




ARTICLE



<https://doi.org/10.1057/s41599-024-02890-0>

OPEN

How does social capital promote consumer participation in food safety governance? Evidence from online food consumers in China

Yiqing Su¹, Shifei Zhang², Yanyan Li² & Hailong Yu³  

Consumer participation is critical to achieving successful food safety governance. However, in the field of food safety governance, consumer participation faces the dilemma of collective action. Based on social capital theory, this study introduces a total of 1229 questionnaires from online food consumers in China were collected by randomly distributing electronic questionnaires to online shoppers, and tests the effect and mechanism of social capital on consumer participation in food safety governance. By using ordered regression and multinomial logit models, the empirical results show that social capital can reduce the adverse effects of free-riding on consumers' participation in food safety governance and in fact will ultimately encourage consumers to participate in food safety governance. Furthermore, social capital will enhance people's participation in food safety governance through two paths: promoting consumers' sharing of food safety information and promoting consumers' direct supply of safe food. The conclusion of this paper provides inspiration for the promotion of consumer participation in the public affairs related to food safety governance in developing countries.

¹ Associate Professor, School of Public Policy and Management, Guangxi University, Nanning, Guangxi 530004, China. ² Graduate student, School of Public Policy and Management, Guangxi University, Nanning, Guangxi 530004, China. ³ Associate professor, School of Economics, Beijing Technology and Business University, Haidian District, Beijing 100048, China. email: yuhailong110@126.com; 20180907@btbu.edu.cn

Introduction

The significance of food to human beings goes far beyond food's monetized value. The ultimate goal should not be profit maximization but sustainable access to food equity and food safety (Vivero-Pol (2017)). Therefore, food cannot be treated solely as a commodity. A food system includes producers, retailers, consumers, governments and societies. This means that the food system is an interdependent network composed of different stakeholders, which adds complexity to food safety governance (Augstburger et al., 2019). Consumer participation in food safety governance is crucial (Rouviere and Caswell (2012)). To begin with, in the process of food safety governance, consumers are the ultimate arbiters of food safety. They provide the most direct judgment of food safety. Their judgments can provide essential information for and ultimately improve food safety governance. In addition, introducing consumer participation in food safety policy-making will positively impact scientific and rational decision-making and improve the legal system with regard to food safety (Rothstein, 2013; Buzby and Frenzen (2011)). Consumer participation in food safety governance is an expression of the public's demand for safe food. Their participation reduces information asymmetry in the food system, improves other consumers' cognition of producer behavior, and is conducive to food safety governance (Sankar and Bhattacharya (2001)).

However, in practice, consumer participation in food safety governance is affected by the dilemma of collective action (Gram et al., 2019). When consumers perceive problems with food safety, they cannot claim compensation from retailers or producers, mainly because providing conclusive evidence of food safety failures is difficult. Moreover, if consumers cannot solve food safety problems on their own, complaining to a food department is a reasonable course of action. However, consumers must pay high economic, social, and psychological costs in the process of information collection, negotiation, and supervision in the food safety governance process, and that is regardless of whether they solve the problem independently or complain to the government (Olsen et al., 2013; Weyant and Michael (1978); Wagner and Wheeler (1969); Piliavin et al., 1975). The objective existence of this high participation cost causes most consumers to passively wait for the government and other consumers to solve any food safety problems. This free-riding behavior causes a collective action dilemma in food safety governance.

For half a century, numerous scholars have been discussing how to break through the collective action dilemma. The research on collective action dilemmas – and the proposals to solve those dilemmas – in existing literature can be summarized as being three types. First, proposals related to third-party coercive means are based on Olson's (1965) idea of selective incentive. This approach emphasizes the acceptance by the state of the people (as well as the enforcement of mutual respect), in order to gain the trust necessary for participation in public activities. However, this approach is prone to corruption, mainly because that method fails to answer the question of, "Who will supervise the supervisors?" (Hu and Sun (2012)). The second type of proposals relate to market-based solutions. Although collective action theory challenges Adam Smith's "invisible hand", many scholars still tend to use the market as a means to solve the collective action dilemma. Adam Smith was the first to point out that the market forms an "invisible hand" to regulate the market through the individual pursuit of profits. This regulation includes the promotion of cooperation between people (Smith, 2008). Coase further explained that, as long as property rights are allocated, the market mechanism can effectively allocate resources (Coase, 1960). Axelrod and Hamilton (1981) made a specific analysis of the cooperation between people that is promoted by the market

mechanism. The study pointed out that people can win the cooperation and trust of other people, enterprises, and countries, as long as they adhere to the strategy of "tit-for-tat" in the process of market communication and interaction. Previous researches on market mechanisms show that there are three preconditions for market mechanisms to promote collective action: (1) limited organizational scale, (2) small organizational mobility, and (3) members can monitor each other based on mutual understanding. However, in the natural market system, realizing these three conditions simultaneously is still too difficult (Hu and Sun (2012)). Finally, the solution is based on social capital theory. Putnam et al. (1993) pointed out that social capital can improve social efficiency by promoting cooperation. When people interact and connect, interests also intersect; the trust they accumulate in social networks also makes people more willing to give when providing public goods for the common good. At the same time, norms and institutions in the provision of social capital can impose constraints on people's behavior rules. These constraints give individuals the confidence needed to invest in collective activities and ensure that their rights will not be violated. This will curb the free-riding problem in collective cooperation. Further, as people continue to use social capital, the value of that social capital increases. When reciprocity increases interpersonal connections, which in turn leads to greater trust, confidence, and the ability to innovate, the self-reinforcing cycle of social capital can inhibit short-term self-interest and thus promote collective action (Perty and Ward (2001); Pretty (2003)). Nevertheless, neither Olsen's third-party coercion nor the market's privatization approach are revolutionary ideas that can break through the collective action dilemma. People, as the kernel of collective action, are focused on trust, reciprocity, communication, and cooperation between each other (Araral, 2014). As such, if people can use social capital, increase the level of trust between partners, sustain cooperation for the development of the power system, reduce transaction costs, and solve the contradiction between individual rationality and collective rationality, the collective action dilemma can be effectively solved. Ostrom (1990) also pointed out that, when driven by social capital, people can still realize the supply of public goods through spontaneous self-organization, even without third-party coercive force and the market mechanism.

To date, in the research on promoting consumer participation in food safety governance, the approach based on Olson's view has not been able to be applied to potentially large groups, such as consumer groups. At the same time, most of the approaches used to solve the collective action dilemma with regard to consumer participation in food safety governance through the market mechanism have failed. The main reason for this failure has been the widespread existence of free-riding behavior. However, the issue of how to solve the collective action dilemma of consumer participation in food safety governance from the perspective of social capital has not been fully discussed. For this reason, based on the social capital perspective, this paper mainly focuses on two specific issues: (1) whether social capital can help consumers overcome the dilemma of collective action and thus promote their participation in food safety governance. (2) What are the specific forms of consumer participation in food safety governance under the promotion of social capital?

In order to systematically answer the above research questions, this paper explores the impact and mechanism of social capital on consumer participation in food safety governance. The findings are based on an online food consumer survey conducted in China in 2016. Globally, food security is essential to the health of people, economic stability, and social trust. The dilemma of public participation in food safety governance goes much further than just

China; other countries face similar challenges. Therefore, the research in this paper responds to a global topic, namely that social capital plays a vital role in promoting public participation in food safety governance and in building a sound food safety governance system. Also, the results provide a new public policy reference for those attempting to improve global food safety governance from the practical level of strengthening the cultivation of social capital. At the same time, for developing countries, the economic and social situation faced by China in 2016 is very similar to the current situation of many developing countries experiencing rapid development. Therefore, the analysis based on the situation of China in 2016 can also provide a helpful reference for developing countries in the corresponding development stage.

Theoretical framework and research hypotheses

You and Hon (2019) believed that social capital is a productive asset that can increase the provision of quasi-public goods and public goods. This is achieved by increasing trust between partners, developing institutions that provide lasting incentives for cooperation, and reducing transaction costs. The increasing use of social capital makes it an excellent solution to the problems commonly faced, which also means that social capital is likely to be the main link to solving the dilemma of collective action. This paper argues that social capital can overcome the collective action dilemma of consumer participation in food safety governance in three ways, which will be detailed below.

Social capital increases the total benefit accrued by consumers who participate in food safety governance. This paper argues that consumers will choose to participate in food safety governance only when the total benefit obtained through participation is greater than the total cost. Therefore, in the process of participating in food safety governance, if individuals in an organization can obtain an additional benefit X in addition to the essential benefit V_i from collective goods (such as safe food), then the total benefit of consumers participating in food safety governance may be greater than the total cost:

$$V_i + X > C$$

What, then, is this X going to be? This study believes that X can be the social capital consumers acquire in the process of forming self-organization. The reasons are as follows: First of all, self-organization itself is an investment in social capital, enabling members to obtain higher quality social capital. Secondly, Ostrom (1990) believed that, in self-organization, members engage in significant amounts of communication, exchanges, information sharing, mutual commitment, and mutual supervision. These interactions promote the establishment of interpersonal networks and ultimately lead to the formation of trust and norms of behavior. The establishment of a social relationship network and the formation of trust and norms also form social capital. Therefore, S_c represents social capital, and the motivation for consumers to participate in food safety governance is that the acquisition of social capital makes the total benefit to consumers participating in food safety governance greater than the total cost:

$$V_i + S_c > C$$

Social capital reduces the free-riding behavior of consumers in the process of food safety. From the perspectives of trust and reciprocity, social capital promotes the wide dissemination of food safety information and promotes consumer participation in food safety governance. Because of social capital, group members will care about each other's health status and share food safety information, based on reciprocity. In this process,

the high level of trust among group members enables recipients of information to believe that the food safety information they have obtained is essential and true. At the same time, the existence of a network means food safety information will be widely disseminated, because people typically belong to multiple organizations simultaneously. For example, individual A can be a member of his (or her) classmates' network and his (or her) colleagues' network. Therefore, the food safety information shared by A's classmates can be transmitted to his (or her) colleagues' network through A, then to his (or her) hometown network through B in this colleague network, and so on. Thus, the widespread sharing of food safety information in different organizations is realized. Such information can spread faster and more widely with the help of such networks. When the spread of food safety information in different organizations forms a certain scale, it will also form a certain momentum in public opinion. This form of public opinion reflects consumers' demand for food safety, from both the government and producers. Therefore, consumers actively spread and share food safety information based on social capital, enabling consumer groups to avoid problematic food selectively and ensuring that producers improve the supply of safe food, in order to guarantee their own profits. At this point, under the influence of social capital, every consumer who disseminates food safety information takes the initiative to participate in food safety governance. Thus, the emergence of free-riding behavior in food safety governance is successfully avoided.

Social capital directly promotes the provision of safe food.

Some organizations in which the collective goal is to ensure food safety work directly with specific producers. In this social relationship, consumers provide a stable income for producers, and producers provide safe food for consumers. This direct supply of food security usually means that consumers and producers are often in close proximity to each other, and often engage in face-to-face, fixed transactions. In the long run, in cooperative organizations, close communication between consumers and producers increases social capital. Trust and reciprocity prevent either party from sacrificing the investment by defaulting behavior. This means that members who blindly pursue personal economic benefit and choose to break the contract will lose the social-economic identity obtained through joining social organizations. Ultimately, such members will once again become isolated economic people. One can see that consumers' acquisition and maintenance of social capital, as reflected by their social-economic personal attributes, help ensure that safe food can be continuously supplied.

Research hypotheses. To sum up, the essence of social capital promoting consumer participation in food safety governance can be summarized as follows: First, as an additional social benefit, social capital makes the total benefit of participating in food safety governance greater than the total cost. This effectively reduces the inhibiting effect of participation cost. Second, social capital promotes the widespread dissemination of food safety information and reduces free-riding behavior. Third, social capital forces producers to directly guarantee food safety. In summary, this paper proposes the following hypotheses:

H1: Social capital promotes consumer participation in food safety governance by reducing the inhibiting effect of free-riding and participation costs.

H2: Social capital promotes people's participation in food safety governance in two forms: the sharing of food safety information and the direct supply of safe food.

Research design

Data collection. All data were collected in August 2016, a year which was a challenging one for China's food safety governance. The frequent occurrence of excessive food additives, non-standard food labels, as well as substandard food hygiene from online food ordering platforms, all caused severe food safety problems. In particular, the online food ordering platform "Hungry Me" had many unlicensed merchants using its online platform to sell food and beverages. The primary case of industrial gelatin being used either to make food such as skin jelly or as a food additive for market sales has aroused solid social repercussions. Since these issues became widely known, the public has increasingly called for improving food safety governance. At the same time, on July 2016, the results of the "2016 China Safe and Well-off Index" survey were released. The survey was conducted by "Xiaokang" magazine in conjunction with the Media Survey Laboratory of Tsinghua University, relevant experts, and institutions. The results at that time showed that food safety issues ranked first in China's top ten safety issues for the fifth consecutive year. In this context, in 2016, the Chinese public had very different attitudes towards and levels of participation in food safety governance. On the one hand, frequent food safety incidents have caused a massive threat to people's health and lives, and food safety governance has become a hot issue of concern. The public's tolerance for food safety issues is increasingly getting lower. On the other hand, the public must more actively participate in food safety governance. Although many people feel that it is crucial to participate in food safety governance, relatively few people actually do participate by taking practical actions. During this period (2016), the Chinese public participating in food safety governance generally had a collective action dilemma of "Say willing when inquiry, but unwilling to take action" (Su et al., 2022).

Also in 2016, in response to public concerns, the Chinese government issued a strategic document emphasizing the implementation of food safety. The document required the active promotion of cooperation between the national public sector, residential communities, and all sectors of society to strengthen and promote the governance of food safety. This was to be achieved through the establishment of a pattern of social co-governance of food safety. Therefore, in 2016, China's situation with regard to food safety was one of challenges and responses. One must not only observe the public's difficulties in food safety governance; but also, the effectiveness of relevant strategies in coping with difficulties must also be examined. Therefore, the situation of China's food safety in 2016 provides a good background and discussion foundation for this paper to answer the research questions raised. The data collected in this period can provide reasonable support for answering those research questions.

The empirical analysis is based on data collected through a survey. Respondents were recruited from a database of online shoppers of a nationwide Chinese multichannel grocery e-retailer. This e-retailer advocates the concept of "whole family, whole food" in its food sales and marketing, and tries to meet all consumers' needs with sound food sales practices. Based on the payment record of the electronic payment platform, the grocery e-retailer extended an electronic invitation text message to their consumers' cell phones, inviting them to fill out the demographic questions and subsequently answer the rest of the questionnaire online.

Online food consumers were chosen because online food shopping has lower participation costs and a higher probability of free-riding. In China, many online grocery vendors make it easy for consumers to provide evaluations and feedback after the shopping experience. Customers can even upload pictures of the

received goods and enter feedback online. All other potential customers can see this information. Free-riding behavior is also more likely to occur through forums such as this, as consumers may wait for others to expose food safety problems (i.e., "to do the right thing") so that they may enjoy safe food with no participatory "cost." Therefore, online consumer feedback is suitable for testing the formulated hypotheses. In cases where the participation rate is low because of free-riding in an online food shopping environment with low participation costs, consumers will most likely wait for others to take action in offline purchases, because of higher participation costs.

It should be noted that the method of asking respondents to fill out questionnaires online is prone to the problem of common method bias, which is a common problem with self-report questionnaires. The main reasons for this problem are the consistency of motivation, implicit correlation bias, default tendency, mood state, and transient emotion. To overcome the common method bias problem, this study adopted the following two approaches in conducting the survey and data analysis process: First, at the beginning of the questionnaire, respondents were assured that the survey was anonymous and that their personal privacy information would be strictly protected. This meant respondents could fill in the survey with complete confidence and reduced concerns regarding the study's purpose. Second, this study referred to Gao et al. (2016) to find out how to improve the reliability of respondents' feedback in unsupervised subjective questionnaires. This paper set up several "trap questions" that were logically related to each other. The respondents' responses to the "trap questions" were used to determine whether the respondents had adverse reactions, to see if they intentionally provided useless information, and if they provided false information in the answering process. Those samples that failed the trap question were eliminated, in order to minimize the impact of common methodology bias on the study, further improving the credibility of the data.

The questionnaire survey was approved by the respondents. Specifically, before officially answering the questions, respondents read our pre-designed Online Participant Consent Form on the first page. After understanding the contents of the survey, respondents were free to choose whether to start answering questions online. Meanwhile, to further ensure the freedom of the respondents, the research team also designed the function of freely exiting the answer page in the questionnaire, so that the respondent could freely exit and terminate the answer page in the process of answering the online questions.

According to Palmieri (2020), the pre-tested questionnaire was constructed as a means to study the social capital situation and the participation level of the respondents. Thanks to the analysis of scientific literature on this issue, the following semantic aspects of this multidimensional concept were identified: reciprocity, collective actions, trust, norms, networks, bonding, and cohesion. This conceptual grid helped the research team choose the questions in the questionnaire. In this activity, the team applied two criteria: 1) constructing a highly-structured questionnaire to pre-test and 2) finding questions (the operational definitions and formulations) often used to study the attitude toward stranger consumers in national surveys.

To pre-test the questionnaire conventionally, the research team organized a debriefing with their two standardized interviewers. The research team representative asked them to report an overview of the questionnaire pre-testing experience to identify the problems faced in the field work. To maximize the usefulness of the meeting, the research team representative asked them three questions: (1) Did you have any difficulty reading the questions exactly as they were? (2) Did the respondents need help understanding any words or concepts in the questions? (3) Did

the respondents need help retrieving the requested information or providing a valid answer to the questions?

The representative identified the worst questions, which prevented them from administering questions without respondents' misunderstandings. The research team representative asked the interviewers to evaluate how these questions worked in the field and to make suggestions on how to revise the questions. Thanks to this procedure, the two standardized interviewers equally and profoundly contributed to the questionnaire evaluation. The formulation of the question reliability judgment was more accessible when the flexible interviewer played an active role in the interaction with the respondent, catching the inconsistency of the answer. The interviewer could inform the respondent, at that moment, of the distance between the answer and the original sense of question and help her or him to understand the question as expected. This interaction between interviewer and respondent offered unreplaceable ideas on how to rephrase the poorly formulated question and prevent this distortion from occurring again during the survey.

All data were collected in August 2016, during the one-month survey, and 1,286 consumers participated in the online survey. After collecting the questionnaires through the network platform, the research team excluded unqualified samples from the overall sample if any of the following were found: (1) the answers to the subjective questions did not conform to standard logic. (2) Obvious logical errors appear before and after the answer. (3) The question selection has apparent regularity (such as continuous oblique filling). (4) Answer times were too short and did not meet the average speed. The average time for completing the questionnaire was 27.3 minutes. And it takes about 8 minutes to fill out a questionnaire on the Internet without thinking about it. Therefore, we excluded questionnaires with a response time of less than 10 minutes from the sample, taking into account network latency. (5) Incorrect answers were given to trap questions. After the screening, there were 1229 valid questionnaires left, and the overall effective rate was 95.57%.

Based on the above control of the bias that online surveys may create, the representativeness of the sample in this paper lies in the following points: First is nationwide coverage. The sample comes from an online shopping platform accessible to all Chinese residents. The online survey covers online shopping consumers in different regions, cities, and rural areas. Second is the diversity of food types in online shopping platforms. The focal online shopping platform covers many food types, and the selection samples on such a platform can represent a variety of online consumers with different food preferences. Third is the randomness of sample selection. The random sampling method in this paper uses online survey tools to send questionnaire links to sample groups, thereby ensuring that every consumer has the same opportunity to be selected for the sample and reducing the possibility of sample selection bias. Fourth is the diversity of the sample itself. The 1229 samples selected in this paper include groups of different ages, genders, marital statuses, income levels, and education levels. Such a diverse selection helps to avoid samples being too concentrated in one aspect and can better capture the online food shopping behaviors and preferences of different people.

Table 1 shows the basic descriptions of this study's samples. Firstly, in 2016 China, most online consumers are females; and females also make up a more significant proportion of survey respondents (53.81%) in this study than males (46.14%). Secondly, married online food consumers (69.57%) are far more numerous than unmarried online food consumers (30.43%). Thirdly, highly educated consumers have become the main force of online shopping in China, and this study's survey also shows that most respondents have high-level education experience.

Table 1 Basic description of samples.

Statistical indicator	Classification indicator	Frequency (person)	Proportion (%)
Sex	Male	567	46.14
	Female	662	53.86
Marital status	Unmarried	374	30.43
	Married	855	69.57
Education	No chance to access school	2	0.16
	Primary school	7	0.57
	Junior middle school	24	1.95
	Senior high school	77	6.27
	Specialized secondary school/college	256	20.83
	Undergraduate university	759	61.76
	Master's and above	104	8.46
	Age	Below 20	64
Age	20-29	480	39.06
	30-39	510	41.50
	40-49	118	9.60
	50-59	48	3.91
	Above 60	9	0.73
Address	Village	112	9.11
	Rural-urban fringe zone	118	9.60
	Second tier cities outside provincial capitals	341	27.75
	Provincial capitals	314	25.55
	First-tier cities	344	27.99
Annual household income (Yuan)	Below 50,000	101	8.22
	50,000-90,000	219	17.82
	100,000-140,000	316	25.71
	150,000-190,000	198	16.11
	200,000-240,000	186	15.13
	250,000-300,000	58	4.72
	Above 300,000	151	12.29

Specifically, the proportion of those who had no chance to enter school is 0.16%, the proportion of those with a primary school education is 0.57%, the proportion of those with a junior high school education is 1.95%, the proportion of those with a high school education is 6.27%. Then, the proportion of those with junior high school/college education rises to 20.83%; the proportion of those with a bachelor's degree is 61.76%, and the proportion of those with a master's degree or above is 8.46%. Fourthly, more young people aged 20-39 were among the sampled online food consumers, accounting for 80.56%. Specifically, 5.21% of the respondents were under 20 years old, 39.06% were between 20 and 29 years old, 41.50% were between 30 and 39 years old, 9.60% were between 40 and 49 years old, 3.91% were between 50 and 59 years old, and 0.73% were over 60 years of age. Fifthly, urban consumers account for a more significant proportion of online food purchases, and the group of online food consumers in first-tier cities, provincial capitals, and second-tier cities is roughly the same. Specifically, first-tier cities accounted for 27.99%, provincial capital cities accounted for 25.55%, second-tier cities other than provincial capital cities accounted for 27.75%, urban and rural fringe areas accounted for 9.60%, and rural areas accounted for 9.11%. Sixthly, from the perspective of annual household income, there are more middle-income groups among online food consumers. Among them, 8.22% were below 50,000 yuan per annum; 17.82% were between 50,000 and 90,000; 25.71% were between 100,000 and 140,000; 16.11% were between 150,000 and 190,000; 15.13% were between

200,000 and 240,000; 4.72% were between 250,000 and 300,000, and 12.29% were above 300,000. As seen in Table 1, this study's survey reflects the characteristics of the full range of Chinese online food consumers.

Variable selection

The dependent variable. In this paper, consumer participation in food safety governance is a dependent variable. The typical consumer practice regarding food safety governance is to use complaints, reports, and claims. Therefore, the participation rate was measured by calculating the total score of "whether to file complaints and make reporting calls", "whether to claim for compensation from responsible parties", or "whether to expose the problem of unsafe food to Internet platforms, such as Weibo and WeChat". These questions were evaluated using a 5-point Likert-type scale. Finally, a specific value to measure the degree of consumer participation (PR) could be obtained by summing up the scores of each question.

Core independent variables. On the one hand, respondents were asked whether they agreed with "When encountering food safety problems, I think others would try to solve the problem, so I do not need to take any action." A 5-point Likert-type scale was also applied here (from 1 = very unfavorable to 5 = very favorable). The higher the score was, the higher the free-riding (FR) tendency was deemed to be.

On the other hand, the consumers' participation cost (PC) was measured by choosing whether consumers live in regions that implement policies to reduce those participation costs. According to the 2016 "Blue Skin Report on Online Food Consumption in China", Beijing, Hunan, Hubei, and other regions in China have already discussed consumer participation in food safety governance. A policy of giving rewards back to consumers has been explicitly adopted. Therefore, consumers living in these regions can enjoy higher participation returns and lower participation costs than those in other regions.

Social capital and other control variables. Putnam et al. (1993) presented a systematic original definition of social capital based on previous research findings, turning the concept and theory of social capital into a novel research paradigm. For Putnam, social capital referred to specific characteristics that influence social activities, such as trust, norms, and networks. Therefore, according to the three dimensions named as trust, norms, and networks proposed by Putnam et al. (1993) to measure social capital, three variables used to measure the accumulation of social capital were selected by this study to measure social capital, as follows: "Can you borrow money from other people in your community?" was used to measure the trust dimension (TRUST) of social capital (1 = yes; 0 = no). "Do you get to know the people in your community?" was used to measure the network dimension (NETWORKS) of social capital (1 = rarely to 5 = often). The social norm dimension (NORMS) of social capital was measured by "I live in a community where people behave within the norms of honesty" (1 = strongly disagree to 5 = strongly agree). Furthermore, according to Sampson (1991) and Bruhn (2009), this study further reflects the influence of social capital on consumer participation in food safety governance from the perspective of community cohesion. This paper refers to Bruhn's (2009) description of how to measure the dimensions of community cohesion and adopts two variables, sense of belonging (SOB) and collective efficacy (CE), to reflect community cohesion. In this study, SOB refers to an individual's emotional connection and closeness to a specific social group, community, organization, or environment, as well as the individual's sense of place and

identity in a specific social collective. Five subscales can be used to measure more complex concepts, such as respondents' expressed attitudes, which can capture the subtle differences between the different opinions of different respondents. Therefore, in this paper, a five-component scale is used to capture individuals' sense of belonging to the community. Specifically, "I have helped the community to become better through practical actions (1 = strongly disagree; 5 = strongly agree)" is used to measure an SOB to the community. In this study, CE refers to the shared belief among members of a social group or community in their ability to act to achieve a specific goal. Also, CE signifies an emphasis on shared goals and the beliefs in a neighborhood's capability to take action to accomplish specific goals, and whether they can work together to achieve common goals. Bruhn (2009) proposed measuring social cohesion/trust by asking respondents whether they agreed or disagreed that "People around here are willing to help their neighbors." "This is a close-knit neighborhood." "People in the neighborhood can be trusted." "People in this neighborhood generally do not get along with each other." "People in this neighborhood do not share the same values." Therefore, drawing on that research, this paper uses a dummy variable to measure CE. Specifically, the use of "residents can carry out cooperative activities under common values (1 = yes; 0 = no)" is used to measure the CE of the community in which respondents live. Table 2 is a summary of the variables selected in this article.

Results

Promoting the effect of social capital on consumer participation in food safety governance. When the dependent variable is nominal, a logit or probit model can be chosen. The difference lies in the different distribution functions adopted. The former assumes that the random variable follows the logical probability distribution; the latter assumes that the random variable follows the normal distribution. However, if the dependent variable is ordered, only the ordered probit model can be used in the regression. Since the degree of consumer participation in food safety governance is an order variable, this paper uses the ordered probit model to test the role of social capital in promoting consumer participation in food safety governance. Table 3 shows the regression results of the ordered probit model. The results show that social capital significantly promotes consumer participation in food safety governance, by inhibiting free-riding behavior and reducing the negative impact of participation cost. Specifically, on the one hand, in Model 1, when social capital is not considered, the degree of free-riding and participation cost has a significant negative impact on the degree of consumer participation. On the other hand, when the three variables representing social capital are added to the regression model (Model 2), the influence of free-riding behavior and participation cost on the degree of participation loses significance.

From the perspective of the promoting effect of social capital on consumers' participation in food safety governance, the five dimensions of social capital selected in this paper have different promoting effects on consumers' participation in food safety governance. On the one hand, when the five dimensions of social capital are placed separately in the models (Models 3–7), TRUST, NETWORKS, NORMS, and SOB are all found to promote consumer participation in food safety governance. However, CE does not significantly promote consumer participation in food safety governance (Model 7). This paper explains the reasons for such results as TRUST, NETWORKS, NORMS, and SOB focus more on reflecting people's actual actions in communication. In contrast, the CE variable reflects people's willingness to cooperate. Therefore, the four control variables representing the actual action

Table 2 Variable selection.

Variable name	Definition and assignment	Mean	Std. Dev.
Dependent variable:			
PR	The participation rate was measured by calculating the total score of “whether to file complaints and make reporting calls”, “whether to claim for compensation from responsible parties”, or “whether to expose the problem of unsafe food to Internet platforms, such as Weibo and WeChat”. These questions are evaluated with a 5-point Likert-type scale. Finally, a specific value to measure the degree of consumer participation was obtained by summing up the scores of each question.	8.075	3.127
Core independent variables:			
FR	When encountering food safety problems, I think others will try to solve the problem, so I do not need to take any action (from 1 = very unfavorable to 5 = very favorable).	2.548	1.144
PC	Whether the consumer lives in an area that has implemented policies to reduce the cost of consumer participation (1 = yes; 0 = no)	0.156	0.363
Social capital and community cohesion			
TRUST	Can you borrow money from other people in your community? (1 = yes; 0 = no)	0.127	0.334
NETWORKS	Do you get to know the people in your community? (1 = rarely to 5 = often)	3.580	0.865
NORMS	I live in a community where people behave within the norms of honesty (1 = strongly disagree to 5 = strongly agree)	3.652	0.854
SOB	I have helped the community to become better through practical actions (1 = strongly disagree to 5 = strongly agree)	3.735	0.966
CE	Residents can carry out cooperative activities under shared values. (1 = yes; 0 = no)	0.084	0.278
Control variables			
GENDER	Gender (1 = male; 0 = female)	0.539	0.499
AGE	Age (continuous variable, years)	31.522	8.421
MARRIGE	Marital status (1 = married; 0 = unmarried)	0.696	0.460
EDU	Educational level (1 = primary school or below junior high school; 2 = junior high school; 3 = senior high school; 4 = technical secondary school or junior college; 5 = college; 6 = Master's degree or above)	5.662	0.859
INCOME	Annual household income (million yuan)	0.181	0.341
FAMILY	Number of family members	3.838	1.341
GES	Getting enough sleep (1 = very inadequate to 5 = very adequate)	3.104	0.954
OD	Do you drink alcohol regularly (1 = hardly any alcohol to 5 = often)	1.905	0.919
LIR	Live in a rural area (1 = yes; 0 = no)	0.091	0.288

significantly promote the dependent variable. In contrast, the control variable representing the subjective will has no significant effect on the dependent variable. The results show that the essence of social capital in promoting consumers’ participation in food safety governance is that social capital promotes consumers’ implementation of specific actions. This enables the public to step out of the “Say willing when inquiry, but unwilling to take action” mode—the collective action dilemma. On the other hand, the variables representing the five dimensions of social capital are added into the regression model, one can find that when the four variables TRUST, NORMS, NETWORKS, and SOB are added sequentially (Model 3, 8, 9, and 10), the promotion of consumer participation in food safety governance is significant. When TRUST, NORMS, NETWORKS, and CE, in turn, are incorporated into the models (Models 3, 8, 9, and 11), only CE has no significant promoting effect on the dependent variables. This finding still confirms the above analysis, namely that the essence of social capital in promoting consumer participation in food safety governance is that social capital promotes the implementation of specific actions by consumers. From the perspective of community cohesion, the estimated results of Model 10 and Model 11 can also conclude that community cohesion enhances consumers’ participation in food safety governance by promoting their specific actions. Therefore, the impact of comprehensive social capital on consumers’ participation in collective action can be seen. To be precise, a specific mechanism through which social capital promotes public participation is to promote consumers’ concrete actions, rather than their will, to ultimately realize people’s improvement in collective action.

In addition, the estimation results of Model 3 show that, although the estimation results of the trust dimension can promote consumers’ participation in food safety issues, a single trust dimension cannot eliminate the negative impact of free-

riding on consumers’ participation in food safety governance. Other models estimate that the adverse effects of free-riding on consumer participation in collective action can only be eliminated when multiple dimensions of social capital exist simultaneously. Suppose there is a desire to eliminate the influence of free-riding behavior on consumers’ participation in food safety governance through social capital. To achieve that objective, a multi-dimensional social capital system must be established.

To sum up, the above analysis reflects a remarkable positive influence whereby social capital variables in the model not only eliminate the cost of free-riding behavior and participate in the negative effect on the degree of participation but can also directly promote an increase in the degree of participation. This proves Hypothesis 1.

Path selection of consumer participation in food safety governance under the promotion of social capital

Identification of possible participation options. Based on the sample data described above, this paper divides consumers into the four modes they use to participate in food safety governance. First is the traditional way, namely complaint reporting. Second is information sharing; that is, sharing food safety information on the Internet through We-media platforms. Third is the direct supply of safe food; that is, through the consumers’ participation in the planting process to realize the direct supply of safe food for themselves. Fourthly, the supply of safe food can be achieved by establishing relationships; that is, by buying food from fixed stalls and fixed sellers to ensure food safety. In the questionnaire survey process, this study found that, with regard to the above four modes of

Table 3 Ordered probit regression results.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
FR	-0.049* (0.029)	-0.033 (0.029)	-0.050* (0.029)	-0.035 (0.029)	-0.045 (0.029)	-0.039 (0.028)	-0.043 (0.029)	-0.037 (0.029)	-0.040 (0.029)	-0.035 (0.029)	-0.039 (0.029)
PC	-0.140* (0.080)	-0.093 (0.081)	-0.132* (0.080)	-0.113 (0.082)	-0.116 (0.081)	-0.122 (0.080)	-0.136* (0.080)	-0.107 (0.082)	-0.103 (0.081)	-0.094 (0.081)	-0.103 (0.081)
TRUST		0.293*** (0.084)	0.318*** (0.084)	-	-	-	-	0.286*** (0.084)	0.286*** (0.084)	0.294*** (0.084)	0.286*** (0.084)
NORMS		0.103** (0.048)	-	0.226*** (0.039)	-	-	-	0.219*** (0.039)	0.132*** (0.047)	0.105** (0.047)	0.131*** (0.048)
NETWORKS		0.115** (0.048)	-	-	0.220*** (0.040)	-	-	-	0.130*** (0.048)	0.116** (0.048)	0.130*** (0.048)
SOB		0.141*** (0.036)	-	-	-	0.180*** (0.034)	-	-	-	0.141*** (0.036)	-
CE		0.0415 (0.127)	-	-	-	-	0.177 (0.123)	-	-	-	0.025 (0.127)
GENDER	0.079 (0.063)	0.087 (0.064)	0.074 (0.063)	0.079 (0.064)	0.084 (0.064)	0.089 (0.064)	0.088 (0.064)	0.075 (0.064)	0.077 (0.064)	0.085 (0.064)	0.079 (0.064)
AGE	-0.010** (0.004)	-0.008* (0.005)	-0.010** (0.005)	-0.009** (0.004)	-0.009* (0.005)	-0.009** (0.004)	-0.010** (0.005)	-0.009* (0.005)	-0.008* (0.005)	-0.008* (0.005)	-0.008* (0.005)
MARRIGE	0.354*** (0.076)	0.270*** (0.077)	0.352*** (0.076)	0.292*** (0.076)	0.303*** (0.076)	0.319*** (0.077)	0.351*** (0.076)	0.292*** (0.076)	0.286*** (0.076)	0.270*** (0.077)	0.286*** (0.076)
EDU	0.165*** (0.040)	0.153*** (0.041)	0.166*** (0.040)	0.150*** (0.041)	0.149*** (0.041)	0.167*** (0.041)	0.168*** (0.040)	0.151*** (0.041)	0.148*** (0.042)	0.152*** (0.042)	0.148*** (0.041)
INCOME	0.085 (0.072)	0.028 (0.067)	0.070 (0.067)	0.061 (0.069)	0.050 (0.070)	0.068 (0.072)	0.082 (0.074)	0.048 (0.065)	0.037 (0.066)	0.028 (0.066)	0.037 (0.066)
FAMILY	0.070*** (0.027)	0.058** (0.027)	0.066** (0.027)	0.062** (0.027)	0.063** (0.027)	0.068** (0.027)	0.069** (0.027)	0.059** (0.027)	0.058** (0.027)	0.058** (0.027)	0.058** (0.027)
GES	0.133*** (0.032)	0.093*** (0.033)	0.132*** (0.032)	0.101*** (0.033)	0.102*** (0.033)	0.125*** (0.032)	0.127*** (0.032)	0.100*** (0.033)	0.094*** (0.033)	0.094*** (0.033)	0.094*** (0.033)
OD	0.181*** (0.036)	0.167*** (0.036)	0.183*** (0.035)	0.174*** (0.036)	0.159*** (0.036)	0.180*** (0.036)	0.181*** (0.036)	0.175*** (0.036)	0.165*** (0.036)	0.167*** (0.036)	0.165*** (0.036)
LIR	-0.076 (0.105)	-0.054 (0.108)	-0.067 (0.105)	-0.059 (0.106)	-0.051 (0.108)	-0.084 (0.105)	-0.081 (0.106)	-0.051 (0.106)	-0.043 (0.108)	-0.053 (0.108)	-0.044 (0.108)
Observations	1229	1229	1229	1229	1229	1229	1229	1229	1229	1229	1229
r ²	0.021	0.034	0.023	0.027	0.027	0.026	0.021	0.029	0.030	0.034	0.030
P	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Robust standard errors are in parentheses; ****p* < 0.01, ***p* < 0.05, and **p* < 0.1.

Table 4 Possible participation schemes.

Serial number	Schemes	Scheme content	Empirical grouping
1	A	Traditional way + Information sharing + Direct supply + Establishing relationships	Analysis group
2	B	Traditional way + Information sharing + Direct supply	Analysis group
3	C	Traditional way + Information sharing + Establishing relationships	Analysis group
4	D	Information sharing + Direct supply + Establishing relationships	Analysis group
5	E	Traditional way + Direct supply + Establishing relationships	Analysis group
6	F	Traditional way + Information sharing	Analysis group
7	G	Traditional way + Direct supply	Analysis group
8	H	Traditional way + Establishing relationships	Analysis group
9	I	Information sharing + Direct supply	Analysis group
10	J	Information sharing + Establishing relationships	Analysis group
11	K	Direct supply + Establishing relationships	Analysis group
12	L	Establishing relationships	Analysis group
13	M	Direct supply	Analysis group
14	N	Information sharing	Analysis group
15	O	Traditional way	Reference group
16	P	Not participating in any way; indifferent	Analysis group

participation, consumers do not have a unique choice. That is, consumers may choose one mode of participation, or they may choose multiple modes of participation at the same time. Therefore, this paper displays the various permutations and combines the above four participation modes. Finally, 16 participation schemes were obtained, as shown in Table 4.

Multinomial logit model and IIA hypothesis testing. Multinomial logit (MNL) models and multivariate probit (MVP) models have been widely used when the variable of interest (dependent variable) has multiple responses. The multivariate probit (MVP) model is among the most suitable options when the responses of dependent variables are mutually interdependent and correlated

(Abid et al., 2019; Mahmood et al., 2021). However, the multinomial logit (MNL) model is one of the best options when all the responses of a dependent variable are self-determining and when the occurrence of each response is exclusively independent of all other responses (Alauddin and Sarker, 2014; Mahmood et al., 2020). Since the interviewees in this paper come from different parts of China, they do not show a strong correlation with each other. Each person’s choice of participation mode is relatively independent and will not have been interfered with by other interviewees. Therefore, this study uses multinomial logit (MNL) models to determine consumers’ various scheme choices when they participate in food safety governance. According to the principle of IIA assumption in multiple logit regression, this paper chooses to compare the equation of the complete scheme with the equation without scheme O. The test results of the IIA hypothesis, using Stata13.0 software, show that the final hypothesis test results do not reject the null hypothesis ($Prob > \chi^2 = 0.9984$), namely that there is no systematic deviation between the equation of the whole scheme and the equation without scheme O. Therefore, the multinomial logit models established in this paper pass the test of IIA hypothesis.

Estimation results of multinomial logit models. Table 5 shows the relative risk ratios of the multinomial logit models that chose the traditional approach as the base group. As can be seen, compared with the traditional way of complaining and reporting, social capital makes consumers more inclined to participate in food safety governance by means of sharing food safety information and directly providing safe food.

Firstly, the increase in trust between consumers and community residents will make consumers more inclined to choose the participation mode of “information sharing + direct supply” (Scheme I), compared with the traditional way. According to Table 5, when the degree of trust between consumers and community residents increases by one level, the probability of consumers choosing “information sharing + direct supply” to participate in food safety governance will be six times higher than traditional participation. Among all the 16 schemes, the increase of trust only shows a significant trend in the choice of the “information sharing + direct supply” scheme. This finding fully reflects how social capital will cause consumers’ participation mode to change from reporting formal complaints to “information sharing + direct supply”.

Secondly, consumers with more developed social networks will adopt more comprehensive participation methods, but these are based on information sharing and the direct supply of safe food. One can see from the estimated results that networks that are more developed are more inclined to choose “traditional way + information sharing + direct supply + establishing relationships” (Scheme A) and the “traditional way + information sharing + establishing relationships” (Scheme B) to participate. The probability of choosing Scheme A and Scheme B was 1.8 times and 2.5 times higher, respectively, than choosing the traditional way. A more extensive social network means a broader range of interpersonal communication. Therefore, a single mode or a combination of fewer participation methods is not suitable for survival in a more extensive social network. Therefore, a more comprehensive participation scheme becomes the choice of consumers with more developed social networks.

In addition, considering the accumulation of social capital, consumers still accept the traditional mode of participation. However, these methods are based on information sharing and direct supply of safe food, which are expanded and integrated in the “information sharing + direct supply” scheme.

In brief, under the promotion of social capital, the mode of consumers’ participation in food safety governance originally

Table 5 Estimation results of the relative risk ratio of multiple logit models (1).

Variables	Schemes															
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
TRUST	2.352	1.766	1.132	1.427	1.074	1.136	2.429	0.216	6.425*	0.733	1.871	1.035	1.842	1.169	Reference group	0.158
NETWORKS	1.835*	2.542**	1.488	1.328	1.889	1.443	1.38	1.113	1.163	1.197	1.515	1.135	0.942	0.991		1.083
NORMS	1.277	0.562	1.086	1.558	1.359	1.022	1.586	1.939	2.972*	1.354	0.914	0.964	1.634	1.156		0.862
SOB	1.138	1.054	1.118	0.797	0.992	1.221	0.673	0.784	0.438**	1.054	0.892	1.004	0.954	1.042		0.808
CE	0.550	1.684	0.558	0.419	1.338	0.805	0.371	0.901	0.7271	0.281	0.943	0.526	0.700	0.748		0.363
Other control variables	Controlled															
LR χ^2 (180)	493.45															
Prob > χ^2	0.000															
R ²	0.0838															

(1) ***, **, and * represent significant at the statistical levels of 1%, 5%, and 10%. (2) Other control variables, namely gender, age, marital status, education level, annual household income, total household population, adequate sleep, regular alcohol consumption, and rural residence are no longer estimated, due to length.

appeared in the form of making formal complaints and reports. Now, consumers pay attention to information sharing and safe food supply, directly changing the way they participate. This change is not a single-content transformation. Rather, the change represents the consumers basing their approach to food safety on information sharing and the direct supply of safe food. This is a new trend towards a more integrated and scientific approach to participation.

Conclusion and enlightenment

Conclusion. The accumulation of social capital will promote people's participation in food safety governance. The empirical results show that social capital has an inhibitory effect on free-riding behavior. This makes the accumulation of social capital an effective way for consumers to break through the dilemma of collective action and participate in food safety governance. In the case of social capital, consumers' participation in food safety governance has changed from traditional reporting of complaints to more comprehensive participation. The new modes of participation are based on information sharing and direct supply. This study believes that, in organizations that do not make food safety a primary goal, the supply and sharing of food safety information, promoted by social capital, is the primary way for consumers to participate in food safety governance. In organizations that do make food safety their primary goal, the direct supply of safe food, guaranteed by social capital, is the leading way for consumers to participate in food safety governance.

Theoretical implications. In terms of research conclusions, this study's main contribution is to prove that social capital promotes consumers' participation in food safety governance by reducing the inhibition of free-riding and participation costs. Previous research has pointed out that the collective action dilemma represented by free-riding has become an essential factor that hinders consumers' active participation in food safety governance (Su et al., 2022). Therefore, the main issue that current researchers should address is how to overcome the collective action dilemma represented by free-riding, as well as how to promote consumers' participation in food safety governance. Therefore, based on the previous study of Su et al. (2022), this paper puts forward the view that social capital can effectively reduce participation costs, overcome the free-riding problem, and further promote consumers' participation in food safety governance. This conclusion continues and expands the previous research and further answers the question of how to overcome the collective action dilemma to promote consumer participation in food safety governance.

This research proves that social capital, in deciphering the consumer participation roles in food safety governance in the process of collective action dilemma, promotes consumer participation in the governance of food safety, thus providing a new understanding from the perspective of social capital. This study paves the way for other research on public participation in public affairs management and the governance of the commons. Moreover, this paper further presents the core of how social capital promotes consumer participation in the food safety governance path, showing how people should directly respond to consumer participation in food safety governance theory. Follow-up studies could further examine consumer participation in food safety management, governance, and public participation in concrete public affairs governance mechanisms. As such, this study provides an excellent and logical starting point.

Traditional commons are easy to be consumed, so the collective action dilemma is a disaster for traditional commons (Hardin, 1968; Ostrom, 1990). On the contrary, if social capital is

also regarded as a kind of commons, then the use of social capital has a completely different feature from the traditional commons, that is, the more social capital is used, the more it grows (Brondizio et al., (2009)). This may also explain from another perspective why social capital can overcome the dilemma of collective action, so that public things such as food safety can be maintained for a long time. Future research can also be further explored in this respect.

Political implications. This paper proves that social capital promotes consumers' participation in food safety governance. This is done by reducing the inhibition of free-riding and participation costs and promoting the formation of food safety information sharing and the direct supply of safe food. In traditional food safety management, information asymmetry means it is often difficult for consumers to grasp enough food safety information. However, with the widespread adoption and use of the Internet, as well as the rapid growth of social media and news channels, including nutrition labels, food recalls, production processes, food additives, etc., a large amount of food safety information is now being published and shared. This is causing the amount of food safety information being received by consumers to exponentially increase. As a result, however, in the new food safety governance landscape, consumers face the risk of information overload, and this excessive food safety information requires consumers to spend more time and energy finding, screening, and verifying information. Therefore, managing and adapting to information overload is a food safety governance challenge that policymakers must face. The conclusion of this paper proves that social capital can promote the sharing of food safety information, which in turn indicates that social capital will still play an essential role in promoting consumers' participation in food safety governance in the current evolution of the food safety governance pattern. Both parties with substantial social capital have a solid foundation of trust and reciprocity motivation. Therefore, in sharing food safety information, one party will convey accurate and practical information to the other party out of reciprocity, and the other party will believe the information based on trust. In general, when there is substantial social capital within a group, not only will the risk of information overload caused by too much false information be weakened, but the cost of verifying information will also be reduced.

Therefore, the policy implications of this research conclusion are that the public sector should guide consumer groups to independently form relevant organizations and platforms, such as social media or online communities. This can promote the social capital accumulation of consumers who participate in the organization and use the platforms. In addition, these organizations and platforms will also ensure that, under the accumulation of social capital, consumers can quickly obtain food safety information, report problems, query food ingredients, etc., thereby realizing the participation of food safety governance based on information sharing and direct supply. In addition, from a global perspective, food safety governance is a global challenge, but different countries have different approaches to food safety governance. In any event, many countries, including China, face the collective action dilemma of consumer participation in food safety governance. Therefore, China and numerous other countries need to encourage consumers to participate in food safety governance. According to the conclusions of this paper, social capital can promote consumers' participation in food safety governance by restraining participation costs and free-riding. Therefore, as a point of fact, for different countries and regions at different times, as long as they are faced with the collective action dilemma of consumers' participation in food safety governance,

the research conclusions of this paper also have policy guidance significance.

Limitations. This paper is insufficient in some respects. Due to limited data availability, social capital in this study is only measured from a limited dimension. Future studies can further explore more dimensions of public participation in food safety governance by using more timely data, including participation motivation and participation degree, to provide a more comprehensive understanding of the internal mechanism and driving force of public participation in food safety governance.

Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Received: 23 August 2022; Accepted: 29 February 2024;

Published online: 14 March 2024

References

- Abid M, Scheffran J, Schneider UA, Elahi E (2019) Farmer perceptions of climate change, observed trends and adaptation of agriculture in Pakistan. *Environ Manag* 63:110–123
- Alauddin M, Sarker MdAbdurRashid (2014) Climate change and farm-level adaptation decisions and strategies in drought-prone and groundwater-depleted areas of Bangladesh: an empirical investigation. *Ecol Econ* 106:204–213
- Araral E (2014) Ostrom, Hardin and the commons: a critical appreciation and a revisionist view. *Environ Sci Policy* 36:11–23
- Augstburger H, Kser F, Rist S (2019) Assessing food systems and their impact on common pool resources and resilience. *Land* 8:71
- Axelrod R, Hamilton WD (1981) The evolution of cooperation. *Science* 211(4489):1390–1396
- Brondizio ES, Ostrom E, Young OR (2009) Connectivity and the governance of multilevel social-ecological systems: the role of social capital. *Annu Rev Environ Resour* 34:253–278
- Bruhn J (2009) The group effect: social cohesion and health outcomes. Springer
- Buzby JC, Frenzen PD (2011) Food safety and product liability. *Food Policy* 6:637–651
- Coase RH (1960) The problem of social cost. Palgrave Macmillan UK
- Gao Z, House L, Bi X (2016) Impact of satisficing behavior in online surveys on consumer preference and welfare estimates. *Food Policy* 64:26–36
- Gram L, Daruwalla N, Osrin D (2019) Understanding participation dilemmas in community mobilisation: can collective action theory help?. *J Epidemiol Community Health* 73(1):90–96
- Hardin G (1968) The tragedy of the commons: the population problem has no technical solution; it requires a fundamental extension in morality. *Science* 162(3859):1243–1248
- Hu D, Sun Y (2012) The Emergence and Resolution of collective action dilemma. *J Nanchang Univ (Humanities Soc Sci Ed)* 43(2):67–70
- Perty J, Ward H (2001) Social capital and the environment. *World Dev* 29(2):209–227
- Pretty J (2003) Social capital and the collective management of resources. *Sciences* 302(5652):1912–1914
- L You & L Hon. How social ties contribute to collective actions on social media: a social capital approach. *Public Relat Rev* 2019,45(4):101771
- Mahmood N, Arshad M, Mehmood Y, Shahzad MF, Kächele H (2021) Farmers' perceptions and role of institutional arrangements in climate change adaptation: Insights from rainfed Pakistan. *Clim Risk Manag* 32:100288
- Mahmood N, Arshad M, Kächele H, Shahzad MF, Ullah A, Mueller K (2020) Fatalism, climate resiliency training and farmers' adaptation responses: Implications for sustainable rainfed-wheat production in Pakistan. *Sustainability* 12(4):1650
- Olsen S, Mai H et al. (2013) Consumer participation: the case of home meal preparation. *Psychol Mark* 30(1):1–11
- Olson M (1965) The logic of collective action: Public goods and the theory of groups. Harvard University Press, Cambridge, MA
- Ostrom, E (1990) Governing the commons: the evolution of institutions for collective action. Cambridge University Press
- Palmieri M (2020) An innovative approach to pretest questionnaire: the analysis of respondents' comments in the flexible interview. *Sociol Methods Res* 49(1):108–132

- Piliavin IM, Piliavin JA, Rodin J (1975) Costs, diffusion, and the stigmatized victim. *J Personal Soc Psychol* 32(3):429–438
- Putnam, RD, Leonardi, R, & Nanetti, RY (1993). Making democracy work: civic traditions in modern Italy. Princeton, NJ, Princeton University Press
- Rothstein H (2013) Domesticating participation: participation and the institution rationalities of science-based policy-making in the UK food standards agency. *J Risk Res* 16(6):771–790
- Rouviere E, Caswell J(2012) From punishment to prevention: a French case study of the introduction of co-regulation in enforcing food safety *Food Policy* 37(3):246–254
- Sankar S, Bhattacharya CB (2001) Does doing good always lead to doing better? Consumer reactions to corporate social responsibility. *J Mark Res* 38(2):225–243
- Sampson RJ (1991) Linking the micro-and macrolevel dimensions of community social organization. *Soc Forces* 70(1):43–64
- Smith A (2008) An inquiry into the nature and the causes of the wealth of nations. University of Chicago Press Economics Books
- Su Y, Yu H, Wang M et al. (2022) Why did China's cost-reduction-oriented policies in food safety governance fail? The collective action dilemma perspective. *Can J Agric Econ/Rev Canadienne d'agroeconomie* 70(3):203–217
- Vivero-Pol LJ (2017) The idea of food as commons or commodity in academia. A systematic review of English scholarly texts. *J Rural Stud* 53:182–201
- Wagner C, Wheeler L (1969) Model, need, and cost effects in helping behavior. *J Personal Soc Psychol* 12(2):111–116
- Weyant, Michael J (1978) The influence of temporary mood states and costs-benefits on helpful behavior. *J Personal Soc Psychol* 36(10):1169–1176

Acknowledgements

Project supported by National Social Science Foundation of China (Grant No. 19CGL034 and 22GBL225).

Author contributions

Methodology, Shifei Zhang and Yanyan Li; Formal analysis, Shifei Zhang; Investigation, Yiqing Su; Resources, Yiqing Su and Hailong Yu; Writing—review & editing, Yiqing Su and Yanyan Li; Supervision, Hailong Yu. All authors have read and agreed to the published version of the manuscript.

Competing interests

The authors declare no competing interests.

Ethical approval

Approval was obtained from the Medical Ethics Committee of Guangxi University. The procedures used in this study adhere to the tenets of the Declaration of Helsinki. We applied for ethical approval from the Medical Ethics Committee of Guangxi University in 2015 and were approved. The initial ethics approval number was GXU-2015-055. In 2024, we applied to the Medical Ethics Committee of Guangxi University for an ethics review again and were approved. The second ethics approval number was GXU-2024-014.

Informed consent

Informed consent was deemed not necessary. The empirical analysis is based on data collected through a survey. Respondents were recruited from a database of online shoppers of a nationwide Chinese multichannel grocery e-retailer. Based on the payment record of the electronic payment platform, the grocery e-retailer extended an electronic invitation text message to their consumers' cell phones, inviting them to fill out the demographic questions and subsequently answer the rest of the questionnaire online. The purpose of the questionnaire and the use of the data are clearly stated in the description of the questionnaire, and the questionnaire does not involve privacy issues. In the questionnaire description, all respondents were informed that the information collected in the survey are used only for academic research and will not be used for commercial purposes for profit or for purposes that may harm others. If respondents disagree, they can terminate the questionnaire at any time.

Additional information

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1057/s41599-024-02890-0>.

Correspondence and requests for materials should be addressed to Hailong Yu.

Reprints and permission information is available at <http://www.nature.com/reprints>

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

© The Author(s) 2024