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Public perception of climate change in China: results from the questionnaire survey

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Abstract

Based on the questionnaire survey, this paper analyzes China's public perception of climate change in terms of several influence factors and some empirical findings are obtained. We find that some respondents are willing to take individual actions to address climate change, and they pay more attention to climate change or approve that climate change does harm to residents and society; meanwhile, they tend to have confidence in the government to deal with climate change or believe that fiscal and taxation policies are the effective policy measures. However there are also other respondents unwilling to take actions and argue that climate change proves the natural consequences. Thus, in order to motivate the public to take actions, the paper suggests that the government should widespread disseminate relevant knowledge about climate change to the public and guide the work to address climate change and adopt proper fiscal and taxation policies.

Key words: *Public perception; Climate change; Questionnaire survey; Individual actions*

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1 Introduction

Climate change, which has become one of the severe challenges to sustainable development of global social economy, is causing widespread concerns of the international community. In the Fourth Assessment Report, IPCC (2007) indicates that impacts caused by climate change are inevitable and it will be beyond the current ability to cope with. Therefore, measures must be taken to adapt to the influences and changes (Patt and Schroter 2008). For China, on the one hand, global warming and the associated climate change will necessarily influence numerous aspects of China's social economic development. On the other hand, as the world's largest emitter, China's emission reduction is under huge pressure of public opinion. Moreover, in recent years, environmental group incidents occurred frequently and became a serious social problem in China. Since 1996, the number of environmental protests in China has been growing by 29% per year and over 300,000 petitions have been received on environmental matters during the Eleventh Five-Year Plan period (2005-2010) (Chinadialogue 2012). Thus, it is necessary for China to mobilize the public and make relevant policies and strategies to respond to climate change actively.

The perception of climate change is the foundation for making related policies to cope with climate change issues. Only be aware of the existence, the impact and causes of climate change, will it be possible to integrate climate change into policy planning, projects and daily activities and make the whole society to participate in the entire process to mitigate climate change (Zhou and Feng 2011). In addition, research on how perceptions of climate change motivate the public to take individual action to respond to climate change is of great significance for the government to implement the climatic policy properly. Hence, this paper aims to analyze public perception of climate change and explore how those perceptions promote the public to take individual actions to cope with climate change.

There are a great many of studies about public perception, opinions and attitude of climate change (Leiserowitz et al. 2010; Corner et al. 2011; Poortinga et al. 2011; Aitken et al. 2011; Whitmarsh 2011; Kempton 1997). Bostrom et al. (1994) conduct a set of exploratory studies and mental model interviews to characterize public understanding of climate change. Based on the questionnaire survey about awareness of climate change among enterprise managers, Xu et al. (2011) analyze the relationship between climate change awareness and

enterprise managers' background through cognitive index, behavior index, and awareness index of climate change. Chen (2011) investigates 3489 net citizens to study the cognition of net citizens in China on climate change and puts forwards the suggestion of publicity and education activities to raise public awareness. Chan (1999) investigates environmental attitudes and behavior of respondents in Beijing and Guangzhou and finds that the China's ecological perception is of limitations during that time. Huda (2013) explores the relationship between perception on climate change as well as climatic hazards with socio-demographic characteristics. Through the generalized ordered logit models, Shields and Zeng (2012) find that gender differences in environmental attitudes and the gender gap may have a relation with the substantial economic and educational differences between men and women in China. Based on the literature above, we come to the conclusion that most of studies are about the relationship between the perception or attitude towards climate change and some other factors, such as socio-demographic characteristics and respondents' background.

In addition, some studies draw comparison of different objects' perception about climate change, or the same object's concern with climate change in different times. Bord et al. (1998) conduct a national and international survey on global warming in terms of levels of awareness, actual knowledge, the degree of concern, perceived risk and the willingness to pay or sacrifice to mitigate or adapt to potential negative impacts. Using the time-series analysis, Brulle et al. (2012) analyze five factors of extreme weather events, public access to accurate scientific information, media coverage, elite cues and movement/countermovement advocacy affecting U.S. public concern about climate change between 2002 and 2010. Through a national and representative survey conducted in the US, Leiserowitz (2006) discovers that Americans have moderate climate change risk perceptions and strongly support a variety of national and international policies to mitigate climate change. Geir et al. (2010) demonstrate the climate change attitude through the survey of college students in China and Norway, and find that college students in the two countries generally are of the view that two governments should take more efforts to reduce greenhouse gas emissions. Lorenzoni and Pidgeon (2006) examine how climate change is conceptualized by the public in Europe and the USA, and the results indicate that most individuals relate to climate change through personal experience, knowledge, the balance of benefits and costs, and trust in other societal actors.

Rare studies are conducted to combine the perception of climate change with individual action to address climate change. For instance, Xie (2012) establishes the Binary Logistic model to analyze the main factors influencing public willingness to take actions in response to climate change in China, based on 3489 civil net citizens' effective questionnaire data. O'Connor (1999) examines the relationship between risk perceptions and willingness to address climate change and the survey includes measures of risk perceptions and knowledge tied to climate change.

Based on the literature analysis and situation of reality, it should be noted that: (1) it is crucial to study on the perception of climate change and analyses of those impact factors of the public to adopt individual action for the public to address climate change effectively as well as for the government to implement climate change policy properly; (2) current research on this issue has certain limitations; specifically, first, little literature investigates the public perception of climate change and attitude to respond to climate change in China; second, though a body of literature considers the perception or the attitude towards climate change, seldom of them studies how the perception may influence the public to take individual action to address climate change; moreover, the quantitative scale in the investigation is not accurate; for instance, some items are measured with only three levels in some literature, which may lead to great inaccuracy of the results. Therefore, this paper takes the China's public as research object and examines climate change issues of the public in order to obtain China's public perception and attitude to deal with climate change and carry out targeted publicity activities to promote China's public and government to address climate change more effectively.

The rest of the paper is organized as follows. Section 2 puts forward the methodology. Section 3 presents the discussion of the survey results. Finally, the conclusions are displayed in Section 4.

2 Methodologies

2.1 Research framework

The research framework of public perception of climate change in this paper is shown in Figure1.

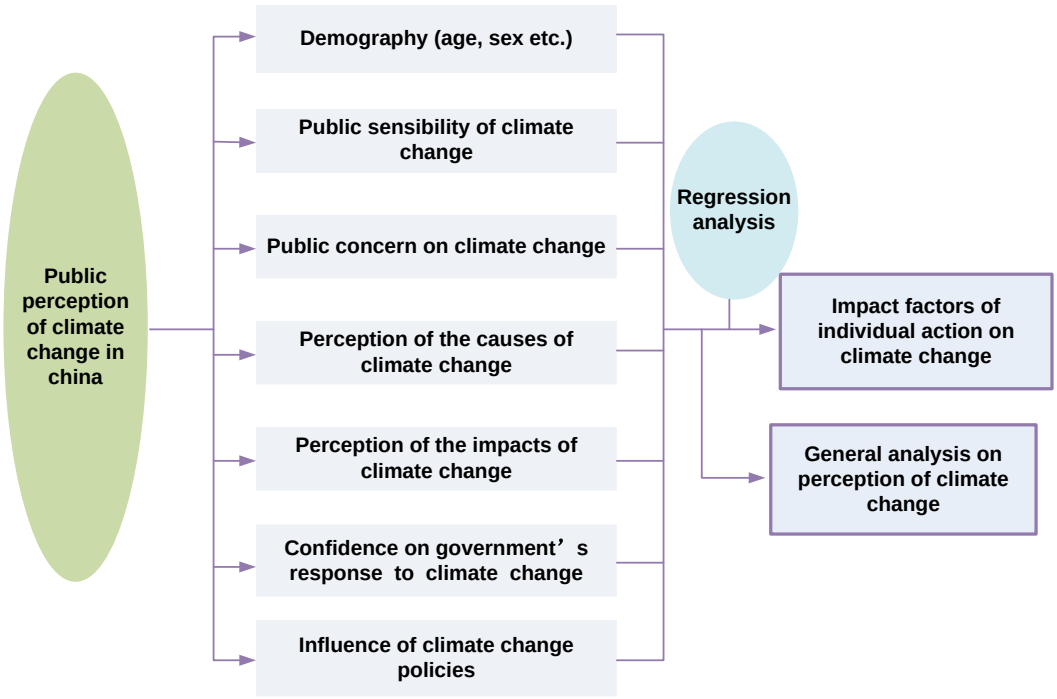


Fig.1 Research framework of public perception of climate change

Based on the questionnaire survey, this paper analyzes the climate change issues including public sensibility, public concern, perception of the causes, perception of the impact, confidence on government's response to climate change and the influence of climate change policies and then applies the regression model to explore the impact factors of individual actions. Finally based on the results, it puts forward some policy suggestions to promote individual actions to address climate change.

2.2 Data collection

The survey is divided into two phases: a small-scale test and random sampling survey. Small-scale test was mainly taken in the districts of Beijing, delivering 50 questionnaires. Based on the 50 feedbacks, some improvement was made. In the phase of random sampling survey, both network investigation and field survey were used, and 277 questionnaires were received in the network investigation, of which 272 questionnaires were effective. The field survey was mainly conducted in Beijing, and 400 questionnaires were delivered, of which 237 questionnaires were effectively returned, with the qualified rate of 58.5%. Consequently, 509 valid questionnaires were obtained in these two ways and the respondents were from 21 provinces, 4 autonomous regions and 4 municipality cities in China. Figure 2 shows the widespread attributions of the respondents. The female accounts for about 40% and it shows a

slight imbalance in gender. 49% of the respondents are between 18 and 24 years old followed by respondents of 25-34 and 35-44 years old whose percentages are 26% and 10%.

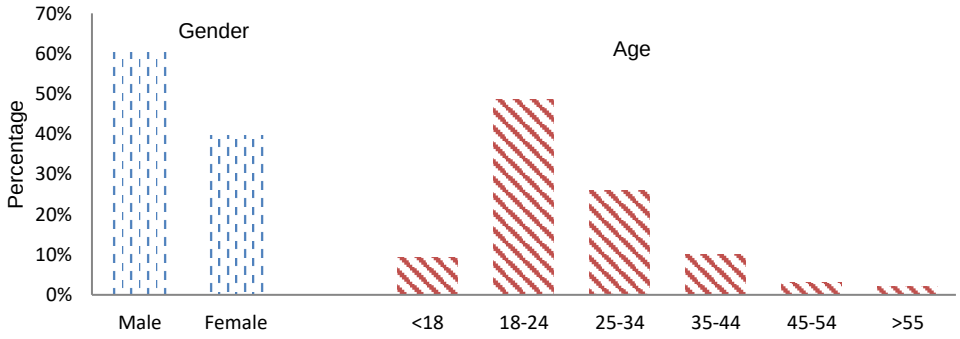


Fig.2 Widespread attributions of the respondents

2.3 Sample size

According to the statistical theory of questionnaire survey, the calculation formula of effective sample size introduced by Kish and Ni (1997) is defined as:

$$N = Z^2\sigma^2 / d^2 \qquad (1)$$

where Z is Z statistics with a confidence interval. This survey takes the confidence of 95% to ensure the accuracy, and the corresponding Z value is 1.96; σ is the overall standard deviation, and generally takes 0.5; and d is the sampling error range and equals 5% in this survey.

Based on the calculation, the applicable observations in our survey are 509, which is greater than the minimum effective sample size 384. Therefore, the sample satisfies the basic requirements.

3 Results and discussions

3.1 Analysis of public perception of climate change

3.1.1 Sensibility and concern about climate change

The survey shows that 93% of the respondents are aware of climate change. Hence public sensibility to climate change is high. At the same time, it indicates that climate change has existed in general life and the public has accepted the fact of climate change.

The public concern about climate change includes three aspects: general concern about climate change, that is, without considering other conditions; concern about climate change considering its impact on respondents personally ; concern about climate change considering its impact on society.

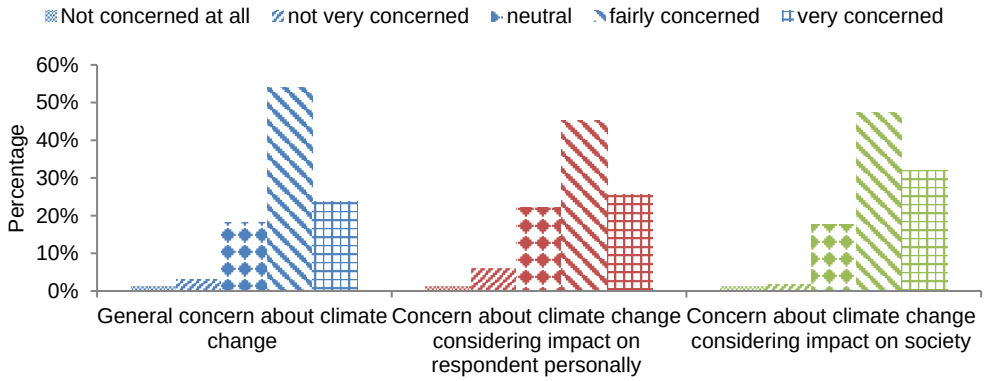


Fig. 3 Public concern about climate change

As is shown in Figure 3, most of the respondents (78%) are either fairly or very concern about climate change issues and only 1% of respondents do not concern at all. The proportion of respondents who fairly concern or very concern about climate change under the three conditions is 57%. Therefore, China's public concerns about climate change is high and it is maybe because of the national program in response to climate change and the government's promoting energy conservation and emission reduction.

After considering the impact of climate change on respondents and society, the concern appears to be changed obviously: (1) the proportion of respondents who are very concerned about climate change increases a lot. And the proportion increases from 24% of general concern to 26% and 32% after considering the impact of climate change on personal level and society level, respectively; (2) the concern considering impact on society is higher than that considering impact on respondents personally. The reason may be that the impacts of climate change are often reflected in the whole society level, and the impact on public personally is not easy to observe.

3.1.2 Perception of causes of climate change

Global warming is closely related to carbon dioxide emissions from human activities. IPCC (2007) points out that global greenhouse gas emissions caused by human activities are

the main reasons of climate change. Figure 4 shows the statistics of public perception about causes of climate change. It states that 27% of respondents fairly or strongly agree that climate change proves the natural consequences and 85% fairly or strongly approve that it is human activities that cause climate change. In addition, 22% of respondents agree with both of the two causes.

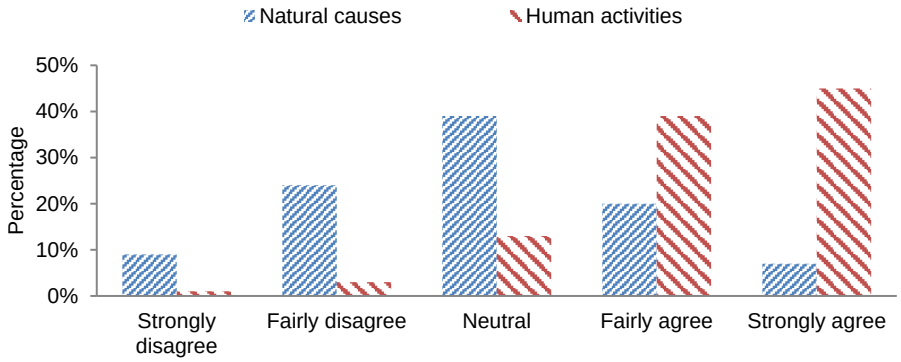


Fig. 4 Public perception of causes of climate change

Basically speaking, China's public accepts the viewpoint of current international society, that is, climate change is mainly caused by human activities. It can be inferred that respondents who agree that human activities cause climate change, tend to take positive action to improve the current situation of climate change, which will be further analyzed in Section 3.2.

3.1.3 Perception of the impact of climate change

For the impact of climate change, the numbers of respondents who agree or disagree that "the impact is uncertain" are almost the same, accounting for 30% or so, and the share of respondents who are neutral is 40%, as is shown in Figure 5. In general, the public is uncertain about how much impact of climate change, so it is necessary to popularize to the public about the effect of climate change.

About the question whether the seriousness of climate change is exaggerated, half of respondents agree with the severity of climate change, and 35% of respondents take neutral attitude, while only 15% of respondents agree that the seriousness of climate change is exaggerated.

The public attitude is distinct about the question whether climate change is harmful to residents and society. As is shown in Figure 5, 78% of respondents agree that climate change does harm to residents and society, while only 4% disagree.

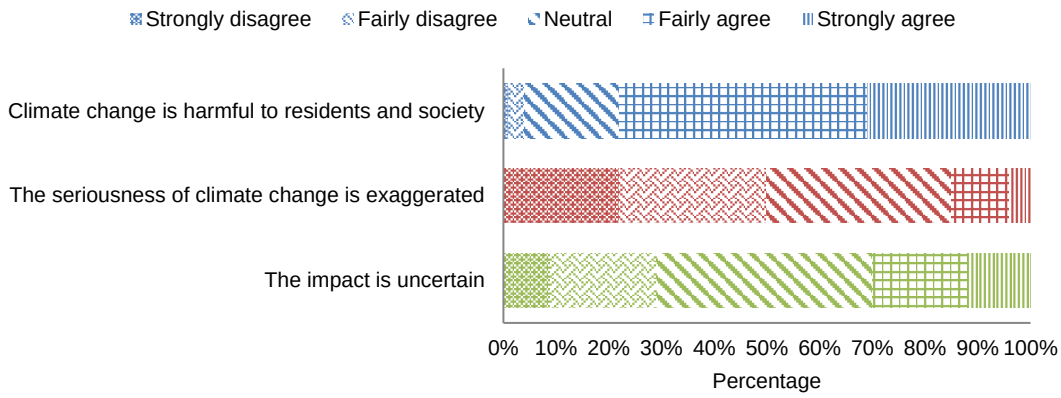


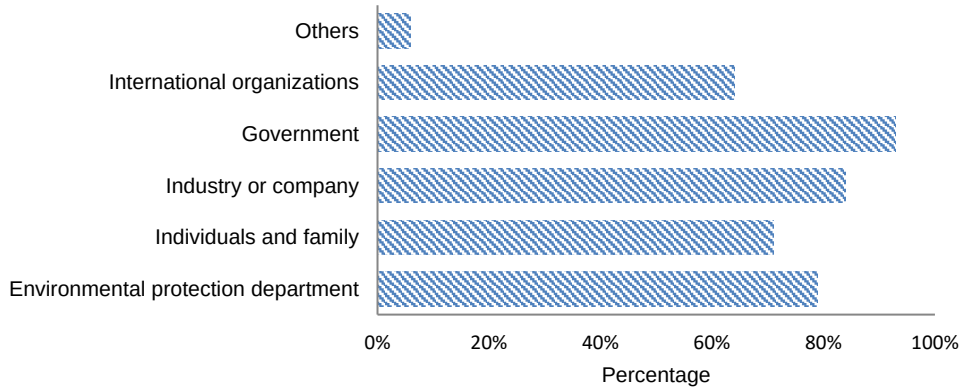
Fig. 5 Public attitudes towards the impact of climate change

Therefore, although respondents are uncertain about how much impact of climate change, generally they accept that the seriousness is not exaggerated. That is to say, the impact of climate change should be alert. This ambivalence, on the one hand, reflects that the public recognizes the uncertainty of climate change; on the other hand, it states that climate change makes effects gradually. Meanwhile, the public mainly agrees that climate change is harmful and the reason may lie in the frequent extreme climate events, such as the snow disaster in 2008, southwest drought and southern flood and drought in recent years.

3.1.4 Public attitudes towards government credibility and policy influence in response to climate change

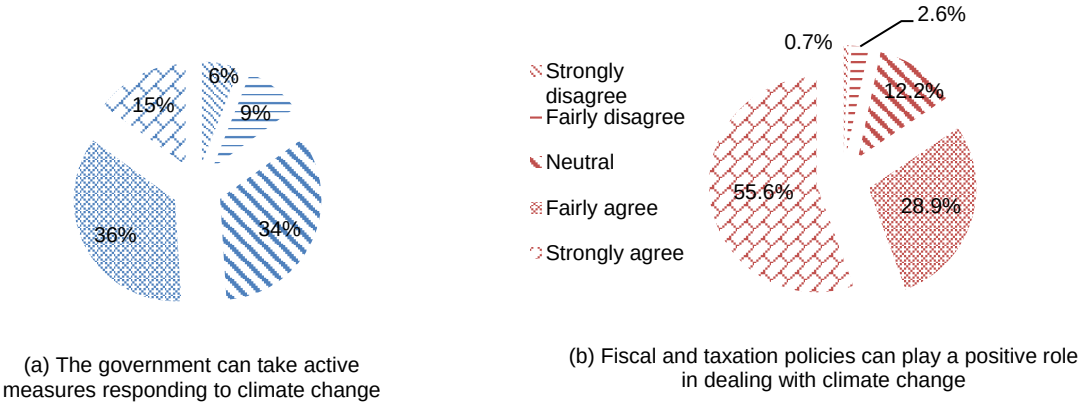
In the survey, we examine the public about the responsible party of responding to climate change, and the result is shown in Figure 6. It shows that 93% of respondents agree that in China, the government should play a leading role in response to climate change. In addition, 51% of respondents hold positive attitudes towards that the government can take active measures responding to climate change, as is shown in Figure 7. While a third of respondents are neutral and tend to watch the enforcement of the government to cope with climate change in the future. On the whole, the public is satisfied and confident with the

actions of government to address climate change, but there still exist some wait-and-see attitudes.



Note: Respondents can select several items.

Fig.6 Responsible party for responding to climate change



(a) The government can take active measures responding to climate change

(b) Fiscal and taxation policies can play a positive role in dealing with climate change

Fig.7 Public attitudes towards government credibility and policy influence in response to climate change

Some effective policies should be adopted to guide and support the efforts to address climate change. And fiscal and taxation policies related to climate change are important and efficient tools, which have been given wide attention by the international community. Recently, levies on international aviation by the EU have pushed up the public opinions of the effect of fiscal and taxation policies.

The Kyoto Protocol states three mechanisms in response to climate change, among which, fiscal and taxation policies such as carbon tax and energy tax are regarded as the most feasible measures to reduce emissions and causing extensive concern of the global society (Liang 2012). As Figure 7 shows, 85% of respondents agree that fiscal and taxation policies can play a constructive role in dealing with climate change, and only about 3% of respondents

hold a negative attitude. It reveals that China's public has accepted the effect of fiscal and taxation policies in response to climate change. Thus, the implementation of fiscal and taxation policies is faced with a good atmosphere of public opinions, and we suggest that the government should implement feasible measures of fiscal and taxation to cope with climate change.

3.2 Impact factors of individual action on climate change

3.2.1 Data definitions

Table 1 shows the definition and description of impact factors of individual action in response to climate change.

The concern about climate change is measured using the following three items: general concern about climate change; concern about climate change considering its impact on society; concern about climate change considering its impact on respondent personally. The Cronbach's coefficient of the three items is 0.73, which proves that they can be integrated into the indicator of climate change.

Table 1 Definitions of impact factors of individual action in response to climate change

Impact factor	Indicator	Definition

Demography	● Age (X_1)	✧ Under 18 years old=1; 18-24 years old=2; 25-34 years old =3; 35-44 years old=4; 45-54 years old=5; 55 years and older=6
	● Gender (X_2)	✧ Female=0; male=1
	● Length of residence (X_3)	✧ Under 6 months=1; 6 months to 1 year=2; 1 to 3 years=3; 3 to 5 years=4; 5 to 7 years=5; 7 to 10 years=6; more than 10 years=7
Public sensibility of climate change	● Whether be aware of climate change (X_4)	✧ No =0; yes=1
Public concern about climate change	● Integrated concern about climate change (X_5)	✧ Not concerned at all=1; not very concerned=2; neutral=3; fairly concerned=4; very concerned=5
Perception of the causes of climate change	● Climate change proves natural consequences (X_6)	✧ Strongly disagree=1; fairly disagree=2; neutral=3; fairly agree=4; strongly agree=5
Perception of the impacts of climate change	● The effects of climate change are uncertain (X_7)	
	● The seriousness of climate change is exaggerated (X_8)	✧ Strongly disagree=1; fairly disagree=2; neutral=3; fairly agree=4; strongly agree=5
	● Climate change is harmful to residents and society(X_9)	
Confidence on government's response to climate	● Trust the government to respond to climate change effectively (X_{10})	✧ Strongly disagree=1; fairly disagree=2; neutral=3; fairly agree=4; strongly agree=5

change			
Influence of climate change policies	●	Fiscal and taxation policies can be used in response to climate change (x_{11})	✧ Strongly disagree=1; fairly disagree=2; neutral=3; fairly agree=4; strongly agree=5

The result of individual action to cope with climate change is displayed in Figure 8 and the majority of respondents agree that individuals can play an important role in response to climate change. Specifically, 71% of respondents believe that it is their responsibility to take actions to mitigate climate change and 65% agree that personal behavior is important to address climate change, of which respondents between 18-34 accounts for 89%. In addition, 62% of respondents approve that they can make a contribution to cope with climate change and 61% believe that they can change their behavior to against climate change.

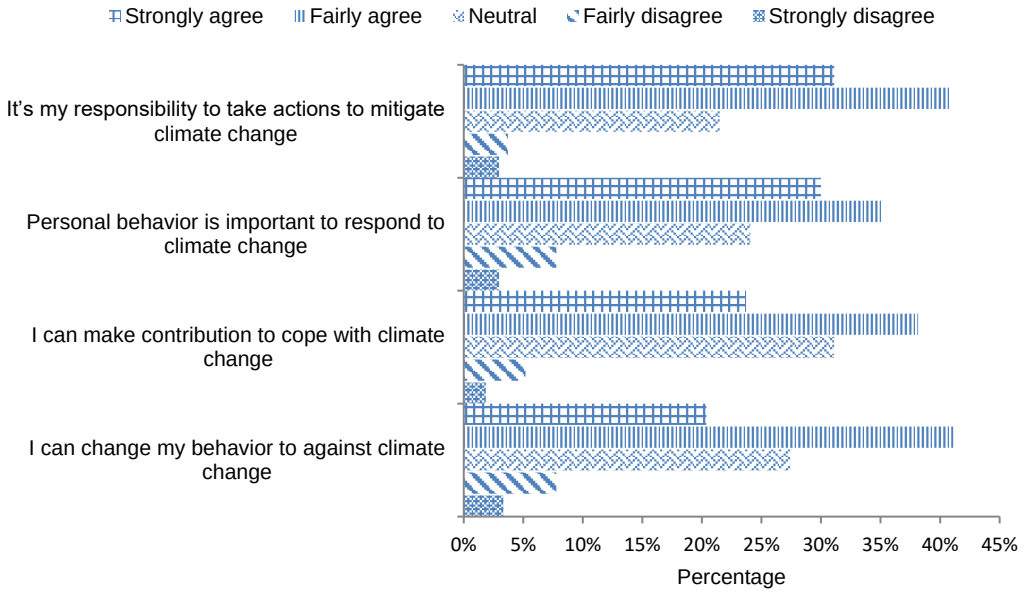


Fig. 8 Public attitudes on individual action to cope with climate change

This paper uses four items to measure "individual action in response to climate change", including: (i) It's my responsibility to take actions to mitigate climate change; (ii) Personal behavior is important to respond to climate change; (iii) I can make contribution to cope with climate change; (iv) I can change my behavior to against climate change. The Cronbach's

coefficient of the four items is 0.85, which indicates that they can be used as the indicator of "individual action in response to climate change". The value of indicator varies from 1 to 5 and means the degree of possibility for the public to approve the importance of individual action in response to climate change and take action.

3.2.2 Analysis of impact factors of individual action in response to climate change

The correlation analysis is conducted by regarding "individual action in response to climate change" as the dependent variable and the eleven indicators as prediction variables and the results are shown in Table 2.

Table 2 Regression parameter of impact factors of individual action in response to climate change

Impact factor	**Indicator**	**Unstandardized coefficients**	**P value**
Demography	• Age (X_1)	-0.067	0.213
	• Gender (X_2)	-0.124	0.122
	• Length of residence (X_3)	0.026	0.214
Public sensibility of climate change	• Whether be aware of climate change (X_4)	-0.082	0.608
Public concern about climate change	• Integrated concern about climate change (X_5)	0.421	0.000***
Perception of causes of climate change	• Climate change proves natural consequences (X_6)	-0.100	0.013**
Perception of the impact of climate change	• The effects of climate change are uncertain (X_7)	0.03	0.433
	• The seriousness of climate change is exaggerated (X_8)	-0.134	0.002***

	● Climate change is harmful to residents and society(x_9)	0.110	0.034**
Confidence on government's response to climate change	● Trust the government to respond to climate change effectively (x_{10})	0.217	0.000***
Influence of climate change policies	● Fiscal and taxation policies can be used in response to climate change (x_{11})	0.175	0.000***
Constant		0.720	0.045**
R^2	0.449		

Note: ***p<0.001; **p<0.05; *p<0.10

First, respondents' age, gender and length of residence do not pass the test of significance, and an analysis of one-way ANOVA is conducted. The result is presented in Table 3 and it states that in 5% significance level, the age has a significant impact on the individual action. In addition, the gender and time do not have significant impact on the individual actions.

Table 3 Results of ANOVA on the factor of age

	Sum of squares	df	Mean square	F	P value
Interblock	5.514	3	1.838	2.903	0.040**
Interclass	174.395	266	0.656		
Total	179.908	269			

Second, the concern about climate change (x_5), the x_9 indicator of perception of the impact of climate change (that is, climate change is harmful to residents and society), confidence on government's response to climate change (x_{10}) and influence of fiscal and taxation policies in response to climate change (x_{11}) have a significant positive impact on the individual action. In contrast, perception of causes of climate change (x_6), the x_8 indicator of perception of the impact of climate change (that is, the seriousness of climate change is

exaggerated) have a significant but negative impact on the individual action to cope with climate change.

Additionally, the sensitivity to climate change (x_4) and the x_7 indicator of perception of the impact of climate change (that is, the effect of climate change are uncertain) do not have significant impact on the individual action in response to climate change.

In summary, the age (x_1), concern about climate change (x_5), perception of causes of climate change (x_6), perception of the impact of climate change (x_8 and x_9), confidence on government's response to climate change (x_{10}) and influence of fiscal and taxation policies in response to climate change (x_{11}) are factors that affect the public to take individual action in response to climate change.

4 Conclusions and policy implications

According to the investigation on the China's public, this paper summarizes the climate change issues including the public sensitivity, public concern, public perception of causes, public perception of the impact, public confidence of the government's response to climate change and the influence of fiscal and taxation policies, and then analyzes the interrelation between those factors above and the willingness to take individual actions to address climate change. And some conclusions are drawn as follows:

First, the young people agree more on the importance of individual action in response to climate change. Even though 93% of respondents are sensitive to climate change, public sensitivity to climate change does not significantly influence public actions.

Second, besides the higher concern on climate change, there is a positive correlation between public concern on climate change and the subjective response to climate change. The public tend to believe that climate change is more likely caused by human behavior and those respondents with the opposite view may be unlikely or reluctant to mitigate climate change.

Third, 78% of respondents hold the opinion that climate change may bring a detrimental impact upon residents' life and social development and they greatly approve the significance of individual actions in climate change.

Finally, there is a close link between public confidence towards the action of government to deal with climate change and individual actions. 85% of respondents argue that fiscal and

taxation policy is an effective tool to deal with climate change, and they are more willing to take individual actions.

Based on the conclusions above, the following policy implications are put forward.

(1) The government should expand the publicity on the knowledge of climate change and raise public awareness of climate change issue. This survey demonstrates that respondents who concern about climate change would like to agree with the importance of individual action in climate change and is of further willingness to take action. Accordingly, it is wise for the government to deeply facilitate the diffusion of climate change knowledge, especially to strengthen the publicity among the old and to raise public awareness of climate change. Only in this way can we improve the overall public response to climate change.

(2) It is of vital necessity for the relevant departments to make public pay attention to the effect of climate change and easily access to the information of the possible effects caused by climate change. The result indicates that they are more willing to take individual actions in climate change when respondents recognize the probable impact to our daily life and social development. Therefore, in order to improve the individual action in climate change, the government or other organizations should increase the publicity on the possible influence of climate change and provide the latest information to the public in time.

(3) The government should actively guide the public participation and properly adopt the fiscal and taxation policies to address climate change issues. The results indicate that, respondents who have trust in the ability of government or acknowledge the active role of the fiscal and taxation policy in response to climate change would be more willing to take individual action to tackle climate change issues. Thus, to enhance public confidence in the government, the government should play a guiding role to deal with climate change. On the one hand, it should adopt a constructive attitude to address climate change. On the other hand, the global cooperation in the field of climate change should be strengthened. Moreover, appropriate use of the relevant fiscal and tax policy may be a wise choice to address climate change. The government still needs

improvement in decision-making through multi-sectoral participation and coordination mechanism in order to further boost the public participation in climate change action.

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