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Article

How to encourage more public participation in marine disaster risk management: Evidence from a survey experiment in China

Qun Cui[1], Lisheng Dong[2,*], Tom Christensen[3]

[1] Department of Sociology, Qingdao Institute of Administration, Qingdao, 266000, China
[2] School of Public Management, University of Chinese Academy of Social Sciences, Beijing 102488, China
[3] Department of Political Science, University of Oslo, NO-0316 OSLO, Norway
*** Corresponding author:** Lisheng Dong, dongls@cass.org.cn, lsdong1955@live.com

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Abstract: Raising public awareness of maritime risk and disseminating information about disaster prevention and reduction are the most frequent ways that the government incorporates citizens in marine disaster risk management (DRM). However, these measures are deemed to be insufficient to drive the participation rate. This study aims to understand the participation trend of citizens in marine DRM. On the basis of the theory of citizen participation's ladder, public participation within marine DRM is categorized into non-participation, tokenistic participation, and substantive participation. Using organization theory, the government's strategies for encouraging participation are classified into common approach (raising awareness), structural approach (innovating instruments), and cultural approach (developing citizenship). Considering the vignette experiment of 403 citizens in a coastal city of China that has historically been subject to marine disasters, it was found that effectiveness of the strategies, from highest to lowest, are citizenship development, risk education, and instruments innovation. At the individual level, psychological characteristics such as trust in the government, past disaster experience, and knowledge of marine DRM did not significantly influence citizens' participation preferences. At the government level, even when citizens are informed about new participatory mechanisms and tools, they still tend to be unwilling to share responsibilities. However, self-efficacy and understanding the beneficial outcomes of their participation in marine (DRM) can positively impact the willingness to participate. The results show that to encourage public participation substantively in the marine DRM, it is important to cultivate a sense of civic duty and enhance citizens' sense of ownership, fostering a closer and more equitable partnership between the state and society.

Keywords: public participation; marine disaster risk management; public awareness; organization theory; vignette experiment

1. Introduction

Along with the theoretical shift in political science and public administration from a managerial viewpoint—which focuses on elected officials and administrators acting in the public interest—to a pluralist viewpoint—which sees the government as an arbitrator among various organized interest groups (Pearce, 2003), there has been a re-focus from a predominantly top-down, 'command and control' style of disaster risk management (DRM), to the encouragement of 'people-centred' strategies, where the public is a central component and resource (Scolobig et al., 2015).

As Dorcey and McDaniels (1999) highlight that, the question in the 1980s and 1990s was "why" public engagement in DRM is required, the focus in the twenty-first century has shifted to "how" it should be utilized. In reality, public participation in DRM is still considered as elusive (Samaddar et al., 2017), partly due to the varying

levels of public willingness, which is not a binary choice. Regarding the marine disaster, some individuals would rather be content with seeing the typhoon weather warning than selecting not to go to the beach, while others may wish to engage in discussions about the post-storm surge recovery strategy. Therefore, adopting the mitigation strategies requested by the authorities does not imply that they wish to actively participate in the DRM decision-making and implementation procedures, even though both require some level of citizen interaction. As a result, it is important to consider the diverse viewpoints of citizens and distinguish between their expectations, which range from token, passive, and one time engagement to concentration, initiative, and continuing process participation.

Raising public awareness is the most frequent method by which the government incorporates citizens in marine disaster risk management (DRM). Most disaster managers start with the premise that people do not fully comprehend the risks they face or how to deal with them (Blaikie et al., 2004). Therefore, they engage in public awareness activities such as information dissemination, education, and radio or television broadcasts to popularize knowledge, support the public in correctly receiving and considering meteorological disaster warning information and improve the public's willingness to take part.

Since 2000, the frequency of disasters caused by super-typhoons, storm surges, and red tides in China has increased dramatically (Qi et al., 2019). For example, the super typhoon Lekima in August 2019 caused a direct economic loss totalling 10.288 billion yuan in eight coastal provinces of China (Ministry of Natural Resources of China, 2020). In response, China has made significant adjustments in its organizational structure and institutional design. One major reform took place in March 2018, when the functions of the former State Oceanic Administration were integrated into the Ministry of Natural Resources and the Ministry of Ecology and Environment. Additionally, a new Ministry of Emergency Management was established to enhance the overall efficiency of disaster emergency management. Moreover, China has been advocating for the implementation of a "prevention-oriented, comprehensive disaster reduction" strategy. The "Opinions on Promoting the Reform of Disaster Prevention, Mitigation, and Relief Systems and Mechanisms" proposed a shift from merely reducing disaster losses to mitigating disaster risks. This strategic shift also places greater emphasis on the role of non-government bodies, encouraging and supporting social forces to participate comprehensively in disaster mitigation, emergency rescue, recovery and reconstruction efforts.

In line with practical needs, Chinese scholars are also paying more attention to this topic. Some adopt a technical perspective, such as evaluating the intensity and spatial distribution patterns of marine disasters (Jia et al., 2022) and assessing the vulnerability of disaster-bearing bodies (Wang et al., 2022). On the other hand, some focus on policy and institutional analysis, including examining the action logic of marine environmental governance under multilateral interest coordination (Ning and Shi, 2021), conducting SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis for regional marine disaster prevention and control strategies (Zhou et al., 2024), and analyzing the existing marine DRM systems between China and Japan from a comparative perspective (Hu et al., 2022). However, compared to other natural and man-made disasters, research on marine disasters remains relatively limited, and there

is insufficient focus on public disaster mitigation and participation preferences and behaviors.

Compared to Western countries, researching the participation of Chinese citizens in DRM requires consideration of unique characteristics. Recent years, China has implemented many disaster risk reduction programs that focus on spreading public awareness and scientific information to enhance marine risk perception and promote protective or mitigating behaviours. Despite these efforts, the predominant crisis management approach has been characterized by campaign style governance, which mainly refers to the temporary political mobilization of government and social resources to deal with the urgent issues (Liu et al. 2015). This impacts the public assessment regarding the government crisis capacity and legitimacy (Chiristensen et al., 2016). When perceptions of government competency and agency are high, public may be less inclined to engage in crisis and disaster management (Shepherd and Kay, 2014).

The main research questions addressed in this study are the following:

1) To what extent do Chinese citizens want to get involved in marine DRM, and how can these preferences be categorized?
2) Is the strategy of raising public awareness effective on motivating citizens to participate? what are the other options to encourage more public participation in marine DRM?
3) What characterizes the relationships between different types of citizens' preferences and government strategies?

This study addresses these questions using a vignette experiment survey involving 403 citizens in a coastal city of China to gather data. The article is organized as follows: Firstly, the introduction of the theoretical basis, based on the ladder of citizen participation theory (Arnstein, 1969) and organization theory (Christensen et al., 2007) is introduced, where four hypotheses are set regarding the levels of public participation and different government strategies. Secondly, the experimental design is outlined, presenting the vignette experiment used, including details on the design, location, and methods. Thirdly, the empirical results and analysis are presented, discussing the factors that encourage public participation in marine DRM and explaining the interactions between the three different government strategies and the three levels of public preferences. Finally, the conclusion discusses the implications for enhancing public roles and how the government and society can collaborate more effectively in marine DRM, along with future research avenues.

2. Concepts and theoretical frameworks

2.1. Extent of public participation in marine DRM

There are significant gradations of public participation. Arnstein (1969) arranges the typology in an eight-ladders pattern with each rung corresponding to the extent of citizens' power in determining the plan and/or program. The bottom rungs of the ladder are (1) Manipulation and (2) Therapy. These two rungs describe levels of "non-participation" where powerholders to "educate" or "cure" the participants. (3) Informing and (4) Consideration progress to levels of "tokenistic" that citizens may indeed hear and be heard but lack the power to ensure that their views will be heeded

by the powerful. Rung (5) Placation, is simply a higher level of tokenistic, where participants can advise, but the power-holders retain the right to decide. Further up the ladder are levels of citizen power with increasing degrees of decision-making clout. Citizens can enter into a (6) Partnership that enables them to negotiate and engage in trade-offs with traditional power-holders. At the topmost rungs, (7) Delegated Power and (8) Citizen Control, citizens obtain the majority of decision-making seats, or full managerial power (Arnstein, 1969, p. 217).

Many scholars have highlighted the insufficient public participation in DRM. According to Scolobig et al. (2015), the public is viewed as a passive recipient of technical information on risk assessment, preparedness measures, emergency plans, etc. In the traditional DRM approach, where authorities completely dominate and be hold the power and responsibility to decide about risks and responses, warning, and emergency management (Alexander, 2008). Although the situation has improved, participatory processes remain largely restricted to informing residents of a new program, gathering input from large groups of participants in surveys (Hamideh, 2020). Essentially management authorities initially start and design DRM plan, local residents are invited to provide opinions and suggestions in response to this plan (Samaddar et al., 2015) without having the power to decide. In modern people-centred approaches to handling natural hazards, the public participates as newly empowered decision makers (Scolobig et al., 2015), facilitating truthful and useful exchange between citizens and administrators (Hafer and Ran, 2016).

Therefore, the eight-rung ladder is simplified into three categories for marine DRM: non-participation, tokenistic and substantive participation. It is assumed that the public has corresponding preferences and expectations concerning responsibility. For citizens who prefer non-participation, they adopt a passive, fatalistic attitude and are satisfied with a one-way marine DRM process where authorities are in charge of everything and protect citizens from disaster. For those who prefer tokenistic participation, they want to be more engaged, self-reliant, empowered in risk prevention, mitigation, and recovery process but not to take on the power and responsibility to decide. For those inclined towards substantive participation, they desire to be integral parts of a bottom-up, egalitarian, collaborative marine DRM model. Their aim is to co-generate crisis knowledge, co-produced public services and co-manage risks and hazards with authorities.

2.2. Factors and strategies for improving public participation preference

The socio-psychological factors influencing public adoption of protective behaviours in natural disasters are extensively explored in the literature. According to the protection motivation theory (PMT) (Rogers, 1983; Rogers and Prentice-Dunn, 1997), a person's response to the threat of natural hazards is based on two components: 'threat appraisal' and 'coping appraisal'. 'Threat appraisal', also known as risk perception, describes how a person assesses a threat's probability and potential damage to valued assets. 'Coping appraisal' involves a person's evaluation of their ability to deal with and avoid harm from the threat, as well as the costs associated with coping (Grothmann and Reusswig, 2006). Although the focus of PMT is on increasing the public's self-protective mitigation behaviours at the micro level, it can also explain

the potential factors that affect the public's participation in the DRM. These factors include:

1) Self-efficacy: Whether a person feels capable of undertaking protective behaviours (Prior and Paton, 2008). People increasingly turn to external sources of control, such the government, to deal with complex problems that are beyond comprehension and erode self-efficacy (Shepherd and Kay, 2012).
2) Understanding DRM: Whether a person is equipped with the knowledge to deal with disasters, including laws, regulations, and other basic skills (Duan et al., 2020). Knowledge provides tools for vulnerability reduction and life-improving self-help techniques (Shaw et al., 2009), and directly influences on the public's willingness to participate. (Duan et al., 2020).
3) Trust: Whether a person trusts authorities can affect the willingness of the individual to deal with disasters. Higher public trust in governmental behavior increases the effectiveness of government actions and raises public willingness to participate (Duan et al., 2020). However, other work in political science argues that citizens are encouraged to take part due to their distrust with the government (John et al., 2011).
4) Previous Experience: Whether a person has previously encountered the marine hazards and disaster. Personal experience makes individuals to see themselves as potential future victims, thereby increasing their threat knowledge, risk perception, and precautionary measures (Paton et al., 2000; Weinstein, 1989).

The present government strategy is to increase public awareness of factors that influence people's preferences for public engagement. Transmitting messages about marine disasters from small groups of experts to the uninformed masses could impact an individual's receptiveness to interpret and understand risk communication information, regardless of whether they agree to adopt protective behaviours (Prior and Paton, 2006). This may also lead to a preference for public participation.

Marine DRM is not only a technical issue but also an organization management issue. Essentially, the public participation rate reflects how the government coordinates with external stakeholders, such as civil society, in crisis management. A broad organization theory with two perspectives used—structural and cultural (Christensen et al., 2007)—is helpful for understanding possible strategies to encourage public participation in marine DRM.

A structural perspective views formal structures of public organizations as instruments for achieving goals. These structures channel and influence the modes of thought and decision-making behaviour of politicians and civil servants (Egeberg, 2012). The extent to which citizens desire to be engage in marine DRM is depends on whether the government introduces specific organizational arrangements and instruments. By building new institutional structures that connect formal decision-making entities with feedback loops between government and citizens (Hamideh, 2020), engagement can be enhanced. For citizens who choosing to participate in a more interactive way, they need access to visible, coordinated platforms and mechanisms that differ from the hierarchically organized DRM structure.

A cultural perspective emphasizes informal norms, values and practices that develop over time through institutionalization, resulting from mutual adaptation to internal and external pressure. (Ma and Christensen, 2019; Selznick, 1957) Public

administration literature shows that coproduction between citizens and administrators tends to be higher when citizens feel their actions make a difference (Hafer and Ran, 2016) The extent to which citizens want to be involved in the marine DRM also depends on whether government introduces informal norms of participation efficacy, accountability, transparency, representation, and inclusiveness as logics of appropriateness (March and Olsen, 1989).

From the above discussion, four hypotheses can be formulated regarding public preference to participate in marine DRM, relating to individual characteristic, raising awareness, innovating instruments and developing citizenship.

Hypothesis 1: Citizens, who have a certain high level of knowledge, self-efficacy, trust in government and past hazards experience, are more prone to choose substantive participation over tokenistic and non-participation in marine DRM.

Hypothesis 2: Citizens, who understand the severity and threat of marine disasters, are more prone to choose substantive participation over tokenistic and non-participation in marine DRM.

Hypothesis 3: Citizens, who are aware of new coordination instruments and institutional arrangements, are more prone to choose substantive participation over tokenistic and non-participation in marine DRM.

Hypothesis 4: Citizens, who know the meaning of authentic public participation for themselves and holistic DRM performance, are more prone to choose substantive participation than tokenistic and non-participation.

3. Methods and data

3.1. Case selection and context

This study examines the relationship between public participation preferences and government strategies in the context of Qingdao, a coastal city, situated on Shandong Peninsula and facing the Yellow Sea with a population of over 10 million. Major marine disasters in Qingdao include storm surges, sea waves, sea ice, red tides, and harmful marine creature blooms, which have caused significant economic losses and casualties (Zhang et al., 2015). Local government in Qingdao has demonstrated strong crisis management capacities in marine disasters. For example, two months before the start of the Olympic sailing games in 2008, green algae appeared on an unprecedented scale in Qingdao's nearshore area, and the city successfully managed the emergency within half a month. Moreover, Qingdao has gathered administrative and research resources across vertical and horizontal levels for marine DRM. The North Sea Bureau of Chinese Ministry of Natural Resources and Chinese Society of Oceanography have initiated multiple marine risk education activities. These include online lectures for middle school students, Open Day visit and science exhibition in community, and the posting of science videos on official websites and mass medias.

3.2. Experimental design

The experiments were conducted with snowball sampling. An online questionnaire, with brief introduction to the research project and qualifications of respondents (live in Qingdao and not civil servants), was sent to Wechat groups, which

consist of 140 costal community neighborhoods and then the questionnaire was transmitted to other groups. In the end, 403 people responded. The respondents included 217 males and 186 females, covering every age, education, and political status group.

To test the socio-psychological variables, respondents are asked a set of questions:

1) Past experience: Have you experienced any marine disasters such as storm surges, red tides, typhoons, oil spills, etc., in the past?
2) Trust: How much do you trust the government (both central and local) in their response to the marine disaster? (Scale: 1 = Not at all, 5 = Completely)
3) Knowledge: How do you evaluate your knowledge and skills in marine disaster prevention and mitigation? (Scale: 1 = Very poor, 5 = Excellent)
4) Self-efficacy: General Self-efficacy Scale (GSES) (Schwarzer, 1995)

In the later portion of the questionnaire, respondents are randomly divided into four groups: Control group, Treament 1 Group (T1), Treatment 2 Group (T2), Treatment 3 Group (T3), and participate in a vignette experiment. All four groups are required to read about a short and abstract introduction with regards to marine disaster:

Marine disasters can be divided into five categories, namely, marine meteorological disasters, marine hydrological disasters, marine geological disasters, marine ecological disasters and man-made marine disasters.

Three treatment groups received different vignettes about a marine City X (see **Table 1**). The vignette for T1 Group describes how city X is experiencing high frequency, strong seasonality, large-scale loss and storm surge with a wide range of influence, with tables showing the losses and causalities increased and pictures displaying the seawater pouring over the offshore buildings. The vignette for T2 Group describes how the local government in City X initiates marine DRM reform by introducing new coordination organizations, dialog platforms, and supportive mechanisms for citizen participation. The vignette for T3 Group describes how stronger public engagement in City X leads to resilience strengthening for both city and participants, such as enhanced mitigation skills and self-help and mutual rescue skills, and improved government performance in prevention, preparation, response and recovery stages.

Table 1. Setting of vignette experiment.

Intervention set	Control	Treatment 1	Treatment 2	Treatment 3
Government strategy	×	√	√	√
raising awareness	×	√	×	×
Innovating instruments	×	×	√	×
Developing citizenship	×	×	×	√

In this experimental setting, actual behaviors are not observed, but the willingness of citizens to participate in marine disaster is considered. The questions are worded as such:

In your opinion, the citizens living in City X should be involved in marine DRM by:

1) Doing little or nothing. Authorities must dominate and be responsible for disaster and emergency management, but citizens should be informed timely and accurately. (Choosing this answer indicates a preference for non-participation)
2) Actively expressing their needs and suggestions about risk prevention, mitigation, and recovery policymaking and implementation. Authorities should give feedback but still have all the power and responsibility to decide the key issues. (Choosing this answer indicates a preference for tokenistic participation)
3) Sharing the responsibility with authorities as partners by co-generating crisis knowledge and policies, co-producing public services, and co-managing the risk and hazards with authorities. (Choosing this answer indicates a preference for substantive participation)

4. Results

4.1. Variations in citizens' preference of participating in marine DRM

In this study, the control group respondents do not receive any specific interventions and are only asked basic questions about their willingness to participate. This setup aims to provide baseline data for comparison with the experimental groups that received different interventions. The analysis of citizens' preferences for participation in marine DRM reveals moderate differences across different experimental groups. **Figure 1** shows the preferences of each group of respondents in different experimental states for the extent of participation in marine DRM.

Firstly, the dominance of "tokenistic" is evident across all groups. The proportion of respondents who support 'tokenistic' is the highest in all four groups. This is particularly evident in the Treatment 2 group, where nearly 40% of respondents believe that citizens should actively express their needs and suggestions but should not have the power and responsibility to decide the key issues. Secondly, the comparative analysis reveals modest differences among the groups. Each group showing about one-third of respondents supporting each of the three levels of participation in marine DRM. Thirdly, government strategies to motivate public participation show varied effectiveness. It is notable that in Treatment 3 Group, significantly fewer respondents (23%) choose non-participation, and more choose substantive participation (39%).

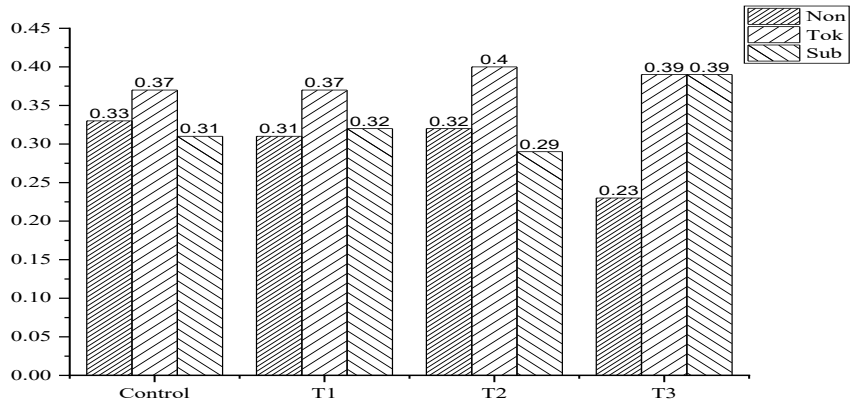

Figure 1. Preferences of respondents in four groups on participation in marine DRM.

4.2. Effects of personal characteristics on preference of participating in marine DRM

In this part, the effects of individual socio-psychological characteristics on participation preferences are examined in **Table 2**. Respondents were categorized based on party affiliation (CPC members, Democratic parties members and Communist Youth League members) and non-party affiliation. Disaster experience is divided into with-experience and without-experience groups. Trust in the government's response to marine disasters and respondents' knowledge of marine disaster management are treated as continuous variables. Additionally, the results of the self-efficacy scale are statistically calculated.

The results in **Figure 2** show that for substantive participation, the OR value for party affiliation is 1.275, for knowledge and skills is 1.132, and for self-efficacy is 1.453. These indicate that respondents with these characteristics are more likely to choose higher levels of participation. However, the 95% confidence intervals for party affiliation [0.664, 2.450] and knowledge and skills [0.853, 1.504] both cross 1, indicating that these results are not statistically significant. In contrast, the 95% confidence interval for self-efficacy [1.025, 2.059] does not cross 1, indicating that this result is statistically significant. On the other hand, for tokenistic participation, the OR value for party affiliation is 1.215, for knowledge and skills is 1.127, and for self-efficacy is 0.963. The 95% confidence intervals for these results are [0.651, 2.268], [0.861, 1.475], and [0.696, 1.333], respectively, all of which cross 1, indicating that the effects of these characteristics on tokenistic participation are not statistically significant.

Additionally, the OR values for trust in the government and disaster experience for substantive participation are 0.765 and 0.731, respectively, and for tokenistic participation are 0.895 and 0.902, respectively. The 95% confidence intervals for these results are [0.546, 1.070], [0.392, 1.365], [0.650, 1.233], and [0.511, 1.590], respectively, all of which cross 1. This indicates that these two characteristics do not have a significant effect on increasing the willingness to participate. In fact, the respondents with higher trust in the government or disaster experience are more likely to choose non-participation.

In summary, respondents with party affiliation, stronger knowledge and skills, and higher self-efficacy are more inclined to choose substantive participation, but only the effect of self-efficacy is statistically significant. Therefore, Hypothesis 1 is only partially validated.

Table 2. Influence of respondent characteristics on tokenistic and substantive participation preference.

	Variables	B	Standard error	B 95%CI		OR	OR 95% CI	
							bottom	top
Tok	Trust (Tok)	−0.111	0.163	−0.450	0.198	0.895	0.650	1.233
	Knowledge (Tok)	0.120	0.137	−0.160	0.419	1.127	0.861	1.475
	Efficacy (Tok)	−0.038	0.166	−0.389	0.291	0.963	0.696	1.333
	Party (Tok)	0.195	0.318	−0.441	0.874	1.215	0.651	2.268
	Experience (Tok)	−0.103	0.295	−0.738	0.502	0.902	0.506	1.610

Table 2. (*Continued*).

	Variables	B	Standard error	B 95%CI		OR	OR 95% CI	
							bottom	top
Sub	Trust (Sub)	−0.268	0.171	−0.660	0.122	0.765	0.548	1.070
	Knowledge (Sub)	0.124	0.145	−0.196	0.458	1.132	0.853	1.504
	Efficacy (Sub)	0.373	0.178	−0.018	0.787	1.453	1.025	2.059
	Party (Sub)	0.243	0.333	−0.395	0.915	1.275	0.664	2.450
	Experience (Sub)	−0.313	0.318	−0.971	0.332	0.731	0.392	1.365

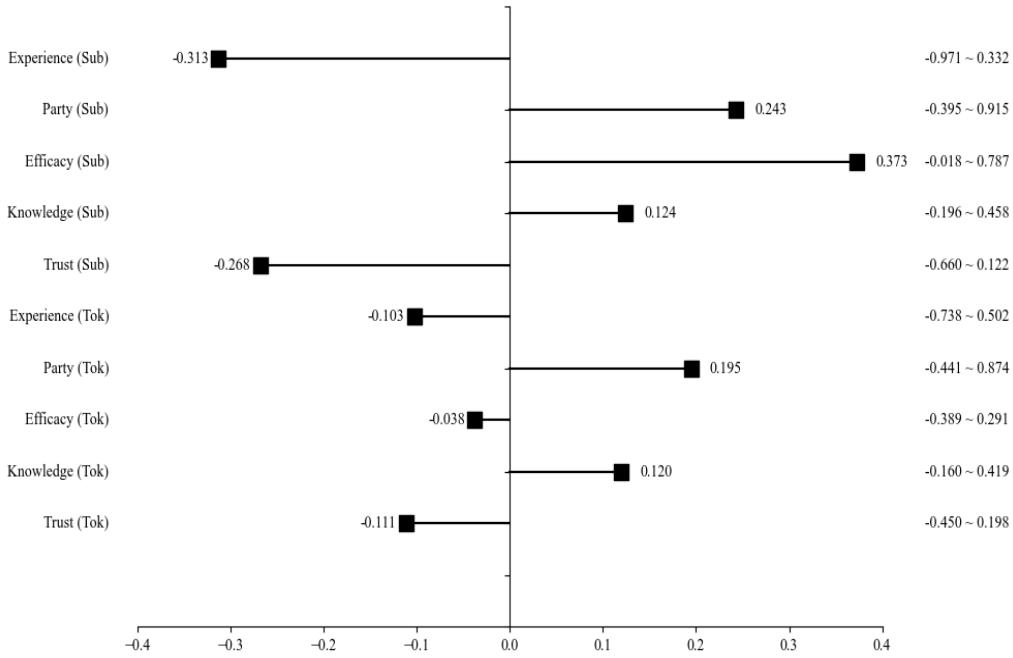

Figure 2. Influences of respondent characteristics on tokenistic and substantive participation preference.

4.3. Effects of government strategies on preference of participating in marine DRM

To validate Hypotheses 2, 3, and 4, logistic regression is used to analyze three different experimental intervention groups to evaluate the impact of three intervention strategies: increasing risk perception, increasing structural space, and increasing outcome expectations on respondents' willingness to participate. **Table 3** and **Figure 3** present the results of the different intervention groups.

Firstly, for T1 Group (raising awareness), compared to non-participation, the OR values for choosing tokenistic and substantive participation are 1.099 and 1.065, respectively, indicating that increasing public perception of the severity of marine disasters slightly enhances the willingness to participate. Although the OR values show a positive trend, the confidence intervals cross 1, making the results statistically insignificant. Secondly, for T2 Group (innovating instruments), compared to non-participation, the OR values for choosing tokenistic and substantive participation are 0.965 and 1.115, respectively, indicating that public awareness of the government's adjustment of formal structures for marine disaster management and the introduction

of new participation mechanisms leads to a slight decrease in the willingness for tokenistic participation and a slight increase in the willingness for substantive participation. Despite the mixed results indicated by the OR values, the confidence intervals cross 1, rendering the results statistically insignificant. Thirdly, for T3 Group (developing citizenship), compared to non-participation, the OR values for choosing tokenistic and substantive participation are 1.805 and 1.512, respectively, suggesting that when respondents recognize the irreplaceable significance of substantive participation for themselves, the community, and the performance of government marine disaster management, it significantly enhances the willingness to participate. Although the confidence intervals cross 1, the OR values exhibit a strong positive trend, indicating that increasing outcome expectations may be an effective intervention strategy.

In summary, among Hypotheses 2, 3, and 4, only Hypothesis 4 (developing citizenship) shows a stronger positive trend. Although these results are not statistically significant, the trends suggest that increasing outcome expectations can foster a higher willingness to participate. Therefore, Hypothesis 4 is supported, while Hypotheses 2 and 3 are not fully validated.

Table 3. Results of the influence of different intervention for each group respondents' participation preference.

Intervention group	Group contrast	B	Standard error	B 95%CI	OR	OR 95%CI	
						bottom	top
Treatment1	Non vs Tok(T1)	0.094	0.355	−0.671～0.816	1.099	0.548	2.204
	Non vs Sub(T1)	0.063	0.341	−0.640～0.714	1.065	0.545	2.079
	Tok vs Sub(T1)	0.032	0.343	−0.646～0.724	1.032	0.527	2.021
Treatment2	Non vs Tok(T2)	−0.036	0.358	−0.754～0.650	0.965	0.478	1.947
	Non vs Sub(T2)	0.109	0.337	−0.590～0.773	1.115	0.576	2.158
	Tok vs Sub(T2)	−0.145	0.345	−0.872～0.524	0.865	0.440	1.700
Treatment3	Non vs Tok(T3)	0.591	0.363	−0.126～1.379	1.805	0.886	3.676
	Non vs Sub(T3)	0.414	0.356	−0.301～1.157	1.512	0.753	3.036
	Tok vs Sub(T3)	0.177	0.333	−0.506～0.791	1.194	0.622	2.290

Reference group: Control group.

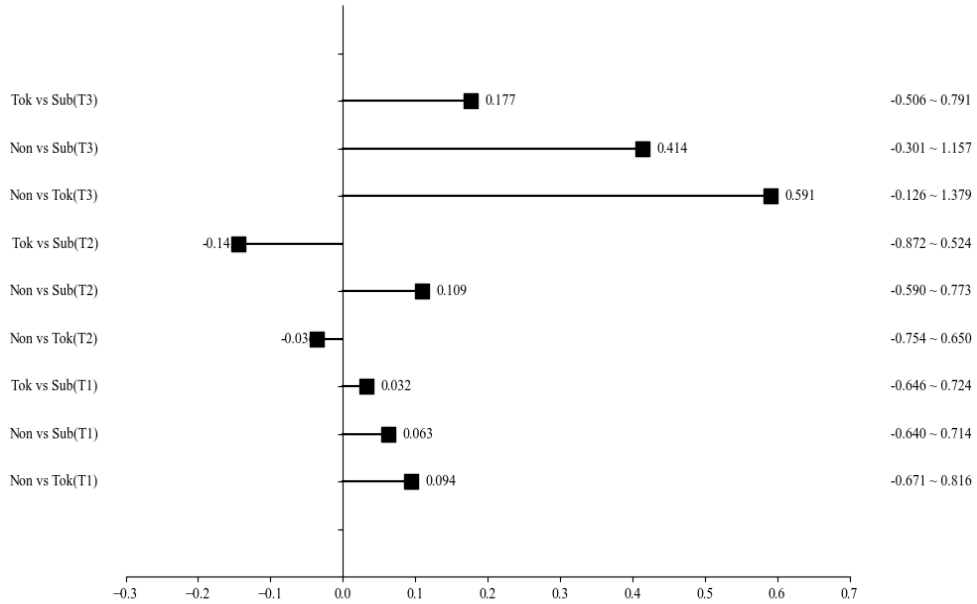

Figure 3. Results of the influence of different intervention for each group respondents' participation preference.

5. Analysis

As previously discussed, the goals of the empirical study are to interpret the categories of public participation in marine DRM and to determine the effectiveness of various intervention approach in increasing participation intention in China. As hypothesized, citizens' preferences are not binary but varied along a spectrum, ranging from tokenistic, passive, and one time engagement to concentrated, initiative active, and continuing process participation. The willingness to participate across the control group and the three intervention groups generally follows a three-tiered rise as theoretically assumed: non-participation, tokenistic participation, and substantive participation. This finding indicates significant potential for involving the public in marine DRM, as the public is more concerned about marine disasters than previously thought and shows incentive inclination to engage.

Differentiated preferences can be influenced by three dimensions of government strategies: common approach (raising awareness), structural approach (innovating instruments) and cultural approach (developing citizenship). It is assumed that citizens would generally be more positive and initiative active in participating in marine DRM when governmental structural interventions are involved. However, the vignette experiments in the coastal city context reveal different results.

Firstly, in the intervention strategy aimed at increasing risk perception, although the results are not statistically significant, the positive trend suggests that raising public awareness of the severity of marine disasters can have a slightly positive impact on their willingness to participate. In the vignette experiment, the risk perception obtained by the respondents through quick reading of the text and pictures is still very limited. However, all respondents in this survey, including those in the control group, have been recipients of risk education. As mentioned earlier, Qingdao has organized various forms of public awareness activities themed on marine DRM in recent years. On

special days, such as May 12 Disaster Prevention and Mitigation Day, the government devotes substantial resources, and media coverage is extensive.

However, the effectiveness of the risk education strategy appears to be limited. Interviews with residents reveal that marine disasters are still perceived as geographically confined issues. Marine risks, unlike air quality, heavy rainfall flooding, or major earthquakes that have "in-everyone's-backyard" feature and affect everyone. As public goods, they hold the major factors promoting public participation (Huang, 2015). Respondents typically do not consider themselves as potential vulnerable groups. The current risk education methods are still characterized by short-term mobilization, have limited reach (often concentrated in a few communities and groups), and single authorities cannot carry out these resource-consuming activities sustainably and frequently. Therefore, obtaining the public's lasting attention to marine DRM through an interactive two-way risk communication process will be a long-term project.

Secondly, somewhat unexpectedly, the improvement in structures did not lead to a significant increase in participation preference. When the public was informed about the government's structural adjustments in marine DRM, their willingness for tokenistic participation slightly decreased, and their willingness for substantive participation only slightly increased. These results are not statistically significant, suggesting that structural improvements alone may be insufficient to motivate public engagement. In the vignette experiment, respondents are presented with policy scenarios such as participating in coastal environment roundtables, the citizen jury system, and new NGO organizations. But some respondents indicated that these policy tools, consultation platforms, and participation channels seemed relatively abstract, making them appear apparently difficult to implement.

Additionally, a few respondents mentioned that they have previously participated in similar public deliberation activities, they feel that their voices and abilities are not integrated into the decision-making process, not reflected in the policy output, and do not hold practical significance, thus lacking practical significance. When the public participates in marine DRM, it requires time, money, energy, and even entails certain risks, especially in volunteer rescue actions during the emergency response phase. When the expected results of participation are ambiguous, citizens are likely to reduce their enthusiasm for participation, perceiving it as merely "window-dressing."

Thirdly, when respondents recognize the irreplaceable significance of substantive participation for themselves, their communities, and the government's performance in marine DRM, their willingness to participate increases significantly. This value norm of participation is different from the emergency mobilization norm, which relies on administrative orders to require and encourage other organizations and individuals to provide various resources for crisis response. Instead, it is a complementary value of administrative responsibility systems and social responsibility systems. However, this aspect is often overlooked by policymakers because cultivating civic spirit cannot quickly be transformed into highlights of government innovation like structural reforms, nor can it be specifically managed and implemented by functional departments.

Based on organization theory (Christensen et al., 2007), cultural-institutional features explain why formal and structural--instrumental goals have not been achieved,

since informal norms may undermine and contradict formal ones. Cultural compatibility is crucial, meaning that changes to and reforms of institutions must reflect the fit between current and potentially new cultural features (Brunsson and Olsen, 1993) When discussing how to engage the public in marine DRM, this issue is often overlooked because it is not as visible as formal structural changes. In China's Confucian tradition of "paternalistic authoritarianism", the public believes that the government should be able to solve all problems. Especially in the context of COVID-19, a strong government culture is likely to form a path dependence, namely, lower quality of participation efficacy, accountability, transparency, representation in input and throughput legitimacy can be traded off with better output legitimacy. Moreover, for a highly professional, transboundary wicked problem like marine DRM, the public spirit is overwhelmed by the spirit of administration and professionalism, making it even more difficult to internally motivate public spirit. New organizational solutions have to pass a cultural compatibility test (Brunsson and Olsen, 1993). Helping citizens become more civically minded by understanding the importance and meaning of participation is essential for increasing their willingness to engage. This understanding serves as the foundation for evolving and transforming cultural norms and rules, thereby creating a more robust framework for sustained public involvement in marine DRM.

Finally, respondents with party affiliation, stronger knowledge and skills, and higher self-efficacy are more inclined to choose substantive participation, but only the effect of self-efficacy is statistically significant. Individuals with higher self-efficacy tend to have more confidence in their abilities and believe they can effectively cope with and manage marine disasters, making them more willing to actively participate in these activities. Citizens with party affiliation and more knowledge about marine disasters are more likely to choose tokenistic and substantive participation because they have more participation channels and resources. On the other hand, citizens with higher trust in the government's competence and direct disaster experience are more inclined not to participate in marine DRM. This may be because they have truly felt the danger of marine disaster and are worried that their own safety will be threatened in DRM like response phrase. It is also possible that the perception of government-led disaster management high performance has been formed from previous experiences, and so they perceive individual participation is unnecessary.

6. Conclusion

Based on the findings from a small-scale experimental survey, the conclusions suggest that to effectively engage the public as responsible stakeholders in comprehensive and proactive marine DRM, alongside government and other multi-stakeholder entities, the strategies need to be integrated, localized, and sustained.

Firstly, strategies need to be more systematic and integrated. Governments should not rely solely on a single approach but should comprehensively utilize multiple paths, including common approach (awareness building), structural approach (innovating instruments) and cultural approach (developing citizenship). It is crucial to focus on how specific norms and values among civil servants and citizens can constrain or

enable structural changes, allowing the governance tools and culture for marine disaster management to complement each other.

Secondly, strategies need to be more precise and localized. The strategies used to promote citizen engagement should be tailored to the specific characteristics of the region, population, and disaster. For example, Qingdao, with its developed economy, high risk exposure, and good foundation in risk education, can focus on making citizens aware of the expected effects of their participation. For cities with less experience in marine risk education, they should start with the most basic popular science publicity to form the basic literacy of citizens for understanding marine disasters.

Thirdly, strategies need to be sustained and incremental. Although two-thirds of the respondents in survey showed willingness to participate, actual behavior may not match this willingness. Authorities should prepare both themselves and citizens for future visions, such as providing assistance for citizens to adequately participate as empowered decision-makers through incentives and capacity building in a long term.

Fourthly, strategies should focus on involving stakeholders in all phases of DRM, including prevention, mitigation, and recovery. Different phases of disaster management overlap and intersect, requiring different types of participation (D'Andrea et al.,2024). For instance, during disaster plan preparation, a collaborative approach that includes the experiences, priorities, and knowledge of those affected is essential, making substantive participation where citizens share responsibilities with the government more crucial. However, during a disaster, a command-and-control approach providing clear instructions is necessary due to legal obligations of responders. In this phase, citizens can maintain tokenistic participation, prioritizing their own risk reduction.

From the perspectives of risk education, structural approaches, cultural approaches, and the socio-psychological characteristics of individual citizens, this study provides specific recommendations for public sector strategies.

1) Update and Expand Risk Education Strategies.

Risk education strategies should shift from one-dimensional, short-term publicity to interactive, regular risk communication, and from specialized education by single departments to the overall cultivation of urban safety culture. This would help gain the public's sustained attention to marine disaster management, ensuring continuous building of emergency knowledge and capabilities.

2) Increase Incentives and Cost Compensation Elements.

In formal structural and institutional reforms, more incentives and cost compensation elements should be incorporated, such as providing financial subsidies, tax reductions, or rewards, as well as additional insurance and medical support for participating citizens.

3) Foster a Culture of Mutual Trust between Government and Citizens.

Multiple stakeholders should work together to foster a culture of mutual trust and value norm for joint action. For example, ensure transparency in public affairs decision-making processes, provide timely feedback on public participation outcomes, and genuinely responding to citizens' input to facilitate authentic participation. Additionally, the importance and practical benefits of citizen participation should be widely publicized through media, community activities, and educational courses.

4) Empower More Communities and Groups.

The government should focus on cultivating a population with risk awareness and emergency literacy through static advocacy, dynamic reporting, and volunteer services. Efforts should be directed towards grassroots communities and even grid-level engagement, addressing the disadvantaged positions of certain social groups regarding rights and resources. By enabling advantaged groups to share their knowledge, skills, channels, and resources with other residents, the overall public sense of efficacy can be enhanced.

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