characterized by local governments involving residents mostly in the phase after policy decisions have been adopted. To be specific, local authorities are obliged to mobilize local residents who live in flood control areas to take an active part in flood control work and flood avoidance measures according to local conditions. Another type of public engagement involves public consultations over environmental impact assessments relating to flood control infrastructure projects.
b) Government has a monopoly over the process of raising public awareness of flood risk management options and its dedicated policy agenda, as well as implementation plans. This is often seen through the government's issuing official policy information in a top-down fashion on issues such as flood-related policy information and advised public behaviors.[1] At the local level, government often provides information about risk management policies through training programmes it runs for local residents, which cover areas such as lifesaving knowledge and being prepared for flooding.
c) Since ancient times, the Chinese state has played an active role in coordinating localized flood defense works and has thus traditionally been seen as the ultimate and legitimate leader of flood management. For this reason, within Chinese society there is a deeply-rooted sense of trust in the government's capacity to deal with floods (Burningham et al. 2008). In contrast, in Central Europe, for instance, where distrust in government is more significant, government-led flood management activities are likely to come up against resistance from the public (Armaş, 2012; Raška, 2015).

Very few studies have explored the effects of government-public collaboration on individuals' flood mitigation behaviors in the context of Chinese society, where the effects of such collaboration on public willingness to take responsible actions may differ from those seen elsewhere. Our paper aims to fill this gap in the literature by examining the relationship between public involvement, public awareness of policy information, political trust and the likelihood that individuals will respond positively to government-led flood management initiatives.

The paper is structured as follows: the second section presents an overview of the literature and the three research objectives of this study; the third section provides

[1] According to Article 31 of the Law of Flood Prevention of PRC (2016 amendments), which is issued 1997, amended 2009, 2015 and 2016, local governments are obligated to provide training or educational activities to raise the public's awareness of flood risks and to prepare them for taking flood control and avoidance measures, according to local conditions.

details of the methodology; section four presents empirical findings from the research; and lastly, section five presents some concluding remarks, including observations on the policy implications of this paper.

2. LITERATURE REVIEW

2.1 The importance of public involvement in mitigation behavior

Some scholarly literature suggests that participatory flood management can promote the adoption of effective responses to flooding disasters (Walker et al., 2010); this work is based on the idea of establishing decentralized governance by including non-state actors (Rollason et al., 2018; Raška et al., 2019), as well as promoting diversity in risk governance. By involving the public at various stages of flood management processes, including those where decisions are made, it becomes easier to encourage the public to accept responsibility for preparing for flooding events, and taking an active role in flood relief work during serious floods (Begg et al., 2015). However, it has also been pointed out that participatory processes aimed at promoting individual responsibility largely depend on contextual conditions, such as pre-existing decision-making structures and specific institutional arrangements (Begg et al., 2018; Kuhlicke, 2014). Depending on how public involvement in flood management is practiced, such activities do not necessarily help to effectively facilitate individual engagement in flood management (Armaş, 2012; Raška, 2015).

Moreover, participatory flood management differs from society to society. Public involvement in flood management is an established practice in the EU and North America, where political authorities have become increasingly keen to promote participation at the policy planning and negotiation stages (Begg et al., 2015), especially when disagreements over land usage may potentially arise from flood risk reduction plans (Raška, 2015). Meanwhile, within the context of China's restrictive political system, unique aspects of public involvement can be observed. The Chinese government's top-down approach to risk governance has given it a monopoly over the prevention and management of risks within China. Thus, in terms of flood management, the historical tradition of government-led risk management (Wei, 2011) has meant that government units at all levels have shown a lack of genuine initiative when it comes to facilitating public involvement in decision-making processes. Indeed, to the extent that there is any public involvement, it mostly comes after policy decisions have already been made by local governments; hence the public is only loosely engaged in government-led activities (Johnson, 2020). For instance, environmental impact assessment (EIA) legislation requires that environmental impact assessments should be conducted over flood control infrastructure projects prior to any decisions being made. While this procedure technically leaves room for public input in policy making, in reality EIA legislation is often implemented after decisions have been taken, thus rendering any public involvement as purely symbolic (Brombal et al., 2017). Therefore, empirical investigations are needed to shed light on the extent to which limited public involvement in China's flood risk management practices affects the willingness of individual citizens to take mitigation actions.

2.2 The importance of public awareness on mitigation behavior

According to some scholars, public awareness of government flood risk management is found to have a relational link with the adoption of mitigation actions by individual citizens (Marschütz et al., 2020). This is because raising public awareness includes disseminating information to: a) prepare the public for increasing risks (Dieperink et al., 2016), often by helping the public to assess the seriousness of the impact of flood risks

(Burningham et al., 2008; Neuwirth et al., 2000); and b) motivating the population at risk to be prepared for an emergency (Hagemeier-Klose & Wagner, 2009), such as by clarifying responsibilities in relation to the preparation of flood defence (Hagemeier-Klose & Wagner, 2009). Therefore, effective information sharing with the public about flood management options, including information about eligibility for public flood protection funding, and the efficacy and costs of self-protective measures, may motivate individuals to adopt flood mitigation actions as recommended by the government (Grothmann & Reusswig, 2006).

Within China's restrictive political system, the process of raising public awareness is monopolized by the state. Moreover, China's exceptionally long history of government-led flood management practices—which may go back as far as 4,000 years—tends to lead individual citizens towards viewing the government as the only legitimate actor when it comes to flood management (Lei, 2007), including the provision of relevant information (Wei, 2011). Accordingly, public awareness communication in China is characterized by the government issuing official policy information in a top-down fashion, regarding the disclosure of risk information (He et al., 2014). Similarly, the government also provides the public with some limited options for flood control actions, but these still place the public in a largely passive role vis-à-vis the state.[2] In contrast, some research indicates that government communication strategies, as well as the extent to which the public is given choices about what information it receives (Mclvor et al., 2009), are important factors that can help to effectively motivate the public to take positive actions. Therefore, empirical investigations are needed to reveal how far public awareness, which in China's case is determined to a large degree by the government's provision of information, affects individuals' willingness to take mitigation actions.

2.3 The importance of trust to government's mitigation behavior

Trust in government is another factor that affects what actions individuals are likely to take. This article focuses on trust in government capacity, which, it has been suggested, correlates with individuals' willingness to adopt positive mitigation actions (Lin et al., 2008). The existing scholarship provides different empirical findings. Some show that, in the context of the US, trust in government capacity to manage a disaster is positively associated with the level of perceived preparedness for risks such as earthquakes and hurricanes (Basolo et al., 2009; DeYoung & Peters, 2016). In contrast, other scholars have found that trust in government capacity may influence individual preparedness in a negative manner. For example, studies of European cases indicate that some people may feel they do not need to invest time and resources in preparing for disasters because they assume the government already has sufficient capacity to plan for and respond to disasters (Grothmann & Reusswig, 2006; Wachinger, 2013). Thus, a high degree of trust may in fact disincentivize individuals from voluntarily engaging in disaster mitigation activities (Terpstra, 2011; Han et al., 2017).

In China, generally speaking, trust in government is a heatedly debated topic. Some scholarship indicates that the nature of the political regime in China may affect how much trust individual citizens place in the government's commitment to serving the public interest rather than its own internal interests (Li, 2021). Nevertheless, in the area of public service provision, the Chinese government enjoys a noticeably high level of public trust, both in terms of commitment and capacity (Duckett & Munro, 2021). Given that the general public in China has a high degree of trust in government when compared to citizens of western countries (Li, 2016), it seems the Chinese government

[2] Interview with local official from the Branch of Risk Management, Dongying, May 2019.

has been able to leverage this trust when promoting responsible actions at the individual level (Rao & Wang, 2015). Past scholarship has also indicated that China's collectivist culture is a factor impacting on individual policy compliance (Schwartz, 2009; Hofstede & Minkov, 2010), and thus perhaps leading to a higher level of personal commitment to flood mitigation actions than can be found elsewhere (Noll et al., 2022). Therefore, it is important to investigate the relationship between political trust and individuals' mitigation actions in the Chinese context, where collectivist culture helps to reinforce a high level of public trust in government.

Accordingly, based on the literature reviewed above, this study focuses on three key features of government-public collaboration in China within the context of government-led efforts to encourage individual citizens to voluntarily adopt actions and behaviors aimed at preparing for and mitigating the risks of flooding:

a) the relationship between public involvement in flood management and individuals' willingness to take positive mitigation actions.
b) the relationship between public awareness of flood risk management options and individuals' willingness to take positive mitigation actions.
c) the relationship between trust in government capacity and individuals' willingness to take positive mitigation actions.

3. DATA AND METHOD

3.1 Data source

This study utilizes survey data from two counties[3] of Dongying, a city located on the Yellow River Delta area of northern Shandong Province (Figure 1). Dongying was selected for the purposes of this study due to its vulnerability to floods. Approximately 138km of the Yellow River flows through the Dongying area, from the southwest to the northeast where it eventually meets the Bohai Sea. This portion of the river produces an annual average runoff of 22.8 billion cubic meters. The riverbed of the Yellow River, which has built up gradually due to sediment deposits, lies about 3-5 meters above the surrounding land, thereby placing the Dongying area at significant risk of flooding.

The two counties selected for the online questionnaire survey are Lijin County and Kenli County. These districts sit facing each other in the northwestern part of Dongying, with the Yellow River forming a border that flows between them. Their being situated along a substantial stretch of the river thus places them at regular risk of flooding. In terms of area and population, Lijin County covers 1665.6 square kilometers and has a population of around 300,000; while Kenli County has an area of 2178 square kilometers and a population of around 210,000. With regard to economic development, the two counties rank towards bottom among Dongying's districts and counties. Specifically, Kenli County's GDP was 31.70 billion yuan in 2021, making it fourth among Dongying's seven regions. Lijin County, on the other hand, had a GDP of 28.06 billion yuan in 2021, ranking fifth among Dongying's seven regions.

The online questionnaire survey was conducted from December 2020 to January 2021 using the Credamo data platform, which is based in China. Due to the difficulties posed by the ongoing pandemic for conducting survey research on the ground, participant recruitment through online panels has become an increasingly popular research method in China that can cover a wide range of topics (Huang, 2015; Truex

[3] Administrative divisions in China are divided into four levels: the provincial level, the prefectural level, the county level, and the township level. The study regions are tow counties, which located in the third level of the administrative division hierarchy, and are parts of the prefecture-level city of Dongying in Shandong Province.

2016). We used Credamo to randomly distribute the questionnaire to local residents living in the selected survey areas: i.e., Lijin County and Kenli County. The investigation largely focused on assessing participants' attitudes towards the issues of: voluntary participation in flood prevention and management measures; public awareness of policy information and political trust in government capacity to deal with flooding. The survey also took account of participants' socio-demographic backgrounds. The questionnaire was programmed anonymously on Credamo so that participants could freely express themselves and be critical in their views. A total of 684 participants participated in the questionnaire;[4] of these, 100 were ruled out because they did not pass an attention check, which indicates that they did not carefully read the questionnaire materials, and a further 34 were ruled out because their response times were too short.[5] Accordingly, data from 550 participants—264 from Lijin County and 286 from Kenli County—were included in the final statistical analysis. Table A1 in the Appendix summarizes the demographic and household characteristics of the respondents.

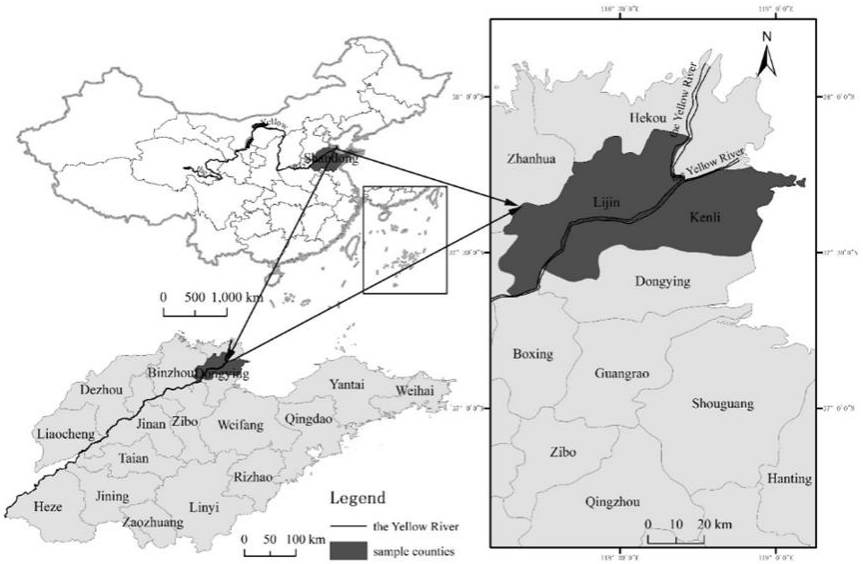

Figure 1. The geographical location of the study areas

3.2 Measurement

This study aims to explore how government-public collaboration in the context of flood management shapes individual citizens' mitigation behavior by investigating three distinctive dimensions as they relate to flood risk management: public involvement, public awareness and trust in government capacity. To achieve this goal, several key variables were measured and will now be described.

1) Dependent variable

Our study assessed individuals' willingness to take positive mitigation actions in two

[4] Individuals registered on this platform received a notification directing them to the questionnaire.

[5] Short response time could decrease the reliability of the collected data. Considering the length of our survey questionnaire, we chose 400 seconds as the cutoff of outliers.

ways. First, respondents were asked about their general views on preparedness: "Faced with the possibility of flooding, do you think it's necessary to make preparations in advance on your own?" (From 1 = Strongly unnecessary to 7 = Strongly necessary). The second question asked respondents for their views on a specific example of mitigation action: "Before or during a flood, are you willing to participate in a flood prevention team to reduce flood damage and protect your property?" (From 1 = Strongly unwilling to 7 = Strongly willing).

2) Independent variables

The core independent variables of this study are the features of government-public collaboration in China's flood management system: i.e., public involvement, public awareness and political trust.

Having summarized the most popular forms of public involvement in China, our study measures public involvement in terms of the frequency with which the respondents participated in specific government-led flood management activities (i.e., public involvement; 4 items, α=0.93). While public awareness in China tends to be characterized in terms of knowledge of official policy information, our study focuses more specifically on the degree of respondents' familiarity with particular flood-related policy information (i.e., public awareness; 3 items, α= 0.92). The detailed variable definitions are reported in Table 1.

Table 1. Public involvement and public awareness measurements

Dimension	Variable Description	Item
Public involvement	Frequency of participation in specific activities	Flood control knowledge lectures to acquire lifesaving knowledge (1-5) [a]
		Flood control regulation lectures to acquire legal knowledge (1-5) [a]
		Environmental impact evaluation program about flood control projects to put forward suggestions (1-5) [a]
		Visiting a resettlement community designed for those moved away from their hometowns as a result of flood control projects (1-5) [a]
Public awareness	Degree of familiarity with specific policy information	Plan for Relocation of Residents to the Yellow River Beach Area of your city (1-7) [b]
		Flood Control Emergency Plan of your city (1-7) [b]
		Comprehensive Plan for the Yellow River Basin (2012-2030) (1-7) [b]

a 1=Never, 2=Seldom, 3=Sometimes, 4=Often, and 5=Always; b 1=Strongly unfamiliar, 2=Unfamiliar, 3=Somewhat unfamiliar, 4=Neutral, 5=Somewhat familiar, 6=Familiar, and 7= Strongly familiar

The level of trust in the authorities' capacity to respond to flood risks was assessed with the question: "If a flood event occurs, how do you trust the response capacity of the following government?" Keeping in mind that Chinese people tend to trust the central government more than local government, trust in government capacity was measured by two items: trust in high-level government, including central government and provincial government; and trust in local government, including city government and county government. Responses relating to all the aforementioned governments were measured on a seven-point scale (From 1 = Strongly distrust to 7 = Strongly trust). Answers to these two items were treated as single indicators of trust in high-level government and local government, respectively. Two items were combined into a composite index of general trust in government capacity (α=0.75).

3) Control variables

To test the robustness of the core independent variables, several control variables, including risk perception, demographic and household characteristics, were added into the analysis.

Since risk perception is a multi-dimensional concept (SjÖberg 2000; Xu et al. 2019), this study measured it with respect to two dimensions: namely, possibility and worry. Specifically, we asked respondents to indicate their level of agreement with statements about the likelihood of a flood in their residential area (i.e. possibility; 2 items, α=0.67), as well as the consequences they anticipated such a flood to have (i.e. worry; 2 items, α=0.64). The detailed variable definitions are reported in Table 2.

Table 2. Risk perception measurements

Dimension	Variable Description	Item
Possibility	Perceived likelihood of a potential flood	I always feel that a flood will come one day (1–7) [a]
		I think the risk of flooding has increased here in recent years (1–7) [a]
Worry	Perceived consequences of a potential flood	I am worried about the impact of a flood on the village and my family (1–7) [a]
		In the event of a disaster, I think the sky is falling (1–7) [a]

a 1=Strongly disagree, 2= Disagree, 3=Somewhat disagree, 4=Neutral, 5=Somewhat agree, 6=Agree, and 7=Strongly agree

Control variables reflecting individual demographic characteristics include: gender, age, educational attainment, *hukou* status[6] and previous experiences of flooding. Additional control variables reflect the characteristics of respondents' households, and include: whether they have migrated from another county, own farmland and their self-reported household income status. For information on the definition and measurement of variables, please see Table A1 in the Appendix.

3.3 Model

The dependent variable in this study was an ordered, multi-classification variable (willingness to take positive mitigation actions), and the independent variables included category variables and continuous variables. Therefore, an ordinal logistic regression model was constructed to explore individual willingness to take positive mitigation actions and the driving mechanisms of the government-public collaborations that underpin such willingness.

The formula developed for the model is as follows:

$$\boldsymbol{Logit(Yi) = \beta_0 + \beta_1 PI_i + \beta_2 PA_i + \beta_3 TR_i + \beta_4 Con_i + \varepsilon_i} \quad (1)$$

In Formula (1), Yirepresents the dependent variable; PI_i, PA_iandTR_iindicate the core independent variables, i.e. public involvement, public awareness and trust in government capacity, respectively; Con_idenotes the control variable; β_1,β_2, and$\beta_3$refer to the parameters to be estimated; and$\varepsilon_i$is the residual. The data analysis was conducted using the statistical software package, Stata (16 MP version).

[6] *Hukou* is a household registration system that was established in the 1950s and remains in place to this day. It provides population statistics and identifies personal status, but also directly regulates population migration between rural and urban areas. A rural *hukou* status effectively denies farmers the same advantages and rights as those enjoyed by the residents of urban areas.

4. FINDINGS AND ANALYSIS

4.1 Descriptive statistics

Primary data in terms of respondent's willingness to take positive mitigation actions, public involvement, public awareness and political trust were collected in the survey questionnaire. For the dependent variables, as shown in Table 3, most respondents (89.64%) indicated that it was very necessary or necessary to make preparations for the possibility of flooding. When asked about their willingness to take a specific mitigation action, 73.09% of respondents said they were very willing or willing to participate in a flood prevention team.

Table 3. Willingness of the respondents on flooding mitigation actions

Variable	Definition	Response	Frequency	%
General action	General willingness to take positive mitigation actions	Strongly unnecessary	4	0.73
		Unnecessary	1	0.18
		Somehow unnecessary	2	0.36
		Neutral	5	0.91
		Somehow necessary	45	8.18
		Necessary	152	27.64
		Strongly necessary	341	62.00
Specific action	Willingness to participate in a flood prevention team	Strongly unwilling	0	0.00
		Unwilling	0	0.00
		Somehow unwilling	8	1.45
		Neutral	20	3.64
		Somehow willing	120	21.82
		Willing	200	36.36
		Strongly willing	202	36.73

Regarding the independent variables of focus, as shown in Table 4, the score for public involvement in government-led activities was 3.17. The majority of respondents (96.7%) participated in at least one of the four activities listed. As for public awareness of official policy information, this was measured with seven response options ranging from high to low awareness. The average score was 4.64, indicating that the majority of respondents had a basic understanding of the listed official policy information. For the final independent variable of focus, respondents showed a high level of trust in the government's flood response capacity, with an average score of 6.26 on a seven-point scale (from 1 = Strongly distrust to 7 = Strongly trust). As expected, respondents expressed more trust in high-level government than in local government, with average scores of 6.44 and 5.89 for high-level government and local government, respectively. Central government is thus likely to enjoy a higher level of trust than lower-level government in its capacity to deal with flood management. This finding confirms the results of the previous study on political trust in different levels of the Chinese government (Li, 2016).

Table 4. Public involvement, public awareness and political trust of the respondents

Variable	Definition	Mean	SD [a]
Public involvement	Public involvement (1-5) [b]	3.17	1.03
Public awareness	Public awareness (1-7) [c]	4.64	1.49
General trust	General trust in government capacity (1-7) [d]	6.26	0.73
Trust in high	Trust in high-level government (1-7) [d]	6.44	0.68
Trust in local	Trust in local government (1-7) [d]	5.89	1.04

a SD—standard deviation; b Five-point scale,1= Never to 5= Always; c Seven-point scale, 1=Strongly unfamiliar to 7=Strongly familiar; d Seven-point scale, 1=Strongly distrust to 7= Strongly trust

4.2 Regression results

The effects of public involvement, public awareness and political trust on willingness to take positive mitigation actions are reported in Table 5. The dependent variable in Model 1 and Model 2 is general willingness to take positive mitigation actions, while the dependent variable in Model 3 and Model 4 is willingness to participate in one specific action; i.e., a flood prevention team. Since these two variables about self-reported preparedness were both measured on seven-point scales, the ordinal logistic regression method was used in the analysis. Model 1 and Model 3 include public involvement, public awareness and general trust in government. In Model 2 and Model 4, general trust in government is broken down into two further elements—trust in high-level government and trust in local government—to capture the differential effects of these different levels of government. To test the robustness of the focus variables, Models 1-4 include all control variables that reflect individual risk perception, demographic characteristics and household characteristics.[7] Additionally, to eliminate the influence of heteroscedasticity from the model results, all of the models used robust standard errors.

As can be seen from Models 1-4, public involvement positively correlates with individual willingness to take positive mitigation actions, and the results were robust. Specifically, keeping all other variables constant, each unit increase of public involvement in government-led activities corresponds to an increase in the odds of willingness to take general mitigation actions and participate in a flood prevention team by 80.8%-84.9% and 96.1%-97.0%, respectively. This proves that involvement in government-led activities is an important factor that directly impacts on whether residents take responsible actions or not. In contrast, no evidence is found to prove that public awareness of policy information does promote individual mitigation actions; that is, the correlations between public awareness and self-reported preparedness were not significant, as shown in Models 1-4. One possible explanation for this is that the public involvement activities, which are mostly face-to-face occasions, could provide good opportunities for the government to engage directly with individual citizens and thus guide them towards taking responsible actions in a manner that provides a sense of satisfaction to all stakeholders (Mclver et al., 2009; Nouzari et al., 2019). Nevertheless, policy information provided by the government could be hard for the public to understand and may not be what they need in any case (Cannon et al., 2020). As previous studies indicate, if governments provide information in forms that ordinary citizens find either inconsistent with their value system or hard to access properly, that information is unlikely to be effective in mobilizing individuals to take responsible actions when faced with flooding (Mclvor et al., 2009).

Political trust positively correlates with respondents' willingness to take positive mitigation actions. As shown by Model 1 and Model 3, general trust in government positively correlates with willingness to take positive mitigation actions, and the results were robust. Specifically, keeping all other variables constant, every unit increase in general trust in government corresponded to an increase in the odds of willingness to take general mitigation actions and to participate in a flood prevention team by 90.2% and 57.8%, respectively. In general, this result does not offer evidence that respondents' trust in local government to manage a disaster nullifies their own personal actions. Instead, what it perhaps suggests is the existence of shared responsibility in Chinese society; that is, Chinese individuals seems to conflate the government's responsibility and capabilities with their own when it comes to issues like flooding. This

[7] For information on the definition and measurement of variables please see Table A1 in the Appendix.

is important because most disaster survivors are actually rescued by their neighbors and family members rather than highly-trained and equipped search-and-rescue professionals (Drabek, 2018). When broken down into two different kinds of trust in Model 2 and Model 4, we find that only trust in high-level government positively correlates with self-reported preparedness. There was also a positive correlation between trust in local government and willingness to take positive mitigation actions, but this was less significant. Specifically, keeping all other variables constant, every unit increase in trust in high-level government corresponded to an increase in the odds of willingness to take general mitigation actions and to participate in a flood prevention team by 81.8% and 40.4%, respectively. These findings reveal that residents are rational actors when determining whether to adopt mitigation actions. They selectively prefer to place their trust in the central government, which plays a monopolizing role in flood management, thus, broadly speaking, demonstrating a rational decision by the public based on their understanding of the greater capacity of the central government to effectively respond to flood risks.

Table 5. Results of regression estimates of willingness to take positive mitigation actions

	(1) General action	(2) General action	(3) Specific action	(4) Specific action
Public involvement	1.808***	1.849***	1.961***	1.970***
	(0.294)	(0.297)	(0.280)	(0.284)
Public awareness	1.058	1.053	1.035	1.034
	(0.111)	(0.109)	(0.109)	(0.109)
General trust	1.902***		1.578***	
	(0.281)		(0.205)	
Trust in high		1.818***		1.404*
		(0.340)		(0.253)
Trust in local		1.088		1.135
		(0.135)		(0.124)
Control variables	Y [a]	Y [a]	Y [a]	Y [a]
Observations	550	550	550	550
R-squared	0.114	0.115	0.121	0.121

Note: The values inside the parentheses are robust standard errors, while the values outside the parentheses are odds ratio; * p < 0.10, ** p < 0.05, *** p < 0.01, respectively. The letter Y indicates that all control variables reflecting individual risk perception, demographic characteristics and household characteristics are included in the model.

5. CONCLUSION AND DISCUSSION

This study has examined how government-public collaboration in the Chinese context, which here is digested into three aspects: public involvement, public awareness and political trust, impacts on the decisions individual citizens make about flood prevention actions. This study uses survey data collected from residents living in high flood risk areas in China, which allows us to draw some conclusions. Respondents who displayed a higher degree of involvement in government-led flood management activities also reported a higher probability of their voluntarily taking preparedness actions. A positive correlation between public awareness of policy information and self-reported preparedness was also seen, although the findings here were less significant. Trust in government was also found to positively correlate to individuals' willingness to take positive mitigation actions, although when different levels of government were compared, central government was found to play a more important role in this respect than local government.

These findings contribute to the existing scholarship where there is currently inadequate discussion of the cognitive aspect of government-public collaboration as it impacts on individuals' actions. Our findings provide new empirical evidence that helps to address current disagreements among scholars about the effects of public involvement on flood risk management (Kuhlicke, 2014; Begg et al., 2015; Begg et al., 2018). In particular, our research highlights that, in the Chinese context, individual public involvement in government-organized participatory activities show its own characteristics. Firstly, public involvement can enhance the subsequent actions taken by those individuals. Individual residents are likely to gain a sense of their shared responsibilities, thus facilitating their taking private actions vis-à-vis flood risk management. These findings differ from those of previous studies which, more often are based on evidence learned from Europe or North America, suggesting that individuals who place a high degree of trust in government may be less likely to act because they fully expect the government to solve problems without their input (Grothmann & Reusswig, 2006; Hung, 2009). Instead, our study suggests that although the scope for public engagement may be limited in the Chinese context, such government-led activities can nevertheless lead to some rather positive outcomes. Second, unlike in western countries, the Chinese government's communication of policy information may not have similar positive effects when mobilizing individual citizens' actions. These findings confirm that cultural factors need to be taken into account in research on government-public collaboration over flood risk management (Adger et al., 2013b). Indeed, in the Chinese context individuals are highly likely to be motivated by social norms to comply with government policy directions, as well as to hold a strong sense of shared responsibility. Such tendencies may be rooted in, for instance, Confucian moral values (Xu et al., 2017), the collective memory and legacy of communism (Tong, 2018), as well as other aspects of Chinese culture. Therefore, our findings confirm that in a culture that emphasizes collective responsibility, we can expect to find a higher level of commitment to flood mitigation practices (Noll et al. 2022).

The results of this study have several potential policy implications. First, there is significant room for the Chinese government to continue to involve the public effectively and earnestly through various forms of community engagement. Such outreach activities provide opportunities for better communication and to guide local residents towards taking responsible actions. Second, multi-level governments involved in flood management, especially those at a local level, need to disseminate information about their work in order to enhance their public trust. Although China's flood management practices continue to operate in a top-down fashion, such governance structures may not be conducive to public engagement for local governments where the level of public trust is lower. Therefore, given the fact that grassroots actors are a key force in managing flood risks, it is highly important for local political authorities to improve their public engagement work.

One limitation of this paper is the sample selection. Since the data was collected on an online platform, the respondents tended to be younger and fairly well-educated. However, a more general or national sample may provide a better understanding of wider tendencies within Chinese society regarding disaster prevention and mitigation behaviors. Moreover, only residents in high flood risk areas were used as the sample population. Another limitation that can be identified here is the inevitable causal inference from cross-sectional research design. Based on the regression results of this study, we could establish a correlation relationship, but not a causal relationship. Accordingly, future studies should make use of longitudinal research design to investigate the causal relationships between the factors that influence how people

perceive risks and respond to them by adopting self-protective behaviors.

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APPENDIX

Table A1. Definition and descriptive statistics of the control variables

Variable	Definition	Mean	SD [a]
Possibility	The perceived likelihood of a potential flood (1-7) [b]	3.60	1.36
Worry	The perceived consequence of a potential flood (1-7) [b]	4.64	1.32
Gender	Responder gender (0 = female, 1 = male)	0.51	0.50
Age	Responder age (years)	32.30	7.49
Education	Years of education (years)	16.35	2.22
Rural *hukou*	Responder *hukou* status (0=Urban *hukou*,1=Rural *hukou*)	0.50	0.50
Experience	Whether responder experiences a flood (0=no, 1=yes)	0.42	0.49
Migration	Whether household migrates from another county(0=no,1=yes)	0.26	0.44
Land	Whether household owns farmland(0=no,1=yes)	0.30	0.46
Household income	Self-reported household income status (1=below average,2=average,3=above average)	2.95	0.53

a SD—standard deviation; b Seven-point scale,1=Strongly disagree to 7=Strongly agree.

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