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Influencing Factors of Public Participation in Meteorological Disaster Prevention and Mitigation

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Abstract: Meteorological disasters have become a global challenge due to the increased prevalence and severity, and China is among the most affected countries. In this paper, based on a randomized survey in China, the authors employed a structural equation model to study the influencing factors of public participation in meteorological disaster prevention and mitigation (MDPM). It is found that the behavior of the government has a significant positive influence, with an influencing coefficient of 0.494 on the public's willingness to participate in MDPM. The degree of community involvement also has a significant positive influence on the public's willingness, with an influencing coefficient of 0.636. The public's attention to meteorological events and ability to participate have less impact on their participation in MDPM, with coefficients of 0.057 and 0.075, respectively. The information acquisition has a significant negative impact, with an influencing coefficient of −0.084. There is a strong positive covariation between community participation and governmental behavior, with a covariance coefficient of 0.27, indicating that the two factors promote each other and together boost the public's willingness to participate in MDPM.

Keywords: meteorological disaster prevention and mitigation; public participation; influencing factors; structural equation model

1. Introduction

Meteorological disasters refer to the disasters caused by atmospheric movement and evolution [1] and include blizzards, hailstorms, droughts, heat waves, tornadoes, cyclonic storms, thunderstorms and floods. These disasters have become a global challenge. Over the 20-year period between 1998 and 2017, climate-related and geophysical disasters killed 1.3 million people and left a further 4.4 billion injured, homeless, displaced or in need of emergency assistance [2]. From 1984 to 2014, meteorological hazards caused an average of 4066 deaths per annum [3].

Meteorological disasters in China generally possess different characteristics, high frequency, strong seasonality, large-scale loss and wide range of influence. Along with the occurrence of natural disasters, a series of other disasters often follow as ripple effects or a disaster chain. Within a disaster chain, the earliest disasters are considered as the primary disasters, which may lead to secondary disasters. When the harmonious conditions of human existence are disrupted and a series of other disasters aroused, derivative disasters may occur [4]. In 2017, the number of people affected by meteorological, secondary and derivative disasters was as high as 140 million. Meteorological risk levels are on the rise. It is difficult to fight, prevent and mitigate huge natural disasters by relying solely on the government [5].

An effective approach to deal with meteorological disasters is to raise public awareness and engage the whole public in meteorological disaster prevention and mitigation (MDPM). The magnitude of the damage caused by meteorological disasters depends not only on the intensity of the disaster, but also largely on the disaster prevention awareness and behavior of the victims. The main body of a disaster incident is the affected public, who plays a key role in disaster prevention and mitigation [6].

The United States, Japan, India and other countries have paid great attention to the field of public awareness of disaster prevention and mitigation. For example, the United States publishes meteorological disaster information in real time through the internet, television, radio and other news media to guide the public. Japan issued the "Basic Law on Disaster Countermeasures" to clarify the disaster prevention responsibilities of the state, the prefectural government, cities, villages and citizens. India has also developed a series of measures to raise the awareness of the public regarding disaster reduction [7]. China, too, has increasingly guided the public to participate in disaster prevention and mitigation. In 2016, the State Council promulgated the "National Natural Disaster Relief Emergency Plan", proposing an emergency plan in which the government acts as the leader and social mutual assistance as the auxiliary, and at the same issuing guidance on how the citizens can save themselves.

Although China has begun to emphasize public power in emergency assistance, people still mainly rely on government-led rescue operations. Frequently, the damage is largely increased due to weaker knowledge, willingness, ability to participate and self-protection skills of the public. Hence, a question arises: What are the influencing factors that affect public participation in MDPM? So far, only a few scholars have studied MDPM from the perspective of the factors influencing public participation. Therefore, this question is to be further elaborated in this paper.

The rest of the paper is structured as follows: Section 2 conducts a review of the related theories. Section 3 analyzes the theoretical mechanism and establishes the research hypothesis. In Section 4, model specifications will be introduced. In Sections 5 and 6, the data is processed and the results are analyzed. Section 7 draws conclusions.

2. Literature Review

The concept of public participation was first proposed in the 1950s and initially applied in public health. Since the expansion of democracy in the 1960s, public participation has been adopted in the political field. As time goes by, public participation is gradually being spread to aspects such as scientific decision-making, public services, democratic politics, etc. [8–14]. With the development of the internet and technology, public participation has been connected with information originating especially from geographic information systems, which provides a unique approach for engaging the public in decision-making by incorporating local knowledge [15–17]. Some scholars have researched ways of increasing public participation from different perspectives, such as the social learning perspective, the e-democracy perspective, etc. [18,19].

The research and focus on meteorological disasters have been shifted from disaster relief to pre-disaster warning. At the same time, more and more scholars began to incorporate public participation into MDPM, because the public has the right to know and access disaster data for making decisions on disaster mitigation [20]. Some scholars studied the factors affecting public participation and believe that the cognition of risk (whether or not the public has experienced a disaster), public awareness to meteorological information, knowledge and capability regarding disaster prevention, accuracy and timeliness of early warning and social support would affect the degree and efficiency of public participation in MDPM [21–25]. Based on the findings of public participation and influencing factors, more scholars began to investigate the difference in emergency management among countries. Through the review and summary of the emergency management models of the US, Japan and China, Zhou [26] found that the transition from a government-centered emergency management model to a community-led emergency management model should be gradually promoted to improve the efficiency of disaster management.

From the above studies, it is seen that international scholars have accomplished certain achievements in studying public participation in disaster prevention and mitigation. However, some concerns remain: Firstly, existing studies only focused on public participation as a whole to estimate the efficient impact on disaster prevention. As a result, the specific influencing factors of public participation are not identified in the field of meteorological disaster reduction. Secondly, the public's willingness to participate, as a subjective factor, is easily affected by various external factors. Biased samples and the lack of large samples can easily lead to a decline in the credibility and practicality of results. The sample size in our study is relatively large, with 62,895 received questionnaires, and thus with a higher credibility and applicability. Particularly, due to smaller deviations of the extreme subjective option, the fluctuations are smaller. By regarding the influencing factors as an organic whole that has an impact on the public's willingness to participate in MDPM, based on the questionnaire survey, and utilizing structural equation modeling, the influencing factors of public participation in MDPM are analyzed and the specific impact path is investigated.

3. Hypotheses

3.1. The Public's Attention to Meteorological Events Affects Its Willingness and Ability to Participate in MDPM

The public's lack of willingness and ability to participate in MDPM may be due to its lack of attention to meteorological events. The degree of public attention to meteorological events refers to the public's attention to meteorological conditions including disaster events, specifically indicated by whether the public calls the weather services, browses weather websites and purchases meteorological financial products [27–29].

Research on the relationship between the attention to meteorological events and the public's willingness and ability to participate is mainly divided into two categories: (1) Some scholars believe that the public's perception of events has little effect on behavior and willingness. Sheridan surveyed the public's perception of high temperature warnings, and the result showed that although 90% of the respondents indicated that they had sufficient knowledge of high temperature warnings, only half of them would change their behavior [30]. (2) Other scholars hold that the public's lack of willingness and ability to participate is related to the low public attention to meteorological events. The public's response to disaster risk behavior is influenced by the perception of risk [31], and the public's attention to meteorological events will affect the benefits of MDPM services. Xie quantified the overall cognitive variables of climate change as the degree of understanding and concern for climate change. Among the surveyed public unwilling to participate in activities to fight climate change, 45.7% understand in general the causes of climate change, and 9.7% are not aware of the causes. This shows that the low willingness to participate in actions to fight climate change is related to the low public attention to climate change [32]. Ajzen, Berk, Leiserowitz and Sander all believe that the public's future actions will be affected by their awareness of meteorological issues [33–36].

Hence, the following two hypotheses are put forward:

Hypothesis (H1). *The public's lack of willingness to participate in MDPM is due to the low public attention to meteorological events*;

Hypothesis (H2). *The public's lack of ability to participate in MDPM is due to the low public attention to meteorological events.*

3.2. Information Acquisition Affects the Public's Willingness and Ability to Participate in MDPM

Information acquisition may have a positive impact on the public's willingness and ability to participate in disaster prevention and mitigation. Information acquisition refers to whether the public is able to obtain timely and accurate meteorological warning and forecast information. Correct and timely weather warning and forecast information can enhance the public trust and security, help the

public to understand the hazards caused by meteorological events and lead the public to improve their ability and willingness in response to meteorological disasters. Scholars believe that the accuracy of meteorological disaster information has a significant positive influence on public satisfaction with MDPM services.

As meteorological disaster data are monitored and released by the government in China, the public is only rarely aware of the relevant information provided in the official platform. At the same time, social media enables valuable information to be shared efficiently, but it also causes the spread of false information [37]. Outdated, inaccurate or erroneous information has greatly weakened the public enthusiasm for using social media in disaster events [38]. However, given the limitation of the existing technology, it is difficult to achieve complete accuracy in meteorological warning and forecast information, which will undoubtedly affect the trust of the public receiving the information, reducing its willingness and ability to actively participate in MDPM.

The following hypotheses are put forward:

Hypothesis (H3). *Information acquisition can increase the public's willingness to participate in MDPM;*

Hypothesis (H4). *Information acquisition can optimize the public's ability to participate in MDPM.*

3.3. Governmental Behavior Affects the Public's Willingness and Ability to Participate in MDPM

The government's behavior may have a positive influence on the willingness and ability of participants to participate.

A higher trust of the public in governmental behavior and a wider coverage of the warning information released by the government can increase the willingness and ability of the public to participate in MDPM. He regarded that institutional trust triggered by a social phenomenon based on "non-human relationships" directly and independently influences organizational behavior [39–41]. The public's recognition and cooperation with the government's rescue behavior will affect the efficiency of the government's disaster rescue operations, and the efficient government rescue actions will in turn increase the public's trust in the government. In this way, the public will be more willing to follow the guidance of the government, cooperate with the government's knowledge popularization and capacity building, and subsequently improve their participation ability and willingness to participate. In other words, the higher the public trust in governmental behavior, the greater the effectiveness of governmental behavior, the higher the willingness of the public to participate and the higher the likelihood that the public will actively learn related skills.

The following hypotheses are put forward:

Hypothesis (H5). *Governmental behavior can increase the public's willingness to participate in MDPM;*

Hypothesis (H6). *Governmental behavior can optimize the public 's ability to participate in MDPM.*

3.4. The Degree of Community Participation Affects the Public's Willingness and Ability to Participate in MDPM

Community participation can have a positive influence on the public's willingness and ability to participate in MDPM. Because the community has a great influence in guiding public behavior by organizing training courses and inviting experienced people to conduct systematic training for residents, participants will understand the use of disaster relief equipment to increase the public's willingness and ability to participate [42].

Chen [43] found that most respondents indicated that public participation in community emergency rescue yields an important impact, and residents who were unwilling to participate in emergency rescue believed that they possessed rescue abilities, such as rescue skills and related knowledge. Therefore, if the community can consciously guide the public to participate in MDPM by actively organizing

capacity training practice courses, engaging the public to participate correctly and effectively will directly promote the public's ability and willingness to participate in disaster prevention and mitigation.

The following hypotheses are put forward:

Hypothesis (H7). *Community participation can increase the public's willingness to participate in MDPM;*

Hypothesis (H8). *Community participation can optimize the public's ability to participate in MDPM.*

3.5. The Public's Ability to Participate Affects the Public's Willingness to Participate in MDPM

The public's ability to participate in MDPM can have a positive impact on the public's willingness to do so. The public's ability to participate in MDPM refers to whether the public is equipped with the knowledge and ability to deal with meteorological disasters, including laws, regulations and basic skills related to MDPM. Understanding the relevant laws and regulations and the specific measures applied by disaster relief volunteers will play a significant role in deciding to participate in disaster relief during the actual disaster occurrence process. Through their subjective awareness, citizens who have the ability to participate can take the initiative to participate in deeper social activities [44].

Therefore, if people realize that they have the ability to participate in MDPM activities and can play a role in MDPM, they will be willing to participate.

Qi [45] believes that only if the citizens recognize their own ability to influence public affairs and understand that they can participate in public affairs will they consider the advantages of the ability to participate in public affairs. If the public lacks relevant knowledge of emergency assistance and does not have the ability to participate in MDPM, it will grow accustomed to passive rescue and less willing to participate in an active manner.

The following hypothesis is put forward:

Hypothesis (H9). *The public's ability to participate in MDPM can increase its willingness to participate.*

4. Survey Design

4.1. Variables and Questionnaire

The measurements adopted to estimate the six latent variables are listed as follows, and specific measurement items are shown in Table 1.

Table 1. Questions design.

Latent Variable	Measurement Item	Mean	Ratio
Public Attention to Meteorological Events (SZ)	SZ1 public concerns about adverse effects of meteorological disasters	2.29	60.9
	SZ2 public purchases of meteorological financial products	2.78	27.4
	SZ3 public purchases of the meteorological lottery	2.16	41.4
Degree of Community Participation (SQ)	SQ1 community undertakes disaster prevention and self-rescue and mutual rescue work	3.46	88.7
	SQ2 community undertakes risk assessment and disaster prevention information release work	3.09	71.6
	SQ3 public participates in community disaster reduction work	3.47	88.4
Governmental Behavior (ZF)	ZF1 public is willing to provide personal positioning information to the disaster reduction system	3.40	80.1
	ZF2 public cooperates with the government to approve and compensate for disaster losses	3.32	78.2
	ZF3 government releases disaster avoidance information	3.31	52.3
Information Acquisition (XX)	XX1 public did not obtain weather forecast warning information	2.34	47.5
	XX2 received weather forecast warning information is not accurate	2.22	37.8
	XX3 public follows the warning information	2.51	59.6

Table 1. *Cont.*

Latent Variable	Measurement Item	Mean	Ratio
Willingness to Participate (YY)	YY1 public is willing to share disaster warning information	3.62	93.3
	YY2 members of the public are willing to become disaster relief volunteers	3.32	85.7
	YY3 public is willing to participate in disaster relief volunteer training	2.69	52
Ability to Participate (NL)	NL1 public donates to the affected area	2.87	54.5
	NL2 public understands the relevant laws and regulations of disaster relief volunteers	1.74	20.8
	NL3 public learns the basic skills of disaster relief volunteers for disaster relief	1.82	22.3

Note: (1) Mean is the average of the measurement item; (2) Ratio is the percentage of the respondents who agree with the item.

The public will investigate the meteorology conditions before the purchase to ensure the advantage or profit [46]. The measures adopted to estimate the degree of public attention to meteorological events include: (1) Proportion of the public that purchases meteorological financial products such as weather index financial products, stocks and lottery tickets, and (2) Proportion of the public concerned with the adverse effects caused by meteorological disasters.

Untimely or erroneous meteorological disaster information can greatly undermine the public's trust in meteorological services and even the governmental offices that oversee the services, and will therefore reduce the likelihood of public willingness and ability to participate. The measures adopted to calculate the information acquisition include: (1) Proportion of the public that will obey the instructions to avoid losses, and (2) Proportion of the public that believes the damage caused by meteorological disasters is due to the failure to receive timely and accurate warning information.

Well-planned governmental actions are an important means to mobilize the public to participate in emergency assistance, and the success of governmental behavior depends on the public's cooperation, which can only be ensured when the public recognizes and trusts governmental organizations. Trust and citizen participation are mutually promoted, for trust is an indispensable part of society, and the possibility of cooperation will be greater if the level of trust is higher. The behavior of government organizations in this article refers to the preventive strategies and rescue operations managed by the government after disasters, and the corresponding measure of the actual effect is determined by the public's participation in activities and recognition of the rescue operations, as well as the transparency of the disaster avoidance information released by the government.

The community, as an agency of the municipal government, accepts the guidance of the subdistrict office and undertakes a lot of administrative actions and tasks. A way to measure the community's participation is to judge whether the community undertakes the actions of disaster prevention and rescue operations, risk assessment, disaster prevention information release and public participation. Community participation in this article refers to the activities organized by the communities under the guidance of the subdistrict office, including the determination of whether the communities are willing to participate in MDPM before and after the occurrence of meteorological disasters, whether the communities undertake the MDPM rescue work and the release of MDPM warning information.

Whether the public donates monetary or material gifts, whether they understand the relevant laws and regulations of disaster relief volunteers and whether they have the basic skills of disaster relief volunteers can be used as a measure of the public's capability of participating in MDPM. Understanding the relevant laws and regulations and the specific measures applied by disaster relief volunteers will play a significant role in participating in disaster relief during the actual disaster occurrence process. Through their subjective awareness, citizens who have the ability to participate can take the initiative to participate in deeper social activities.

The questionnaire has two parts: The first part refers to the influencing factors of public assistance for meteorological disasters. The scale method used in the questionnaire is the classic Likert five-point

scale method. The specific scale is shown in Table 1. The second part refers to the demographic information of the respondents, including gender, age, ethnicity, education status, city, work area and professional field, shown in Table 2.

Table 2. Sample data statistics.

Survey Information	Option	Effective Ratio
Gender	Male	66.9
	Female	33.1
Generation	Under 18 years old	4.7
	18–30 years old	40.1
	30–40 years old	30.1
	40–50 years old	20.6
	50–60 years old	3.8
	60 years old or older	0.6
Educational level	Junior high school and below	18.0
	High school/secondary school	28.7
	College/Bachelor	45.8
	Master degree and above	7.5
Living area	North China	21.4
	Northeast	6.1
	East China	25.8
	Huazhong	11.2
	South China	24.1
	Southwest	5.6
	Northwest	5.7
	Hong Kong, Macao, Taiwan	0.2
Place of residence	Municipality	7.5
	Capital city	14.4
	Prefecture-level city	31.8
	County (county-level city)	20.2
	Township	11.2
	Village	14.9
Occupation	Personnel in charge of institution, enterprise	6.2
	Personnel engaged in professional technology	18.0
	Personnel engaged in business and service industries	11.6
	Personnel in agriculture, forestry, animal husbandry, fishing, water conservancy	21.6
	Production and transportation equipment operator	8.0
	Soldier	0.5
	Other	34.0

As shown in Table 1, 27.4% and 41.4% of respondents were willing to purchase two meteorological financial products, and 60.9% of respondents were concerned with the adverse effects caused by meteorological disasters. The mean values of items range from 2.1 to 2.8, which suggests that the respondents hold a relatively negative attitude toward meteorological events and are not very willing to participate in concerning meteorological disasters. This may be related to two reasons: the uneven distribution of meteorology disasters in China and the lack of variety of meteorological finance products to meet the needs of the public.

47.5% of respondents indicated that they would obey the instructions to avoid losses, and 37.8% and 59.6% of respondents contributed to the losses from meteorological disasters partially due to the failure to receive timely and accurate warning information, respectively. The mean values of items range from 2.2 to 2.6, which reflects a relatively negative attitude and signifies that most of the respondents suspect the information they received or think the information is untimely. This indicates

that the information prediction and dissemination system is not complete enough for them to obey with a high degree of trust.

According to the survey, 52.3% of respondents indicated that the government will release disaster avoidance information when disaster occurs, 80.1% respondents are willing to provide information regarding their personal position to the disaster reduction system during the disaster and 78.2% are willing to cooperate with the government to compensate for disaster losses. The mean values of items range from 3.3 to 3.4, which indicates that most of the respondents have great confidence in the government's behavior during MDPM.

88.7% of respondents believe that the community will participate in MDPM, 71.6% of respondents indicated that the community will participate in the work of risk assessment and the release of disaster prevention information and 88.4% of respondents said that they will participate in community disaster reduction. The mean values of items range from 3 to 3.5, which reveals that most of the respondents hold the belief that the community they live in will perform its duty in the process of MDPM to a high degree.

54.5% of respondents expressed that they will donate to the disaster-affected areas, 20.8% of respondents indicated that they understand the relevant laws and regulations of disaster relief volunteers and 22.3% of respondents said that they are familiar with the skills of disaster relief volunteers. With the mean values ranging from 1.7 to 2.9, the mean of public donation is 2.87 (the reason why the rate and mean of donation are higher than the mastery of disaster relief knowledge and skills is that the former needs less time and effort), which shows that most of the respondents have a relatively negative attitude with regard to their ability. They do not possess the ability to participate in MDPM.

Based on the above nine hypotheses, a relational model was designed, as illustrated in Figure 1, where an arrow indicates the pointed variable being affected by the pointing variable, and H1~H9 respectively represent the corresponding hypotheses' relationships. Based on the following model, a specific refinement analysis will be carried out.

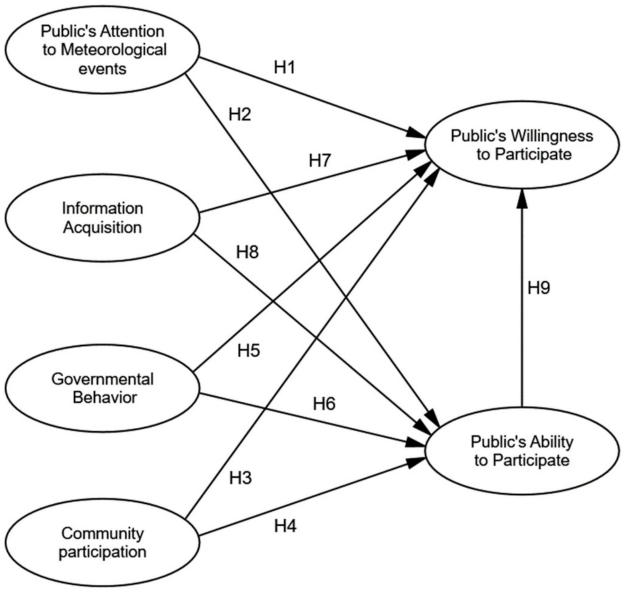

Figure 1. Model design.

4.2. Distribution and Collection of Questionnaires

To reach a higher response rate, the questionnaires have been collected through the website of the Chinese Weather Network, powered by the Baidu Questionnaire engine (with 63,000 questionnaires collected in December 2017 and January 2018). Once the participants complete the questionnaire, they have an opportunity to draw a prize from the website, worth 500 to 5000 yuan in the form of a discount

coupon on a digital product. The questionnaire was randomly distributed to ensure the collection of data from different groups as much as possible, which will guarantee the credibility of the various analyses. A total of 62,895 questionnaires were determined to be valid.

The statistical results of the sample data are shown in Table 2. The structure of gender, generation, educational level, living area, place of residence and occupation are consistent with the distribution of netizens in China, and the sample was deemed to be representative.

5. Results

5.1. Reliability Analysis

Cronbach's alpha is the most common method to measure reliability, but the α coefficient will be affected by the size of the subject's trait variation, the average of correlations between questions, the number of questions and the homogeneity of the difficulty of the questions [47,48]. Taylor and Campbell suggested that the more homogeneous the test traits of the subjects, the smaller the estimated α coefficient. The α coefficient cannot be used to estimate the reliability of a single observation variable and allow the measurement error between the observation variables to be correlated [49]. Therefore, a confirmatory factor analysis (CFA) was carried out to calculate the construct reliability, which is an internal reliability index. If the reliability is high, there is a higher correlation between indicators. Some scholars believe that when this index is greater than, or equal to, 0.5, the measurement is consistent [50]. Some scholars emphasized that this index needs to be at least 0.6 [51]. Although there is no strict rule to determine at which level the coefficient can be utilized to claim a good reliability, quite a few scholars suggested the following rough judgment principle: a reliability coefficient of 0.9 or higher is "excellent"; around 0.8 is "very good"; 0.7 is "moderate"; above 0.5 is acceptable; below 0.5 means that at least half of the observational variation comes from random errors, so its reliability is insufficient and should not be accepted. The results are shown in Table 3, with the composite reliabilities greater than 0.7, indicating that the interrelation between indicators was moderate in the SEM model.

Table 3. Reliability analysis.

Latent Variables	Number of Questions	Composite Reliabilities
SZ	3	0.828
SQ	3	0.847
ZF	3	0.857
XX	3	0.778
YY	3	0.812
NL	3	0.840

5.2. Validity Analysis

According to the CFA analysis of the composition of the questionnaire, the factor load was greater than 0.5, indicating that it has a high validity. If it were less than 0.5, the question items would need to be adjusted or deleted to ensure the validity of the measurement items. The results of the specific factor analysis are shown in Table 4. The factor load and the index of average variance extracted were higher than 0.5, which means that the measurement had a high convergent validity. There was a strong correlation between the explicit variables within one latent variable.

Table 4. Analysis of convergent validity.

Latent Variable	Measurement Item	Factor Load	AVE	P
Public Attention to Meteorological Events (SZ)	SZ1	0.585	0.624	***
	SZ2	0.907		
	SZ3	0.840		
Community Participation (SQ)	SQ1	0.880	0.650	***
	SQ2	0.702		
	SQ3	0.826		
Governmental Behavior (ZF)	ZF1	0.881	0.669	***
	ZF2	0.882		
	ZF3	0.673		
Information Acquisition (XX)	XX1	0.807	0.545	***
	XX2	0.808		
	XX3	0.574		
Willingness to Participate (YY)	YY1	0.654	0.593	***
	YY2	0.826		
	YY3	0.817		
Ability to Participate (NL)	NL1	0.512	0.650	***
	NL2	0.918		
	NL3	0.919		

Note: *P* = *** means denote a significance of 1%, respectively.

The results of the discriminant validity analysis are shown in Table 5.

Table 5. Analysis of discriminant validity.

	SZ	***SQ***	***ZF***	***XX***	***YY***	***NL***
SZ	0.624					
SQ	0.117***	0.650				
ZF	0.287***	0.265***	0.669			
XX	0.109***	0.153***	−0.166***	0.545		
YY	0.291***	0.780***	0.698***	−0.042***	0.593	
NL	0.361***	0.262***	0.062***	0.277***	0.269***	0.650
Square root of AVE	0.801***	0.806***	0.818***	0.738***	0.770***	0.806

Note: *** means denote a significance of 1%, respectively.

It can be seen that each latent variable has a correlation relationship under the significant level of $\alpha = 0.01$ ($p < 0.01$). In addition, the absolute value of the correlation coefficient is less than the corresponding square root of the average variance extracted (AVE), indicating that there was a certain correlation and a certain degree of discrimination between each pair of latent variables. Hence, the discrimination validity of the scale data is ideal, and it can be concluded that there is a strong differentiation between latent variables.

5.3. Hypotheses Testing

To estimate the hypotheses proposed above, the maximum likelihood estimation method was utilized, and the estimation results are shown in Table 6. It can be seen that the *P* value of each path is significant at the level of $\alpha = 0.01$, indicating that the path relationships do not need to be adjusted. The model has not been modified, so the specific coefficient values are not discussed here. The final result will be explained in Section 5.4.

Table 6. Hypotheses test

Hypothesis	Estimate	P	Standardization Coefficient	Hypothesis
H1	0.071	***	0.069	valid
H2	0.345	***	0.330	valid
H3	−0.400	***	−0.115	invalid
H4	0.646	***	0.169	valid
H5	0.208	***	0.468	valid
H6	−0.024	***	−0.054	invalid
H7	0.414	***	0.678	valid
H8	0.117	***	0.190	valid
H9	0.109	***	0.110	valid

Note: (1) Estimate is the non-standardized regression coefficient; (2) *** indicates significant at the 0.01 level.

Based on the significance level shown in Table 6, each path is significant. However, Hypothesis 3 is false, with a significant path relationship, indicating that information acquisition has a negative influence on the public's willingness to participate; Hypothesis 6 is false, and the path relationship is significant, implying that the government's organizational behavior has a negative influence on the participants' ability to participate.

5.4. Model Fitting and Analysis of Results

The fitting indicators used include Chi-square (χ^2), degree of freedom (df), χ^2/df, RMSEA, Incremental Fit Index (IFI), Tucker-Lewis Index (TLI), Comparative Fit Index (CFI). The value of NFI was between 0 and 1. If the value is greater than 0.9, the model is fit [52]. IFI, TLI and CFI are the same as NFI. The value of χ^2/df should be smaller than 3, and RMSEA should be smaller than 0.08. The initial fitness index is shown in Table 7.

Table 7. Fitting Index.

Fitting Index	IFI	TLI	CFI	RMSEA	χ^2	df	χ^2/df
Unadjusted	0.822	0.765	0.815	0.104	256.413	121	2.119
Adjusted	0.959	0.939	0.956	0.053	140.87	109	2.119

From the fitting index in Table 7, the values of IFI, TLI and CFI were all less than 0.9, and RMSEA was greater than 0.08 before adjusted, which means that the fitting degree of the model is not high, and hence that the model needed to be further adjusted. After the model was corrected according to the modification index, each indicator reached the required value of the indicator. The revised indicators are shown in Table 7. Because the sample size was large, there was no excessive restriction on the Chi-square value, and the remaining indicators were consistent with the model fitting index. The adjusted model is shown in Figure 2. The data show that after adjustment and correction, the theoretical model had a good fitting and feasibility, and the results of the model could be analyzed.

From the above analysis of results, it can be concluded that the degree of community participation and governmental behavior have a higher and significant influence on the public's participation and willingness, and the direct impact factors of standardization are 0.636 and 0.494, respectively. The public's attention to meteorological events and the public's participation ability are small but significant, and the direct impact coefficients of standardization are 0.057 and 0.075, respectively. Information acquisition has a significant negative impact on the public's participation willingness, with a standardized impact factor of −0.084.

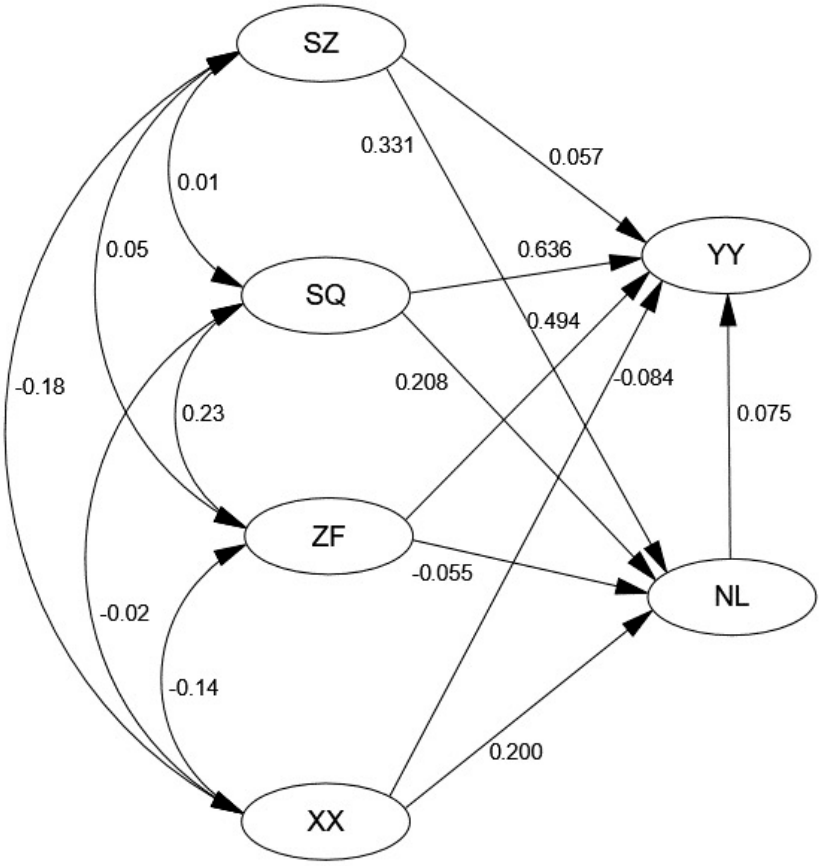

Figure 2. Modified model path.

6. Discussion

The degree of community participation and governmental behavior are the main factors affecting the public's willingness to participate, which is in line with Hypotheses 7 and 5. Since the community has a great influence in guiding public behavior, communities should actively engage in activities concerning the theory and practice of MDPM, which directly transmit the knowledge of MDPM to the public and can help the public to increase its willingness to participate in MDPM. At the same time, the greater the effectiveness of governmental behavior, the higher the willingness of the public to participate. Governmental disaster prevention and mitigation actions and popular science propaganda in meteorology can be implemented to enhance the public's willingness to participate in MDPM. The public's ability to participate and attention to meteorological events play a supporting role in willingness cultivation. Although the negative impact of information acquisition is less influential, which does not match Hypothesis 3, it should not be ignored. Through the frequency analysis of the information acquisition variables in the original questionnaire, it was found that the rate of participants who believed that their losses are caused by inaccurate meteorological warning and by not receiving weather warning information are 21.8% and 26.5%, respectively. This means that the construction of the information dissemination platform is still not complete, and that the public does not fully trust the warning system. Today's timely and accurate meteorological warning and forecast information is not yet sufficient to guide the public to actively participate in the recommended actions.

The factors affecting the public's ability to participate in MDPM mainly include the public's attention to meteorological events, community participation, governmental behavior and information acquisition. The degree of attention to meteorological events, the degree of community participation and information acquisition have greater impacts on the public's ability to participate, with standardization impact coefficients of 0.376, 0.252 and 0.200, respectively, which are in line with Hypotheses 2, 8 and 4. Therefore, raising the public's attention to meteorological events can promote its participation

in the development of MDPM capabilities. The public's conscious participation in MDPM and the improvement of participation capabilities are closely related to people's awareness of the impact of meteorological disasters on their life. Once individual interests are involved, the public will be directly stimulated to pay attention to MDPM and take action to cultivate relevant capabilities. Regarding the level of attention to meteorological events, the influence of community participation and information acquisition is weaker, but there is still a significant positive impact. By organizing training courses and inviting meteorologists to conduct systematic training for residents, participants will learn to use disaster relief equipment, and, at the same time, relevant departments should pay attention to the diversification of the channels for obtaining MDPM information and the accuracy of the released information. Contrary to Hypothesis 6, governmental behavior has a significant negative effect on the public's participation ability. The public has shown a high degree of coordination with measures such as the collection of positioning information, post-disaster accounting and information released by government organizations, but the strength of stimulating the public's ability to exercise is weaker. The reason is that the public is highly dependent on government relief and lacks training approaches to MDPM. Xu believes that the Chinese people's authority orientation is grounded in psychological dependence. They believe that authority is credible, all-powerful and eternal. They tend to completely depend on authority both psychologically and behaviorally [53].

Governmental behavior, however, has a positive impact on the public's willingness to participate, which is in line with Hypothesis 5. This is because the ability to participate requires training and the willingness to participate does not. Therefore, although the government's organizational behavior has a positive impact on the public's willingness to participate, for the public, trustworthy governmental behavior will lead to a dependence on the government which hinders the cultivation of a relevant participation ability. As to why information acquisition has a positive impact on the public's participation ability, which corresponds to Hypothesis 4, and a negative impact on public willingness, which contradicts Hypothesis 3, the reason is that information as a medium may be conventionally accepted by the public, and that information has invisibly transmitted rescue knowledge about MDPM, cultivating the public's ability to participate. The uncertainty of meteorological information will lead to public uncertainty about information, reducing the willingness of the public to participate subjectively.

7. Conclusions

In this section, by summarizing the influencing factors on the public's willingness to participate in MDPM, several paths to efficiently improve willingness are presented.

Recall that (1) governmental behavior and community participation have a significant positive impact on the public's willingness to participate in MDPM; and (2) there is a strong positive connection between the degree of community participation, as well as attention to meteorological events, and governmental behavior. These two findings reveal a mutually reinforcing relationship. Therefore, the following suggestions are obtained.

1. Improving governmental rescue efficiency in response to meteorological disasters

Firstly, the establishment and improvement of the mechanism of MDPM is a complex system involving various institutions and units. The government should take the lead in MDPM, coordinate the work between various departments, boost the efficiency of disaster prevention, mitigation and relief, consolidate the public's trust in the government's behavior and cooperate with communities to provide the opportunities for training the skills to promote public willingness and ability to participate. Secondly, the administrative and legislative departments should be urged to carry out the administrative management, policy and regulation formulation regarding public participation in emergency assistance. Community participation needs to be included in the MDPM system, and the meteorological information release department is required to improve the accuracy of meteorological warning information. Thirdly, relevant management and supervision departments should be established. They would greatly reduce the losses caused by meteorological disasters by

implementing related policies and regulations, improving the linkage mechanism with social forces to coordinate disaster relief and strengthening public participation enthusiasm.

2. Strengthening the science propaganda of MDPM in communities and carrying out the training of first aid skills

As a communication platform, the community can strengthen the science propaganda of MDPM, promote the popularization of knowledge in the community, guide the public to correctly obtain and use meteorological disaster warning information and enhance the public's willingness to participate. The promotion effect of community participation on governmental behavior refers to the fact that the boost in community participation will also increase the public's trust and cooperation with governmental organizations. The community encourages residents to carry out emergency nursing skills training and escape drills to promote public awareness of risk prevention and public disaster prevention, and enhance mitigation skills and self-help and mutual rescue skills.

3. The meteorological information release department should improve the accuracy and coverage of meteorological disaster warning information

With the advancement of living standards, people not only have reached a consensus on the important joint role between the government and the community in MDPM, but have also raised the demand for MDPM information. Improving the accuracy and coverage of early warning information is the basis of MDPM. At present, early warning information release channels and means cannot meet the needs of the public, and the coverage of early warning information is limited and not wide enough. The meteorological information release department should expand its services in releasing information on emergency response, innovate and improve the information dissemination platforms and make full use of various channels of communication by cooperating with the government and the community to deliver disaster warning information to individuals, release and provide timely disaster warning information and widen public service coverages. At the same time, the implementation of new technologies and methods such as big data, cloud computing and geographic information should be promoted to optimize disaster information acquisition, risk assessment, emergency communication and support capabilities, and to ensure that the accuracy of early warning information remains a top priority for the meteorological information release department.

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