

## Article

# Investigating Public Support for the Carbon Generalized System of Preference through the Lens of Protection Motivation Theory and Information Deficit Model

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**Abstract:** The pressing challenges of climate change require government policy interventions. The carbon generalized system of preference (CGSP) is a novel incentive policy that has tremendous potential to reduce carbon emissions in response to climate change. However, there have been few studies focusing on public support for the CGSP, which is the precondition for its seamless implementation. Drawing on the protection motivation theory and information deficit model, this study presents and empirically validates a holistic theoretical framework in which information (information about climate change and information about the CGSP), threat appraisal (threat vulnerability and threat severity), and coping appraisal (response efficacy, self-efficacy, and response cost) are the factors influencing public support for the CGSP. Survey data of 372 respondents were empirically analyzed using the PLS-SEM method. The results show that threat vulnerability, threat severity, response efficacy, and self-efficacy positively affect public support for the CGSP, while response cost does not influence public support for the CGSP. Information about climate change indirectly influences public support for the CGSP through threat vulnerability and threat severity. Information about the CGSP not only directly affects public support for the CGSP but also indirectly affects public support for the CGSP through response efficacy and self-efficacy. The theoretical framework of this study can serve as a reference for future research on public support for environmental policies. The findings of this study also furnish insights for policymakers to develop feasible strategies for the seamless implementation of the CGSP.

**Keywords:** carbon generalized system of preference; carbon emission reduction; public support; protection motivation theory; information deficit model



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## 1. Introduction

The continuous increase in carbon emissions has resulted in drastic climate change, which has sparked widespread concerns in all sectors of society [1–3]. In response to climate change, governments worldwide have agreed to protect the environment and reduce pollution and carbon emissions [4–6]. With this aim, many countries have established and enforced various intervention measures and policies, both at the enterprise and individual level [7–10], to reduce carbon emissions [11–15]. Among these, policies associated with personal carbon emission reduction have become more prevalent, as the rise in carbon emissions due to humans' excessive and unsustainable production and lifestyles accounts for a significant portion of total carbon emissions [3,9,16–19].

The carbon generalized system of preference (CGSP) is a novel proposed policy in China that aims at encouraging individual carbon emission reductions [20–22]. It is an incentive mechanism for carbon emission reduction, which can provide rewards to the public's green and low-carbon behaviors via market mechanisms and financial incentives, as well as steer societal participation in energy conservation and decarbonization [23–25].

As of October 2022, 16 provinces and cities in China have introduced special policies or planning practices related to the implementation of the CGSP [26]. The CGSP is regarded to have tremendous potential for mitigating carbon emissions and realizing China's carbon neutrality goal [21,25]. However, unless the public is supportive of a policy, it is unlikely to be implemented successfully [18,27–29]. For instance, a carbon tax is regarded as an efficient policy for reducing carbon emissions, but the public's strong resistance diminishes its efficacy [13,30]. Therefore, to ensure the smooth implementation of the CGSP, it is essential for the government to understand public reaction to this policy and garner public support [24,31–34].

The earliest academic research on the CGSP dates back to Li et al. [35], who briefly introduced the operational mechanism of the CGSP and provided a methodological design to calculate individual emissions reductions, taking a public bicycle project as an example. Subsequently, Huang et al. [36] proposed a carbon emission reduction calculation methodology for subway travel for when the CGSP is implemented. Tan et al. [20] introduced the mechanism design of the CGSP and investigated the public's willingness to engage in the CGSP based on an extended technology acceptance model. Xiao et al. [21] discussed the CGSP's features, essential characteristics, and conditions for its operation. Si et al. [25] constructed an extended technology acceptance model to investigate the public's willingness to participate in the CGSP. However, few studies have focused on public attitudes and inclinations towards the CGSP and discussed the determinants of public support for the CGSP [24]. To enrich our knowledge of the CGSP and contribute to its seamless implementation, the current study attempts to conduct an evidence-based assessment of public support for the CGSP and relevant determinants.

Public support for environmental policies refers to how individuals orient themselves to the government's policies through their attitudes or behaviors [12,15,37,38]. These non-activist pro-environmental behaviors are essential for far-reaching and long-lasting policy implementation [4,24,39–41]. The theory of planned behavior (TPB), the norm activation model (NAM), the value-belief-norm theory (VBN), and the protection motivation theory (PMT) are the most extensively employed theoretical models for explaining pro-environmental behaviors. Among these theories, the PTM highlights that when individuals are confronted with environmental risks, they tend to engage in two cognitive processes, i.e., threat appraisal and coping appraisal [17,42–45]. These two processes not only consider aspects of individual action but also accommodate aspects of collective action in response to climate change [46–48]. As a result, the PMT is thought to provide a more comprehensive prediction of pro-environmental behaviors than the TPB, the NAM, and the VBN, and can add to our existing knowledge about the motivations behind pro-environmental behaviors [17,49–51]. Consequently, the PMT is currently widely used to investigate residents' pro-environmental behaviors and public support for environmental policies [17,52–54]. Consistent with this view, this study employed the PMT as one of our theoretical bases for investigating public support for the CGSP.

Additionally, although the original PMT posits that information on which individuals judge the scale of threats and their ability to confront the threat are prerequisites for their cognitive processes, previous studies seldom incorporate information about threat and coping appraisals to construct holistic theoretical models [44,47,55,56]. Fortunately, the information deficit model (IDM) claims that providing enough information about the issue in question and corresponding countermeasures to bridge the public's knowledge gap is an ideal way to motivate positive actions [57–60]. Thus, an integration of the PMT and IDM would be able to not only capture individuals' cognitive processes, but also explain the relevance of information. Therefore, this study integrates the PMT and IDM to investigate public support for the CGSP and its determinants. Specifically, this study divided the information construct into two dimensions, i.e., information about climate change (IACC) and information about the CGSP (IACGSP), which were considered as potential determinants to construct a novel and holistic theoretical framework. Afterwards, a survey was undertaken

in the CGSP pilot cities in China, and the partial least squares structural equation model (PLS-SEM) method was employed to perform an empirical analysis.

The contributions of this study are fourfold. First, the current study contributes to the emerging literature on the CGSP by providing a holistic theoretical framework to unveil the determinants of public support for the CGSP. Second, the current study expands the PMT's applicability to the context of the CGSP and contributes to the field of public support for environmental policies by constructing a novel theoretical framework that incorporates the PMT and IDM. Third, this study uncovered the influencing mechanism of information on public support for the CGSP, answering the call for investigations into the information–action gap in environmental research. Finally, the findings of this study may better equip policymakers to develop feasible strategies for the smooth implementation of the CGSP.

The remainder of this study is organized as follows: Section 2 provides the theoretical foundation and develops the research hypotheses for this study. Section 3 outlines the research methodology adopted for this study. Section 4 presents the results and Section 5 discusses the research findings. Finally, Section 6 presents the conclusions, implications, limitations, and future directions.

## 2. Theoretical Foundation and Hypothesis Development

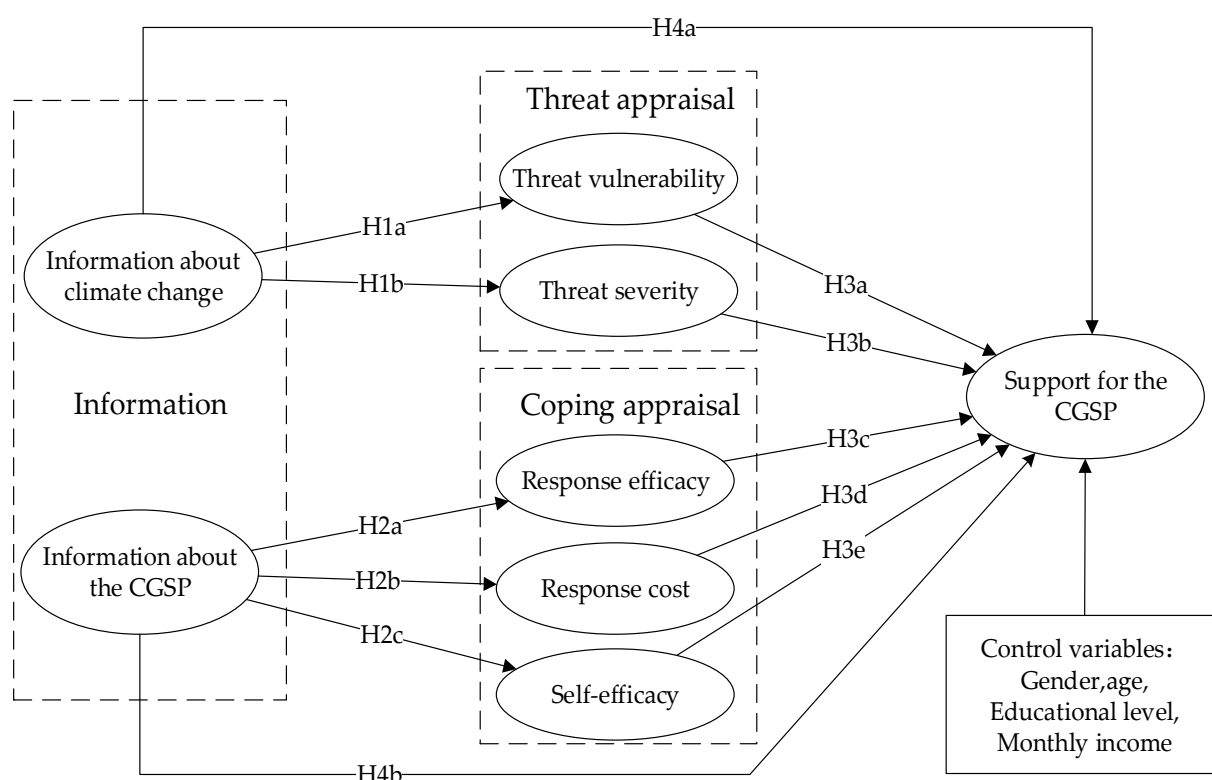
### 2.1. Theoretical Foundation and Research Framework

Over the past few decades, a growing number of studies have explored the determinants of people's pro-environmental behaviors and public support for environmental policies. With regard to the CGSP, Tan et al. [20] claimed that institutional technical environment, perceived usefulness, and participation risk are significant predictors of public willingness to participate in the CGSP. Lin and Yang [24] discovered that members of the public who possess a pro-low-carbon attitude and a high level of social trust are willing to adopt CGSP. Si et al. [25] affirmed that attitude, environmental concern, perceived usefulness, and personal innovativeness are potent drivers of the public's willingness to participate in the CGSP. However, studies that consider individuals' cognitive processes and their information about the CGSP and corresponding countermeasures are still lacking.

The PMT, which was developed by Rogers [42], was originally used to predict individuals' protective behaviors in response to fear or threats [55,61–64]. Its basic principle is that when individuals are confronted with fear appeals, they tend to engage in two cognitive processes, i.e., threat appraisal and coping appraisal [17,43–45]. According to the PMT, the threat appraisal includes two aspects, i.e., threat severity (TS) and threat vulnerability (TV). The coping appraisal includes three aspects, i.e., response efficacy (RE), self-efficacy (SE), and response cost (RC). The model predicts that these two processes guide individuals' adaptive responses [2,44,52,61]. Although the PMT was initially developed to predict individuals' health-related behaviors, the theory has recently been applied to predict individuals' environment-related behaviors, such as residents' pro-environmental behaviors [48,51,65,66] and public support for environmental policies [17,52,67,68].

However, the original PMT has been criticized for ignoring the importance of the information by which individuals estimate the extent of threats and their capacity to confront the threats [44,47,55,56]. According to the IDM, providing enough information about the issue in question to bridge this knowledge deficit is the best way to motivate the public's positive actions [57,58,68,69]. Thus, individuals must be well informed about climate change prior to accepting responsibility and recognizing the necessity of adjusting their actions to mitigate greenhouse gas emissions [65,70–72]. The influence of information on people's involvement in pro-environmental behaviors has been validated by a plethora of studies [65,73–76]. Increasing evidence suggests that, however, there exists an information–behavior gap, and individuals' internal perceptions seem to work as a mediator in the information–action relationship [16,69,77,78]. Therefore, it is reasonable to assume that the PMT variables would function as a pivotal mediator in the information–behavior gap when investigating public support for the CGSP.

Grounded in this rationale, this study aims to integrate the PMT and IDM to construct a holistic theoretical framework to investigate public support for the CGSP, an area that has attracted scant attention in the existing literature. Specifically, the current study conceptualized information as a two-dimensional variable (i.e., IACC and IACGSP), as the public not only needs to know the threats associated with climate change, but also needs to be aware of the information about the CGSP that aims to help them cope with such threats. This study proposes that information (i.e., IACC and IACGSP) and the public's threat appraisal (i.e., TS and TV) and coping appraisal (RE, SE, and RC) impact public support for the CGSP. Also, the public's threat appraisal mediates the relationship between IACC and their support for the CGSP, while the public's coping appraisal mediates the relationship between IACGSP and their support for the CGSP. Also, individuals' gender, age, educational level, and monthly income are employed as control variables. The theoretical framework underpinning this study is depicted in Figure 1.



**Figure 1.** Theoretical framework underpinning this study.

## 2.2. Hypothesis Development

### 2.2.1. Information, Threat Appraisal, and Coping Appraisal

According to the IDM, correcting public knowledge deficiencies by delivering rich, relevant information about an issue and response actions is a remedy for action procrastination [57,79,80]. In this regard, the dissemination and accessibility of information about environmental issues and corresponding countermeasures are essential for the public's engagement in pro-environmental behaviors and support for environmental policies [59,73,75]. In this study, IACC refers to the public's access to information about the threats associated with climate change. When individuals receive more IACC, they tend to form a greater perception of threats [69,77]. For instance, Dietz et al. [31] affirmed that IACC is an important antecedent for residents' perceptions of the severity of environmental problems. Dong et al. [69] validated that the abundant provision of IACC would enhance residents' risk perceptions of climate problems, which, in turn, shape their climate actions. Bijani et al. [81] pointed out that IACC is an important antecedent for the threat appraisal process. Based on the above statements, this study predicts that IACC will have positive

effects on the public's threat appraisal process. Consequently, the following hypotheses are put forward:

**H1a.** *IACC positively influences the public's TS.*

**H1b.** *IACC positively influences the public's TV.*

In addition to the provision of IACC, information about potential solutions to address the issues in question is also essential [5,82,83]. It is commonly acknowledged that ignorance of countermeasures and ways to implement them is a key obstacle for people to adopt pro-environmental behaviors [72,84]. In this study, IACGSP refers to the public's access to information about the countermeasures contained in the CGSP that can eradicate or reduce the risks related to climate change. The literature has identified that people's knowledge of the possible countermeasures against threats is an important antecedent for them to assess the feasibility of putting them into practice [84,85]. Thus, this study holds that IACGSP will be an important antecedent for those in the coping appraisal process, i.e., RE, SE, and RC. These relationships have been consistently validated by previous studies conducted on public support for environmental policies. For instance, Cismaru et al. [56] claimed that providing information about the steps to reduce greenhouse gas emissions is an effective way to increase residents' self-efficacy and reduce their response costs. Tao et al. [86] documented that action-related information boosts the public's efficacy beliefs, and in turn, their willingness to participate in carbon offset schemes. Xue et al. [47] found that access to climate change information is a crucial antecedent to people's coping appraisal process. Correspondingly, the following hypotheses are put forward:

**H2a.** *IACGSP positively influences the public's RE.*

**H2b.** *IACGSP positively influences the public's SE.*

**H2c.** *IACGSP negatively influences the public's RC.*

#### 2.2.2. Threat Appraisal, Coping Appraisal, and Public Support for the CGSP

Threat appraisal, in the context of environmental studies, denotes one's personal judgement of the hazards caused by environmental problems [17,84]. The fundamental process of threat appraisal is to assess the severity and vulnerability of environmental problems [45]. TS refers to the public's assessment of how seriously they perceive the threat of environmental problems [54,55,87]. In this study, TS can be characterized as the public's perceptions of the seriousness of climate change caused by carbon emissions. The PMT postulates that when individuals are confronted with an environmental threat, they go through the cognitive process of threat appraisal [50,88]. Therefore, if the public thinks that the climate change incurred by carbon emissions is severe, they will be more motivated to support the CGSP. Prior studies evidenced that TS leads to public support for environmental policies. Stoutenborough et al. [89] pointed out that people are more prone to support policies that are meant to solve a problem that entails significant risks. Bockarjova and Steg [17] claimed that PS positively influences drivers' acceptability of policies related to electric vehicles. Hence, the following hypothesis is put forward:

**H3a.** *TS positively influences public support for the CGSP.*

TV refers to one's judgement of the chance of being exposed to the threat of environmental problems [17]. In this study, TV denotes the public's sensitivity to the risk of climate change. If the public thinks that they are susceptible to suffering from climate change, they may feel compelled to take action to mitigate these threats [54,90]. A plethora of studies have indicated that TV is a potent driver for residents' pro-environmental behaviors and public support for environmental policies. Zobeidi et al. [84] discovered that TV positively



influences farmers' adaptation behaviors to water scarcity as a climate risk. Savari et al. [91] demonstrated that farmers with higher levels of TV are more willing to adopt environmentally responsible behaviors. It is, therefore, plausible to anticipate that public support for the CGSP will increase with higher levels of TV in regards to climate change. This leads to the following hypothesis:

**H3b.** *TV positively influences public support for the CGSP.*

According to the PMT, coping appraisal includes three factors, i.e., RE, SE, and RC [17,53,77]. RE refers to one's assessment of the perceived effectiveness of adopting a suggested behavior for averting a threat [65,92]. In this study, RE denotes the public's assessment of the perceived effectiveness of CGSP participation in reducing carbon emissions. Generally, people are more prone to engage in pro-environmental behaviors or support environmental policies if they feel their actions can alter the current situation or result in a favorable outcome [52,93]. Pertinent evidence has validated the impact of RE on individuals' pro-environmental behaviors and public support for environmental policies. Lam [52] found that people's views on a certain policy's benefits and effectiveness in addressing climate challenges increase their support for the policy. Wang et al. [50] demonstrated that RE positively shapes farmers' environmental behaviors. Houser et al. [94] affirmed that RE is a crucial motivator for public support for climate adaptation policies. In the context of public support for the CGSP, this study predicts that if the public believes that the CGSP is successful in addressing climate change, they will be more likely to supporting it. This leads to the following hypothesis:

**H3c.** *RE positively influences public support for the CGSP.*

SE denotes people's perceived capacity to adopt a suggested behavior [84,95]. SE is a crucial determinant to increase people's propensity to support a certain policy. In this study, SE is characterized as the public's assessment of their ability to participate in or support the CGSP. The CGSP is accompanied by an online technological platform [20,21]. Participating in the CGSP not only requires the public to possess this technology, such as the features of carbon currency, but also requires them to understand the rules of its operation, such as the feedback mechanism in achieving carbon emissions goals. If the public lacks the essential competence to accomplish these operations or does not fully grasp these rules, they would not be inclined to support the CGSP. Previous studies have consistently validated the positive relationships between residents' SE and pro-environmental behaviors, as well as SE and public support for environmental policies. Horng et al. [96] claimed that SE is the strongest predictor of tourists' intention to adopt carbon reduction behaviors. Geiger et al. [97] affirmed that SE is the foremost predictor shaping the public discussion about climate change. Juan and Revilla [98] declared that SE is a crucial driver for the enhancement of public support for climate change policies. Thus, the current study predicts that the stronger the public's perceived capability to engage in behaviors related to the CGSP, the more likely the public would support the CGSP. Correspondingly, the following hypothesis is put forward:

**H3d.** *SE positively influences public support for the CGSP.*

RC refers to how people perceive the expenses of taking protective activities [51]. In this study, RC refers to the cost that the public must bear as a result of participation in the CGSP, which may include time and effort expenditure, discomfort, and even the revelation of personal data. These expenses constantly pose an impediment to motivation and behaviors. According to De Groot et al. [27], residents are more prone to support environmental policies that target low-cost behaviors. Similarly, Pakmehr et al. [99] claimed that RC is the strongest predictor of farmers' adaptation behaviors with regard to water scarcity induced by climate change. Thus, the following hypothesis is put forward:

**H3e.** *RC negatively influences public support for the CGSP.*

### 2.2.3. Information and Public Support for the CGSP

The IDM posits that providing enough information about the issue in question to bridge the public's knowledge gap is the best way to motivate positive actions [6,79]. Lack of information is a major barrier to residents' pro-environmental behaviors and the public's support of environmental policies [72,75]. Di Falco and Sharma-Khushal [80] declared that the absence of information was detrimental to ensuring people's adaptive behaviors in regards to climate change. Zobeidi et al. [84] pointed out that residents' information about climate change received from government agencies or the media shapes their pro-environmental behaviors.

Concurrently, research has also linked information about policies with public support policies [30,100]. That is, providing information about the actions required and potential benefits is likely to positively shape public support for environmental policies. According to Rhodes et al. [32], the provision of information regarding the efficacy of low-carbon policies serves as a stimulus for the support of such policies. Moon et al. [1] claimed that a shortage of information about carbon capture and storage impedes public support for corresponding policies. Authelet et al. [85] documented that information about the conservation of ecosystem services in solving threats and gaining benefits can influence both the likelihood and the intensity of people's involvement in a program. Odland et al. [3] claimed that information about decarbonization policies is essential in explaining public support. Thus, the following hypothesis is proposed:

**H4a.** *IACC positively influences public support for the CGSP.*

**H4b.** *IACGSP positively influences public support for the CGSP.*

## 3. Methodology

### 3.1. Survey Design

The current study's questionnaire consists of three sections. The first section provides a brief explanation of the questionnaire's background and purpose and emphasizes the significance of marking accurate responses in order to reduce hypothetical bias; the second section surveys respondents' demographic information, including gender, age, education, and income; and the third section contains the measurement items corresponding to the eight latent variables. All items on the questionnaire were measured by a 7-point Likert scale, with 1 representing "strongly disagree" and 7 representing "strongly agree" to clearly distinguish respondents' answers [101]. Afterwards, we conducted a pretest with 20 respondents who are familiar with the CGSP and altered several items' descriptions depending on the pretest results and respondents' suggestions. The corresponding measurement items and their sources are presented in Table 1.

**Table 1.** Measurement items and sources.

Construct	Measurement Items	Sources
Information about climate change (IACC)	IACC1—I can find information about climate change in a variety of ways.	[2,47]
	IACC2—I believe it is simple to obtain information about climate change.	
	IACC3—I always have prompt access to climate change information.	
	IACC4—I can obtain reliable information about climate change.	
Information about the CGSP (IACGSP)	IACGSP1—I can find information about the CGSP in a variety of ways.	[2,47]
	IACGSP2—I believe it is simple to obtain information about the CGSP.	
	IACGSP3—I always have prompt access to information about the CGSP.	
	IACGSP4—I can obtain reliable information about the CGSP.	

Table 1. Cont.

Construct	Measurement Items	Sources
Treat severity (TS)	TS1—Climate change has a severely detrimental impact on social well-being. TS2—Climate change has a severely detrimental impact on the living environment. TS3—Climate change has a severely detrimental impact on human health.	[47,56]
Threat vulnerability (TV)	TV1—Environmental pollution can negatively affect me. TV2—I will experience the detrimental impacts of environmental pollution during my lifetime. TV3—I am susceptible to the detrimental impacts of climate change.	[84,91]
Response efficacy (RE)	RE1—Participating in the CGSP can mitigate the detrimental impact of climate change on social welfare. RE2—Participating in the CGSP can reduce the negative impact of climate change on our living environment. RE3—Participating in the CGSP can reduce the negative impact of climate change on the health of humankind.	[45,91]
Self-efficacy (SE)	SE1—It is simple for me to participate in the CGSP. SE2—I am capable of preventing security threats to healthcare information. SE3—I am able to adhere to the recommendations and engage in the actions suggested by the CGSP.	[91,95]
Response cost (RC)	RC1—Taking the steps to participate in the CGSP costs too much money. RC2—Participation in the CGSP takes up a lot of my time. RC3—It is hard for me to act in accordance with the CGSP.	[50,84]
Support for the CGSP (SCGSP)	SCGSP1—I am completely in favor of the CGSP. SCGSP2—I am willing to participate in the CGSP. SCGSP3—I am ready to recommend the CGSP to others.	[29,95]

### 3.2. Data Collection

The target population of this study is people who are aware of the CGSP, as they are more familiar with the items' meanings and potential supporters of the CGSP. We collected the research data through a web-based survey from China's leading questionnaire website, Questionnaire Star. The reason for utilizing a web-based survey is that the actions to support the CGSP necessitate the public to be familiar with internet technology, such as the exchange procedure of carbon currency. Thus, using a web-based questionnaire to gather data is suitable for the target population of this study. Over a three-week distribution period in December 2022, we finally gathered a total of 512 questionnaires. Then, we removed 140 invalid questionnaires due to their apparent irrationality and contradictory responses. Finally, 372 valid questionnaires were employed for empirical analysis.

The respondents' demographics are displayed in Table 2. Out of all the respondents, the male–female proportion is 1.07, and respondents below the age of 40 account for 72.8%. This distribution is in line with the distribution of general internet users in China [102]. In terms of educational level, most of the respondents have a Bachelor's degree or above, indicating they are capable of actively participating in the CGSP. Concerning monthly income, the majority of respondents have a monthly income under 8000 CNY, which is in line with the income statistics in China [103]. Similar demographics investigating residents' pro-environmental behaviors and public support for environmental policies can be found in prior research [10,25,51]. Overall, the sample of this study is representative.



**Table 2.** Demographics of the respondents.

Characteristic	Demographic	Frequency	Percentage (%)
Gender	Male	192	51.6%
	Female	180	48.4%
Age (years)	Under 20	31	8.3%
	21–30	126	33.9%
	31–40	114	30.6%
	40–49	74	19.9%
	Over 50	27	7.3%
	High school and below	38	10.2%
Educational level	Junior college	68	18.3%
	Bachelor’s degree	189	50.8%
	Master’s degree or above	77	20.7%
Monthly income (CNY)	Below 5000	112	30.1%
	5001–8000	143	38.4%
	8000–10,000	64	17.2%
	Over 10,001	53	14.3%

#### 4. Data Analysis and Results

The study utilizes the PLS-SEM method for data analysis. First, PLS-SEMs are confirmed to be appropriate for exploratory analyses and expansive research according to extant theory [104]. This is an exploratory research study that integrates two theories and seven variables that have not been tested in the context of the CGSP. Second, PLS-SEMs have fewer restrictions on sample size and data distribution [105]. The sample size of our study is 372, and the samples do not entirely follow a normal distribution when testing for skewness and kurtosis. As a result, a PLS-SEM was employed for data analysis and hypothesis validation in this study.

There are two kinds of models in an PLS-SEM analysis, i.e., the measurement model and the structural model [106]. The measurement model is utilized to assess the relationship between latent variables and items, whereas the structural model is utilized to investigate the relationships between these latent variables. In the following, we performed the data analysis in two steps. First, the measurement model was assessed by checking the measurement items’ outer loadings and assessing the constructs’ reliability, internal consistency reliability, and convergent and discriminant validity. Then, the structural model was assessed by calculating the model’s  $R^2$  and  $Q^2$  values, which represent the structural model’s interpretation power and predictive relevance, respectively, and by validating the proposed hypotheses and their significance [104]. SmartPLS 4 was employed to perform the data analysis [107].

##### 4.1. Measurement Model Evaluation

The measurement model’s evaluation was performed as follows. First, the PLS algorithm was employed to compute the measurement items’ outer loadings. The results are presented in Table 3. As can be seen, all the items’ outer loadings exceed 0.6, suggesting that the items fit well into their measured latent variables [104]. Therefore, no items were excluded from the model. Second, this study rerun the PLS algorithm to test the measurement model’s reliability, internal consistency reliability, convergent validity, and discriminant validity. Specifically, the reliability is assessed by the Cronbach’s alpha (CA) test; the internal consistency is assessed by the composite reliability (CR); the convergent validity is assessed by the average variance extracted (AVE); and the discriminant validity is evaluated via the Fornell–Larcker criterion, heterotrait–monotrait (HTMT) ratio, and cross loadings. Table 3 shows the CA, CR, and AVE values; Table 4 shows the AVE’s square roots and HTMT values; and Table 5 shows the cross loadings.

**Table 3.** Reliability and validity test.

Construct	Measurement Items	Outer Loadings	Cronbach's Alpha	CR	AVE
IACC	IACC1	0.783	0.771	0.853	0.593
	IACC2	0.744			
	IACC3	0.765			
	IACC4	0.787			
IACGSP	IACGSP1	0.761	0.716	0.823	0.538
	IACGSP2	0.713			
	IACGSP3	0.713			
	IACGSP4	0.746			
TS	TS1	0.862	0.772	0.867	0.685
	TS2	0.808			
	TS3	0.813			
TV	TV1	0.855	0.811	0.888	0.726
	TV2	0.854			
	TV3	0.847			
RE	RE1	0.807	0.733	0.849	0.652
	RE2	0.793			
	RE3	0.823			
SE	SE1	0.814	0.751	0.858	0.668
	SE2	0.808			
	SE3	0.829			
RC	RC1	0.798	0.745	0.854	0.662
	RC2	0.870			
	RC3	0.769			
SCGSP	SCGSP1	0.829	0.783	0.874	0.698
	SCGSP2	0.831			
	SCGSP3	0.846			

**Table 4.** Discriminant validity test.

Construct	IACC	IACGSP	TV	TS	RE	SE	RC	SCGSP
IACC	<b>0.770</b>	0.676	0.807	0.762	0.705	0.631	0.363	0.705
IACGSP	0.511	<b>0.734</b>	0.812	0.752	0.712	0.832	0.488	0.831
TV	0.642	0.624	<b>0.852</b>	0.687	0.691	0.693	0.398	0.806
TS	0.596	0.567	0.863	<b>0.828</b>	0.703	0.720	0.355	0.793
RE	0.531	0.521	0.534	0.532	<b>0.808</b>	0.808	0.362	0.837
SE	0.482	0.612	0.543	0.551	0.601	<b>0.817</b>	0.351	0.869
RC	0.281	0.368	0.315	0.279	0.269	0.266	<b>0.814</b>	0.385
SCGSP	0.549	0.628	0.643	0.621	0.635	0.668	0.296	<b>0.835</b>

Notes: The square root of the AVE is in bold on the main diagonal. The Fornell–Larcker criterion is below the main diagonal. The heterotrait–monotrait (HTMT) ratio is above the main diagonal.

As can be seen, all the constructs' CA values are within 0.716 and 0.811, and the CR values are within 0.823 and 0.888, exceeding the 0.7 criteria. These results imply that the model has strong reliability and internal consistency [106]. Additionally, all the constructs' AVE values range from 0.538 to 0.726, which surpass the 0.5 criteria, suggesting that the measurement model had a sufficient level of convergent validity [106]. Finally, the square roots of all the constructs' AVE values (bolded values in Table 4) exceed the correlations between them and other constructs [108], all the constructs' HTMT ratios are below 0.9 [109], and all the items' factor loadings are greater than the cross loadings [105]. These results demonstrate that the measurement model has a good level of discriminant validity.

Common method bias may exist in self-reported data taken from the same measurement setting [25]. Harmon's single-factor test is used, and the results show that the variance explained by the first factor is 28.93% (<50%), suggesting that no substantial common method bias affects this investigation [110]. Additionally, the variance inflation factor (VIF) of the measurement items and latent variables is calculated. As a result, all

the VIF values of the measurement items range from 1.122 to 2.369, and all the VIF values of the latent variables range from 1.638 to 2.973. These values are less than the threshold value of 5 [105]. The above results suggest that there is not any significant common method bias or multicollinearity.

**Table 5.** Cross loadings.

	IACC	IACGSP	TV	TS	RE	SE	RC	SCGSP
IACC1	0.783	0.367	0.494	0.439	0.410	0.379	0.220	0.408
IACC2	0.744	0.390	0.436	0.449	0.374	0.373	0.159	0.392
IACC3	0.765	0.357	0.470	0.429	0.438	0.344	0.214	0.438
IACC4	0.787	0.452	0.567	0.512	0.412	0.387	0.264	0.450
IACGSP1	0.437	0.761	0.537	0.507	0.454	0.503	0.244	0.521
IACGSP2	0.347	0.713	0.387	0.369	0.322	0.467	0.247	0.402
IACGSP3	0.287	0.713	0.419	0.342	0.344	0.391	0.197	0.427
IACGSP4	0.410	0.746	0.474	0.427	0.395	0.429	0.380	0.479
TV1	0.532	0.545	0.855	0.597	0.452	0.445	0.273	0.550
TV2	0.536	0.530	0.854	0.620	0.437	0.471	0.249	0.555
TV3	0.573	0.521	0.847	0.539	0.476	0.471	0.283	0.538
TS1	0.567	0.496	0.612	0.862	0.468	0.475	0.273	0.570
TS2	0.432	0.448	0.499	0.808	0.409	0.421	0.164	0.456
TS3	0.468	0.463	0.585	0.813	0.440	0.469	0.245	0.505
RE1	0.450	0.450	0.466	0.485	0.807	0.460	0.218	0.510
RE2	0.412	0.423	0.402	0.382	0.793	0.488	0.238	0.490
RE3	0.423	0.390	0.425	0.419	0.823	0.508	0.196	0.538
SE1	0.414	0.499	0.418	0.433	0.553	0.814	0.269	0.534
SE2	0.347	0.521	0.403	0.419	0.395	0.808	0.154	0.497
SE3	0.419	0.482	0.506	0.495	0.522	0.829	0.228	0.604
RC1	0.196	0.249	0.214	0.205	0.188	0.196	0.798	0.219
RC2	0.258	0.366	0.310	0.279	0.233	0.248	0.870	0.257
RC3	0.226	0.266	0.232	0.186	0.232	0.199	0.769	0.244
SCGSP1	0.429	0.495	0.507	0.518	0.538	0.528	0.259	0.829
SCGSP2	0.474	0.514	0.556	0.530	0.499	0.564	0.187	0.831
SCGSP3	0.472	0.562	0.547	0.508	0.554	0.581	0.294	0.846

#### 4.2. Structural Model Evaluation

The structural model's evaluation was performed as follows. First, the PLS algorithm was performed to calculate the eight latent variables'  $R^2$  and  $Q^2$  values. The  $R^2$  value shows that the model accounted for 35.4%, 41.1%, 27.0%, 37.3%, 13.3%, and 61.5% of the variance in TS, TV, RE, SE, RC, and SCGSP. Furthermore, the  $Q^2$  values of TS, TV, RE, SE, RC, and SCGSP are, respectively, 0.237, 0.293, 0.170, 0.247, 0.084, and 0.422, which exceed the 0 standard [105]. Consequently, the proposed model has high levels of interpretation power and predictive relevance for public support for the CGSP.

Furthermore, the bootstrapping technique was employed to validate the research hypotheses and mediating effects. The results are shown in Figure 2 and Table 6. Specifically, regarding the relationships in the original PMT, the relationships between the two variables in the threat appraisal and SCGSP are validated. Of the three variables in the coping appraisal, the relationships between RC and SCGSP are not validated. Moreover, IACC has no direct impact on SCGSP, but it can affect SCGSP through TV and TS. IACGSP not only directly affects SCGSP but also indirectly affects SCGSP through RE and SE. As for control variables, the results demonstrate that the path coefficients between gender, age, educational level, monthly income, and SCGSP are all unsupported. These results indicate that demographics do not have any controlling effect on public support for the CGSP.

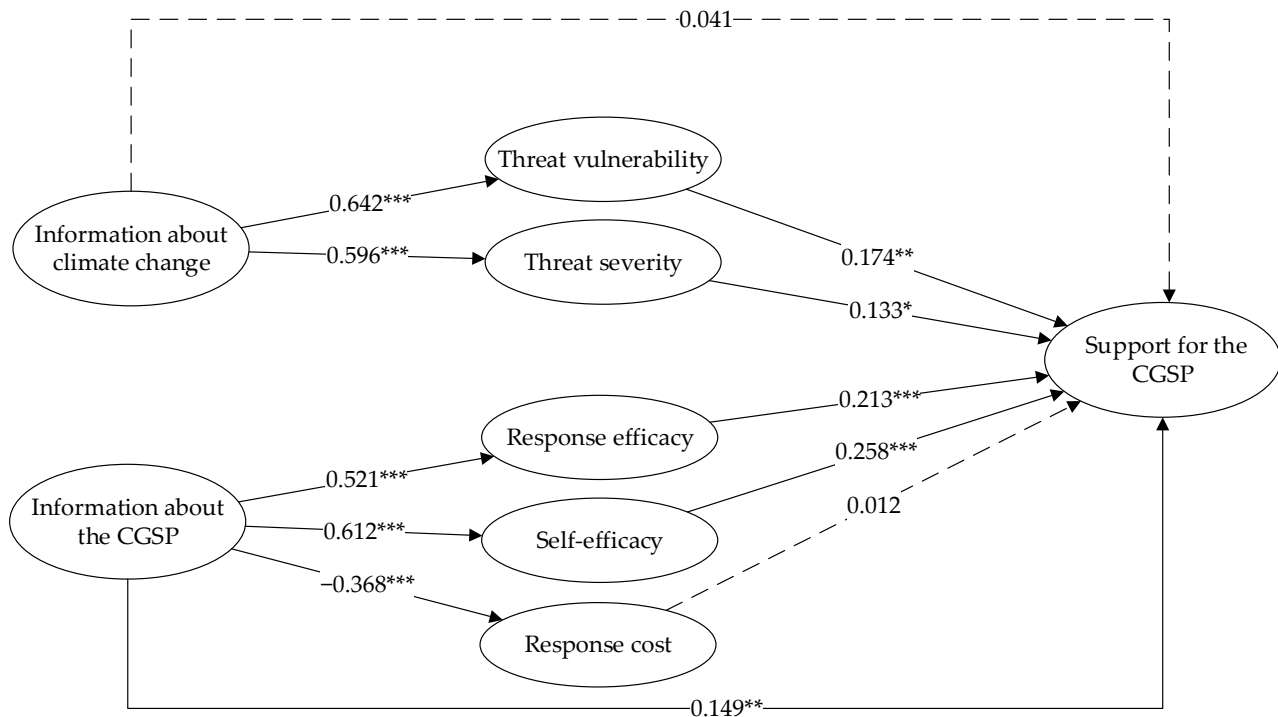


Figure 2. Results of the proposed model (\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ ).

Table 6. Summary of the results of testing our hypotheses.

Hypotheses	Standard Estimate	T-Value	Confidence Interval		p-Value	Supported
			2.5%	97.5%		
H1a: IACC → TV	0.642 ***	15.050	0.550	0.718	0.000	Yes
H1b: IACC → TS	0.596 ***	12.816	0.496	0.679	0.000	Yes
H2a: IACGSP → RE	0.521 ***	10.805	0.419	0.609	0.000	Yes
H2b: IACGSP → SE	0.612 ***	14.470	0.524	0.688	0.000	Yes
H2c: IACGSP → RC	−0.368 ***	6.346	0.252	0.481	0.000	Yes
H3a: TV → SCGSP	0.174 **	2.893	0.061	0.295	0.004	Yes
H3b: TS → SCGSP	0.133 *	2.582	0.032	0.234	0.010	Yes
H3c: RE → SCGSP	0.213 ***	4.595	0.118	0.301	0.000	Yes
H3d: SE → SCGSP	0.258 ***	4.896	0.154	0.361	0.000	Yes
H3e: RC → SCGSP	0.012	0.358	−0.054	0.076	0.721	No
H10: IACC → SCGSP	0.041	0.837	−0.061	0.078	0.403	No
H11: IACGSP → SCGSP	0.149 **	2.921	0.095	0.224	0.004	Yes
Mediating effects						
IACC → TV → SCGSP	0.112 **	2.908	0.040	0.190	0.004	Yes
IACC → TS → SCGSP	0.079 **	2.574	0.020	0.141	0.010	Yes
IACGSP → RE → SCGSP	0.111 ***	4.166	0.058	0.163	0.000	Yes
IACGSP → SE → SCGSP	0.158 ***	4.676	0.091	0.224	0.000	Yes
IACGSP → RC → SCGSP	−0.004	0.349	−0.019	0.030	0.727	No
Control variables						
Gender → SCGSP	0.005	1.543	−0.009	0.068	0.833	No
Age → SCGSP	0.032	0.835	−0.040	0.102	0.136	No
Educational level → SCGSP	0.019	0.604	−0.027	0.058	0.546	No
Monthly income → SCGSP	0.042	0.493	−0.061	0.115	0.655	No

Notes: \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

## 5. Discussions

### 5.1. The Effects of Information on Threat and Coping Appraisal

Our findings show that IACC positively affects the two components of the threat appraisal process. Specifically, IACC positively influences TV. This finding resonates with

those of previous studies, suggesting that information is vital in the public's cognitive process and necessary for one's assessment of vulnerability [47]. Also, IACC exerts a positive influence on TS. This implies that increasing the availability and accessibility of information about climate change would strengthen individuals' perceptions of environmental risks [31,69,70,77]. Uniquely, this study found that IACC has a more significant impact on TV than TS, which is novel in the literature. This means that the provision of abundant IACC, in addition to strengthening the public's awareness of the severity of climate change, would exert a more significant impact on reducing the public's optimistic assumptions and psychological distance in which they believe the negative consequences of climate change are far away from them. As a consequence, the public's perceptions that they are susceptible to climate change would be strengthened and their intention to take action to minimize threats would also be aroused.

Moreover, the findings show that IACGSP affects all three components of the coping appraisal process. The significant correlation between information about a certain policy and RE has also been validated by previous studies conducted on residents' pro-environmental behaviors [81,83,84] and public support for environmental policies [5,79,86]. This indicates that information about the CGSP will help the public understand the effectiveness of engaging in the CGSP to reduce carbon emissions. In addition, IACGSP also positively influences SE, which was consistent with the results of Lin and Yang [24], who claimed that the public's access to information about personal carbon reduction policies guides them to form more positive judgements about their ability to adopt equivalent pro-environmental behaviors. Furthermore, IACGSP is negatively associated with RC. This conclusion corroborates the findings of Cismaru et al. [56], indicating that information about countermeasures designed to cope with climate change is an indispensable determinant for RC in stimulating residents' actions in regards to climate change.

### 5.2. *The Effects of Threat and Coping Appraisal on Public Support for the CGSP*

Among the two components of threat appraisal in the PMT, TV and TS were both validated as significant predictors of public support for the CGSP. The results echo previous studies on people's pro-environmental behaviors [45,53,55,84,88] and public support for environmental policies [17,52,66,89]. Therefore, if the public perceives that climate change is alarming and they are sensitive to its repercussions after a psychological evaluation, they will be more inclined to support the CGSP. Moreover, the impact of TV on public support is larger than that of TS. This conclusion contradicts some previous findings suggesting that the impact of TV on residents' pro-environmental behavior is larger than that of TV [87,93]. One reason for these alternative findings may be that people view their exposure to the risks of climate change as more important in their decision to support the CGSP.

With regard to the components of coping appraisal in the PMT, the impact of RE on public support for the CGSP was validated. This finding is an agreement with the original PMT hypothesis and coincides with previous studies on residents' pro-environmental behaviors [50,54,87,93] and public support for environmental policies [52,67,94]. Also, SE is a potent driver for public support for the CGSP. This finding corroborates previous studies conducted on residents' pro-environmental behaviors [84,95,96] and public support for environmental policies [97,98]. This implies that if the public thinks that they have the necessary skills to complete the operations accompanied by the CGSP and can easily understand the rules, then they will be willing to support the CGSP.

Unexpectedly, the impact of RC on public support for the CGSP was not significant. This conclusion contradicts the findings of most previous studies [27,99], which claimed that RC is a major barrier for residents to participate in environmentally friendly behaviors or support environmental policies. However, this finding resonates with the results of Tan et al. [20], who declared that implementation cost is not a significant predictor for residents' participation in a voluntary carbon-trading scheme. The reasons for these contradictory observations may be that participating in or supporting the CGSP by adopting certain behaviors is simple and does not come with high costs [23,35]. Additionally, the CGSP



not only provides carbon currency for the public to change for value-added services, like product vouchers and membership services, but also offers non-monetary incentives such as carbon neutrality certification [20,24,25]. These incentives may offset the costs incurred when the public chooses to support the CGSP. As a result, RC would not be a factor that prevents the public from supporting the CGSP.

Moreover, the current study affirmed that the impact of coping appraisal on public support for the CGSP is larger than that of risk appraisal. This finding resonates with the conclusion of most prior studies, which claimed that high perceptions of the risk of climate change may not necessarily translate into actual behaviors if the public perceives that their actions are ineffective in coping with environmental problems [44,52,62,64]. This implies that when the public is confronted with the threat of climate change, they are more concerned with the competence of the CGSP and their ability to properly take corresponding actions. Notably, SE is the foremost predictor of public support for the CGSP, which is commensurate with most previous studies [91]. This implies that the public's assessment of their capacity to do the desired tasks is their major concern regarding their support of the CGSP.

### 5.3. Mediating Effects of Threat and Coping Appraisal

The results show that IACC did not directly affect public support for the CGSP. This finding contradicts those of previous studies [65,73–76]. However, the current study found that threat appraisal functions as a pivotal mediator in the information–behavior gap, which echoes prior studies affirming the existence of an information–behavior gap in residents' engagement in pro-environmental behaviors [59,68,69,80] and the public in regards to environmental policies [16]. This indicates that while the provision of information about climate change is vital, it is insufficient to convince the public to support the CGSP.

Moreover, the findings show that IACGSP directly influences public support for the CGSP, which corroborates the findings of Authalet et al. [85], which declared that households' information about the incentive-based conservation program's functionality is a crucial predictor of their participation. This finding implies that for the CGSP to function effectively, information that depicts the roles of the public in this endeavor, the actions necessary for tackling the threat, and the actions' benefits are necessary [2,86,100]. Uniquely, this study validates that the public's coping appraisal process works as a pivotal mediator between IACGSP and PSCGSP. This finding indicates that sufficient information about the CGSP would enable the public to more accurately assess their efficacy beliefs to perform corresponding actions, thereby showing a higher level of support for the CGSP.

## 6. Conclusions, Implications, and Limitations

### 6.1. Conclusions

This study investigates public support for the CGSP by developing a new theoretical framework that incorporates the PMT and IDM. The proposed model is empirically tested utilizing the PLS-SEM method on 372 respondents in China, and the following crucial findings are recorded. First, our findings confirm that the proposed model has moderate interpretability for public support for the CGSP. Threat vulnerability, threat severity, response efficacy, and self-efficacy all positively affect public support for the CGSP. Information about climate change indirectly influences public support for the CGSP through threat vulnerability and threat severity. Information about the CGSP not only directly affects public support for the CGSP but also indirectly affects public support for the CGSP through response efficacy and self-efficacy. These conclusions may better equip policymakers in developing feasible strategies for the smooth implementation of the CGSP.

### 6.2. Theoretical Contribution

This study has several theoretical contributions. First, this study contributes to the emerging literature on the CGSP by providing a holistic theoretical framework to unveil the determinants of public support for the CGSP. Due to the novel feature of the CGSP,

prior studies mainly focused on the CGSP's operational mechanism [21,35] and the development of an associated carbon emission reduction calculation methodology [20,23,36]. Public opinions on and inclinations toward the CGSP and their determinants are rarely considered [10,24,25]. This study clarifies how information and threat and coping appraisal affect public support for the CGSP, thereby enriching previous research on the CGSP.

Second, the current study expands the PMT's applicability to the context of the CGSP and contributes to the field of public support for environmental policies. Although previous studies have demonstrated the suitability of the PMT in predicting public support for other environmental policies, such as electric vehicle policies [17], climate policies [52], and renewable energy policies [66], no prior studies have applied the PMT to investigate public support for the CGSP, a novel policy designed to mitigate carbon emissions. In addition, the current study contributes to research on public support for environmental policies by constructing a novel theoretical framework that incorporates the PMT and IDM. These findings highlighted the importance of the incorporation of the PMT and IDM, as the proposed theoretical framework has more explanatory power (61.5%) as compared to those of studies only utilizing the PMT [64,87]. Consequently, the current study can also serve as a reference for investigations into public support for other environmental policies.

Third, the current study investigated the influencing mechanism of information on public support for the CGSP, answering the call for investigations into the information–action gap in environment research [16,68,69,77,78]. Nonetheless, this study makes a novel contribution by dividing the information construct into two dimensions (i.e., IACC and IACGSP) and revealing their different roles in stimulating public support for the CGSP. IACC does not directly affect public support for the CGSP but influences public support for the CGSP through TV and TS. IACGSP not only directly affects public support for the CGSP but also indirectly affects public support for the CGSP through RE and SE. These findings contribute to our understanding of the influencing mechanism of information on climate action.

### 6.3. Policy Implications

This study also has some implications that may stimulate public support for the CGSP. First, our findings indicate that effective information for increasing public support for the CGSP should be multi-dimensional, as it is necessary to not only provide the public information about climate change but also to provide information about the countermeasures contained in the CGSP that can eradicate or reduce the risks linked to climate change. Therefore, in addition to previous studies highlighting tailored information for the target audience [2,33,56,72], assuring the provision of information regarding both climate change and the CGSP is more important. Therefore, policymakers should pay special attention to enriching the dimensions of information, so that the public can acquire wide-ranging information, enabling them to properly engage in the CGSP. One example could be providing meteorological statistics and charts on climate change trends to show the detrimental consequences of climate change on daily life and highlighting the detailed procedure for participation in the CGSP and its tangible environmental benefits.

Second, the two components of threat appraisal in the PMT, i.e., TV and TS, are significant predictors of public support for the CGSP. Thus, it is essential for policymakers to implement suitable tactics to drive the public's threat appraisal. For instance, the intensity of negative consequences of climate change caused by individuals' carbon emissions should be reinforced through government guidance on a regular basis [10,17]. Also, consensus beliefs about people's susceptibility to climate change should be cultivated through duly explanations of the indiscriminate risks of climate change for human beings in the media [5,72]. One example could be the publicizing of reports from scientific committees and advisory groups on new media platforms such as TikTok and Kwai to popularize people's susceptibility to climate change.

Third, given the significant role of RE and SE in the coping appraisal process in stimulating public support for the CGSP, heightening the public's efficacy beliefs regarding

the CGSP is central to intervention strategies. Therefore, policymakers should increase the public's sense of response efficacy by highlighting that every individual can contribute to mitigating climate change [48]. Statistics, calculators, and visualized carbon emission reductions may be effective ways to lift the public's beliefs that their actions to support the CGSP counts toward China's carbon emission goals. Additionally, the public's self-efficacy should also be strengthened by some targeted educational programs and lectures [24,45], as these measures would equip the public with more skills and serve as guidance or instructions for the public to participate in the CGSP.

#### 6.4. Limitations and Future Work

The current study acquires limitations that could indicate directions for further investigation. First, as self-reported surveys may yield skewed answers, future researchers might conduct interviews or behavioral experiments for related investigations. Second, the data were collected in China; however, pollution levels, policy conditions, and public preferences in different areas and countries may be different. Therefore, future researchers could conduct surveys in other places or nations to investigate behavioral variations. Finally, as the current study's focus is confined to public support for the CGSP, the results and implications are unlikely to be generalizable to other carbon policies. Considering that public support for different types of policies may be different, future studies could concentrate on acquiring empirical data or expanding the current model for generalizability to explore public support for other kinds of policies.

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