

Public opinion risk perception of decision makers' in transboundary watershed emergency water supply

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ABSTRACT

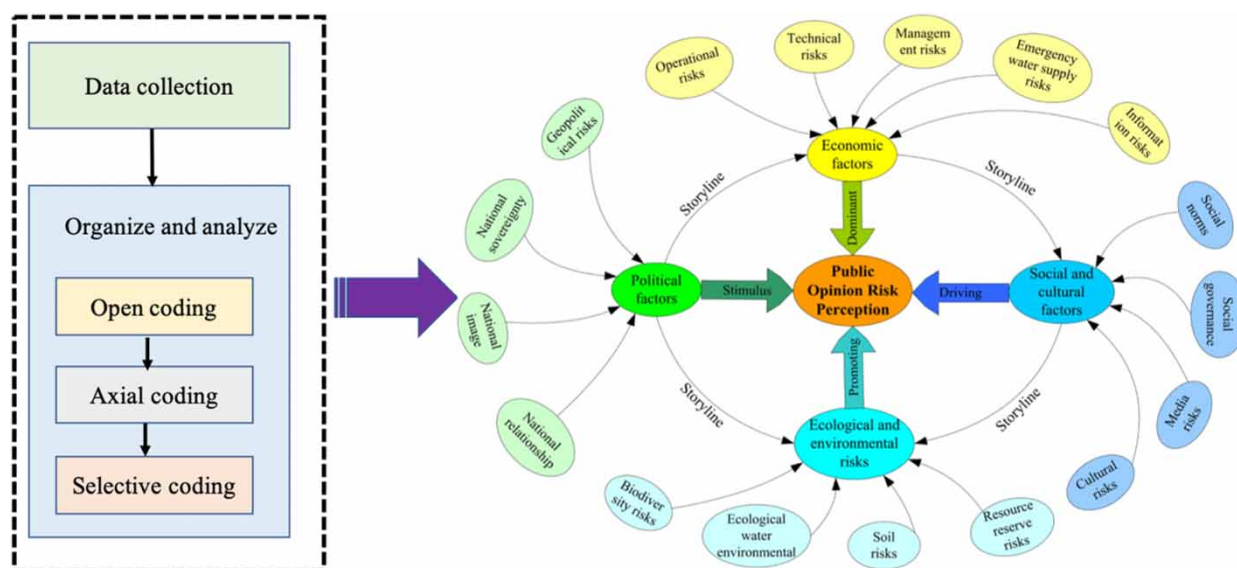
In recent years, the number of public opinion risks related to sudden transboundary drought events has continued to increase. Research on the perception of public opinion risks has become an indispensable and increasingly important part of emergency management research in transboundary watersheds. Based on relevant literature and interview materials, an exploratory theoretical construction was conducted using the grounded theory research method. The research results indicate that four main categories of public opinion risks, namely, political, economic, ecological and environmental, and socio-cultural, have a significant impact on the perception of public opinion risks among decision-makers in transboundary watershed emergency water supply. The formation mechanisms of decision-makers' perception of public opinion risks vary in each of these four categories. This research not only enriches the relevant research on the influencing factors of decision-makers' perception of public opinion risks in theory but also provides decision-making reference and guidance for transboundary watershed water resource management in practice.

Key words: grounded theory research, influencing factors, public opinion risk perception, transboundary rivers, water resource management

HIGHLIGHTS

- This study identified the influencing factors of public opinion risk perception.
- This study analyzed the impact of different influencing factors.
- This study provided new ideas for transboundary watershed water resources management.

GRAPHICAL ABSTRACT



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1. INTRODUCTION

In recent years, with the intensification of climate change and human activities, transboundary watershed water disasters have occurred frequently worldwide. Due to the connectivity of transboundary river channels and the flow characteristics of river water (Giordano *et al.* 2014), upstream countries often receive emergency water supply requests from severely affected countries in the event of sudden drought in transboundary watersheds to alleviate their domestic disaster situations (Zhang *et al.* 2022). However, the upstream countries' emergency water assistance to the downstream countries, despite their own interests being compromised, did not initially gain recognition from all countries in the basin. Instead, it has created public opinion hotspots such as 'dam threats' and 'ecological threats,' which have affected the implementation of emergency water supply decisions across the transboundary watershed. The judgment of decision-makers on public opinion risks mainly depends on their subjective perception of public opinion information. The mismatch of decision-makers' perceptions of public opinion risks will bring challenges to the implementation of transboundary watershed emergency water supply and the management of watershed water resources. Therefore, exploring the influencing factors and the formation mechanism of decision-makers' perception of public opinion risk will be beneficial to the smooth implementation of transboundary watershed emergency water supply and the maintenance of social stability within the watershed.

Existing studies on the antecedents of public opinion risk perception mainly focus on exploring the impact of individual characteristics, socio-economic and environmental factors, etc., on public opinion risk perception in the fields of public administrative decision-making and consumer behavior decision-making (Mauricio & Paul 2003; Zou *et al.* 2021). Domestic and foreign scholars exploring public opinion risk perception from the perspective of government decision-makers and consumers provide good research perspectives, ideas, and methods for understanding their conceptual connotations and influencing factors (Ju & You 2022; Li *et al.* 2022). However, the study of public opinion risk perception is far more complex than what the existing literature portrays, involving the interaction and effects of multiple factors. Most existing studies are based on methods such as questionnaires to explore the influence of one or a few factors on public opinion risk perception, lacking systematic research. However, relatively little research has been conducted on the perception of public opinion risks of decision-makers for transboundary emergency water supply in watersheds. Although scholars have paid attention to this unique group of decision-makers, existing research mainly focuses on decision-maker satisfaction, water resources allocation methods and models, and other related topics (Degefu *et al.* 2016; Wang *et al.* 2021; Bi *et al.* 2022). Recently, scholars have started to pay attention to the impact of decision-makers' risk perception on emergency water supply plans in transboundary watersheds (Enqvist & van Oyen 2022; Zhai *et al.* 2022). However, relatively little research has been conducted specifically on the perception of public opinion risks of decision-makers involved in transboundary emergency water supply. Moreover, the public opinion risks perceived by decision-makers involved in transboundary emergency water supply not only include those within their own country but also within the watershed and beyond. Compared with general decision-makers, they face unique challenges. Furthermore, 'perception' is a complex psychological phenomenon, and the causes of perception for different events and groups differ. Therefore, existing research results on factors influencing public opinion risk perception may not be fully applicable to decision-makers involved in transboundary emergency water supply. The question of 'what factors influence decision-makers' perception of public opinion risk in cross-border emergency water supply' remains largely unknown. So, a deeper and more systematic analysis of the factors influencing decision-makers' public opinion risk perception of transboundary emergency water replenishment is important and necessary to better improve the satisfaction of transboundary emergency water replenishment.

Therefore, this paper explores exploratory theoretical construction through a grounded study of decision-makers in cross-border basin emergency water supply. It aims to develop a model of the factors influencing the perception of public opinion risk among decision-makers in cross-border emergency water replenishment. It is also an attempt to answer the following two questions: (1) What are the factors that influence the perception of public opinion risks of decision-makers involved in transboundary emergency water supply? (2) What are the internal relationships and interactions between the various influencing factors and the perception of public opinion risks of decision-makers involved in transboundary emergency water supply? The paper reveals the influencing factors and mechanisms of public opinion risk perception of emergency water supply decision-makers in cross-border river basins. This not only supplements and enriches the research on influencing factors of public opinion risk perception, but also to some extent makes up for the shortcomings of existing quantitative research. It also helps to enrich the research scope of public opinion risk perception, that is, extending from the general decision-makers' public opinion risk perception to the public opinion risk perception of emergency water supply decision-makers

in cross-border river basins. Furthermore, specialized research on decision-makers involved in transboundary emergency water supply can provide theoretical guidance for China in managing transboundary watershed water resources disputes with neighboring countries.

2. METHODS

2.1. Research methods

The grounded theory research method effectively avoids the shortcomings of quantitative research and provides a bridge between empirical and theoretical research, making it a more scientific and standardized method in qualitative research (Hammersley 2018). Grounded theory is based on raw data, emphasizing the use of systematic procedures to inductively compare and organize data that reflects relevant phenomena, extract the relationships between concepts, and form a concept framework or theory from the bottom up (Strauss 1987; Jia & Heng 2020). It is often used to induce and explore the influencing factors of a particular phenomenon (Sun *et al.* 2018). Therefore, this paper uses the grounded theory method to explore the factors influencing the perception of risk in public opinion by decision-makers on emergency water replenishment in transboundary watersheds, which has great research utility. The grounded theory method is based on theory induction primarily and theory deduction secondarily. With coding as the core on the basis of qualitative data, it involves problem definition, literature research, data collection, data analysis, discovery and induction of theory contained in raw data, and construction of theoretical models. The three levels of coding in the data analysis process is the core part (Sosa-Diaz & Valverde-Berrocoso 2022). Based on the literature and research discussions above, we have drawn Figure 1 to depict the research process of grounded theory.

2.2. Selection of research objects

Regarding the selection of the interviewees' units, the selected sample primarily consists of water resources supervisory departments and hydropower enterprises. The selection of interviewees should follow the following requirements. First, reliability, interviewees should have professional knowledge on emergency water supply in transboundary watersheds or participate in the design of emergency water supply plans in transboundary watersheds. Second, representativeness, interviewees are required to understand the current situation or future research trends of China's transboundary watershed emergency

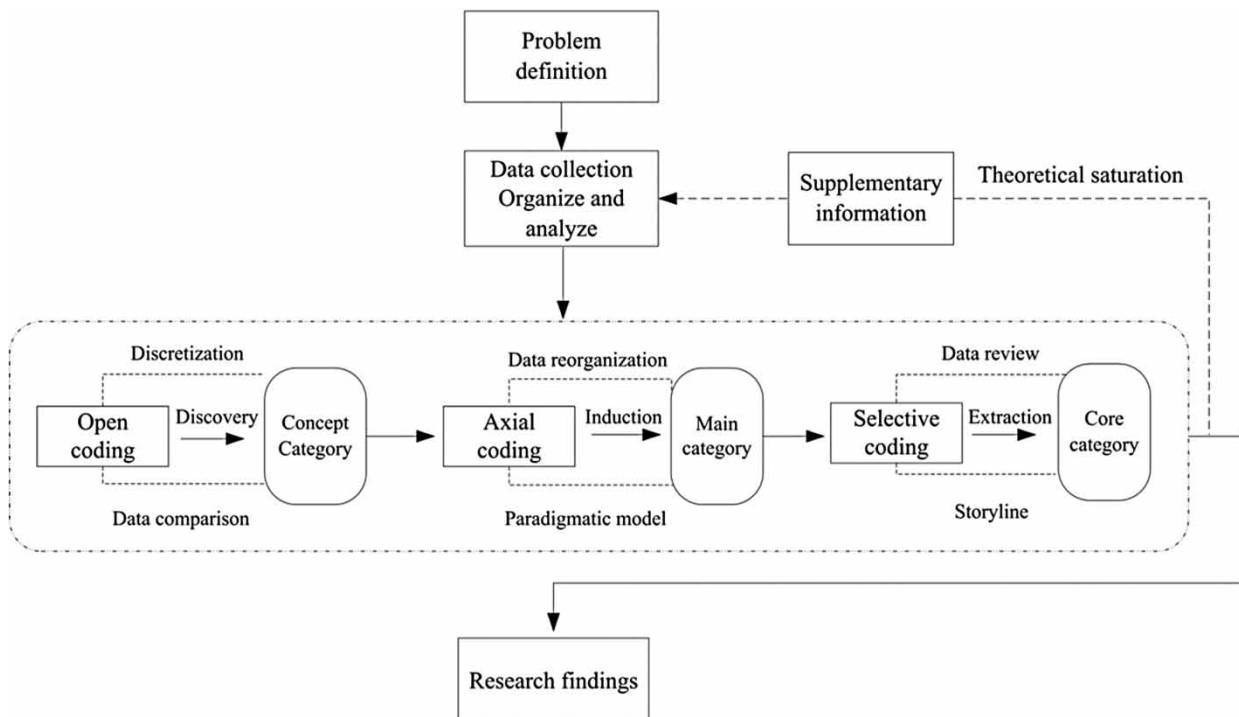


Figure 1 | The research flow of grounded theory.

water supply. Finally, feasibility, the research conditions of the team and the time constraints of interviewees should be comprehensively considered to ensure the smooth implementation of the interviews. Based on the aforementioned sampling principles, this study relied on the National Natural Science Foundation of China's general project and conducted interviews in Xinjiang, Wuhan, Yunnan, Beijing, and Nanjing. The interviewees all had good direct or indirect work or personal relationships with the research group members, which helped this study obtain real and effective research data directly and comprehensively. This is also in line with the principle of grounded theory, which emphasizes the richness of information on the target object rather than the size of the sample (Burns & Schneider 2019).

In this study, the initial interview outline was designed based on existing data on the risk perception of decision-makers on emergency water supply in transboundary watersheds. Then, based on the initial outline, pre-interviews were conducted with two professors, two water and hydropower experts, and two representatives from hydropower companies in the transboundary watershed emergency water supply research field. Based on the recommendations of these experts, the interview outline was further optimized and a formal interview outline was obtained. After each interview, the recordings were transcribed into text data with relevant software, and detailed memos were written based on the non-verbal cues of the interviewees recorded on-site. Gender differences, education level, and work experience are important factors that influence individuals' perception of public opinion risk (Brown *et al.* 2021; Rufat & Botzen 2022). Selecting interviewees with the representative and similar characteristics can better understand their viewpoints and behavioral patterns (Xu *et al.* 2023). Therefore, a description of the characteristics of 25 interviewees is provided to demonstrate the completeness and validity of the collected data (as shown in Table 1). Of these 25 interviewees, there were 16 in-depth interviewees and 9 video interviewees, with a total recording and video length of approximately 1,250 min, and nearly 110,000 words of interview data text were organized in the final analysis. Twenty data samples were selected for data coding and model construction, and the remaining five samples were used for theoretical saturation testing.

2.3. Reliability and validity

This study employed the triangulation method to cross-validate the collected data and enhance the credibility and validity of the research data (Brown & Eisenhardt 1997; Jing & Sun 2021). Applying the triangulation method in the data collection process ensures that each data source is independent of each other and does not interfere with each other. This will result in data from multiple sources and different respondents to mutually confirm the research conclusions. The primary approach of this article was to obtain information from the perspective of time and space to mutually validate the reliability of the data. On the one hand, from the time perspective, in-depth interviews were conducted with personnel from different levels and departments at the same time. Interviewees were mainly from staff members of the Ministry of Water Resources, staff members of the Changjiang Water Resources Commission, the Lancang-Mekong Cooperation, relevant hydropower companies, and water and hydropower experts. On the other hand, from the spatial perspective, transboundary rivers in different regions of China were selected as the research objects, including the northwest, northeast, and southwest regions.

2.4. Memo-writing

The memo-writing work mainly involves recording the non-verbal cues of the interviewees during the interview, recording key information during the interview, and recording inspiring data during the data coding process. Memo-writing facilitates

Table 1 | The description of the interviewees ($N = 25$)

Characteristic	Classification	Numbers	Percentage
Gender	Female	10	40
	Male	15	60
Education	PHD	12	48
	Postgraduate	8	32
	Bachelor degree	5	20
Work Experience	1–5 years	3	12
	6–10 years	12	48
	11–15 years	8	32
	More than 15 years	2	8

data coding, category extraction, category relationships, and the final extraction of theory. At the same time, researchers engage in personal dialogue and reflection through memo-writing and reevaluate data and analysis results (Charmaz 2011).

3. ENCODING PROCESS AND INITIAL RESULTS

3.1. Open coding

Coding refers to the process of looking at data with an open mindset while not altering the original meaning of the data. Open coding involves discretizing the original data, analyzing and categorizing it, and ultimately extracting conceptualization and categorization, with the interviewee's original language as the coding basis (Birks *et al.* 2013). First, two researchers independently analyzed and wrote a memo for 20 interviewee text materials sentence by sentence and paragraph by paragraph. Second, the results with different coding opinions were discussed and ultimately confirmed by the project team (including two associate professors, three doctoral students, and five master students), resulting in 187 original statements and corresponding initial concepts. Finally, based on reflexivity and typicality requirements, the obtained initial concepts were regressed to the original data for further comparison and organization. The coding that represented duplicate and overlapping content was not representative or did not comply with the theme was removed, resulting in 108 initial concepts. Furthermore, the connotation of the initial concepts was sorted and categorized into 45 initial categories, such as peripheral relationships, agricultural production factors, income risks, social psychological risks, among others (Table S1 in the Supplementary Material shows the results of open coding).

3.2. Axial coding

Axial coding is a process that builds organic connections between categories based on open coding and further identifies and extracts main categories by inducing and refining the subcategories that are similar in nature and possess consistent attributes. For example, the initialization categories, peripheral relationship risk and upstream-downstream relationship risk, are aggregated into the subcategory of 'national relationship risk', as is shown in Table S2 in the Supplementary Material. This is because, from the perspective of international rivers, there are two types of rivers, namely boundary rivers and transboundary rivers. Therefore, the public sentiment risk of emergency water replenishment in transboundary watersheds mainly involves the tense relationships between neighboring countries or the conflict-related public opinion information due to the geographic location of upstream and downstream areas. The critical goal during this stage is to deduce a coding paradigm or theoretical model that links categories with relational themes. Research has found that there are some potential logical relationships among the 17 subcategories. Based on the inherent relationships between different subcategories, they were reclassified into four main categories, namely political public opinion risk, economic public opinion risk, ecological and environmental public opinion risk, and social and cultural public opinion risk.

3.3. Selective coding

Selective coding is the process of further refining and integrating categories to extract a 'core category' that encompasses all main categories. This involves a comparison of the core category with main and subcategories and further analysis and concentration of category types. Selective coding clarifies and verifies the relationships between core categories, main categories, and subcategories, and builds a relational phenomenon around the core category and develops a theoretical framework in a 'story line' approach. Based on the open coding and axial coding, this study reviewed literature materials and performed continuous interactive reflexivity thinking and memo-writing of interview data to determine the core category as 'factors influencing decision-makers' perception of public opinion risk'. Further exploration of the core category uncovered a typical relationship structure (as shown in Table 2). In the story line of 'factors influencing decision-makers' perception of public opinion risk', the main influencing factors are political public opinion risk, economic public opinion risk, ecological and environmental public opinion risk, and social-cultural public opinion risk.

3.4. Test of theoretical saturation

Theoretical saturation refers to the process where the researcher knows when to stop gathering data and coding, exploring similarities and differences required to extract new categories (Johnsson 2021). When the researcher can't discover new concepts, categories, or relationships in the latest collected data, it can be considered as a standard for theoretical saturation (Jia & Tan 2010). In this study, one-fifth of the original data (five interview records) were used to test the theoretical saturation. The coding results revealed that there were no new category relationships, categories, or concepts identified in the five data,

Table 2 | The results of the selective coding

Typical relational structures	The connotation of relational structures
Political public opinion risks → perception of public opinion risks	Political public opinion risks mainly manifest in national relationships, national image, national sovereignty, and geopolitics. These risk factors significantly impact decision-makers' perception of public opinion risks and have a stimulating effect.
Economic public opinion risks → perception of public opinion risks	Economic public opinion risks are a significant reflection of the economic losses incurred by stakeholders. The dominant force driving changes in decision-makers' perception of public opinion risks is related to these risk factors.
Ecological and environmental public opinion risks → perception of public opinion risks	Ecological environmental risks play a driving role in the formation of decision-makers' perception of public opinion risks and impact and dominate their subjective perception.
Social and cultural public opinion risks → perception of public opinion risks	The quantity of news reports by social media and the differences in cultural customs within a river basin can create social and cultural risks that can affect decision-makers' perception of public opinion risks. These risks also have a promoting effect on the formation of public opinion risk perception.

and no new influencing factors were formed within the four main categories. Thus, the 'factors influencing decision-makers' perception of public opinion risk in transboundary watershed emergency water supply' model constructed in this study has passed the test of theoretical saturation.

4. RESEARCH FINDINGS AND MODEL EXPLANATIONS

Through three levels of coding of interview data, this study identified the core category and corresponding main categories and constructed a typical structural relationship for the core category. The results of the study showed that the influencing factors of public opinion risk perception of transboundary emergency water supply decision-makers can be mainly classified into four types. Political public opinion risk factors have a stimulating effect; economic public opinion risk factors have a dominant role; ecological and environmental public opinion risk factors have a promoting effect; and social and cultural public opinion risk factors have a promoting effect. They jointly influence the formation of public opinion risk perception of transboundary emergency water supply decision-makers, as shown in [Figure 2](#).

4.1. Political public opinion risk

Political opinion risk is an important factor that affects decision-makers' perception of public opinion risk and also a stimulating factor for forming decision-makers' perception of public opinion risk, which directly influences the level of decision-makers' perception of public opinion risk. Political opinion risk refers to the public opinion information transmission or reflection related to transboundary emergency water supply events that may lead to a series of political risks in the political field, including national relationship risk, national image risk, national sovereignty risk, and geopolitical risk. National relationship risk directly affects the decision-makers' perception of public opinion risk. In other words, decision-makers' subjective cognition of the level of cooperation between transboundary basin countries will promote the formation of public opinion risk perception. For example, some interviewees stated that in terms of international rivers, the relatively harmonious relationship between upstream and downstream or left and right-bank countries helps to reduce negative perceptions of national relationships. In addition, external powers' intervention increases the complexity of basin subject relationships while damaging the international image and regional influence of basin powers ([Jin & Zhang 2019](#)). The competition among geopolitical subjects for water rights and geopolitical risks caused by basin droughts will also affect the subjective cognition of decision-makers' public opinion risk ([Shen et al. 2021](#)).

4.2. Economic public opinion risk

Economic opinion risk mainly refers to the possibility of various stakeholders suffering economic losses due to public opinion information during the emergency water supply process. Economic opinion risk plays a dominant role in the formation of decision-makers' perception of public opinion risk, directly affecting the level of their perception of public opinion risk. This type of public opinion risk includes five factors: operational risk, technical risk, information risk, management risk,

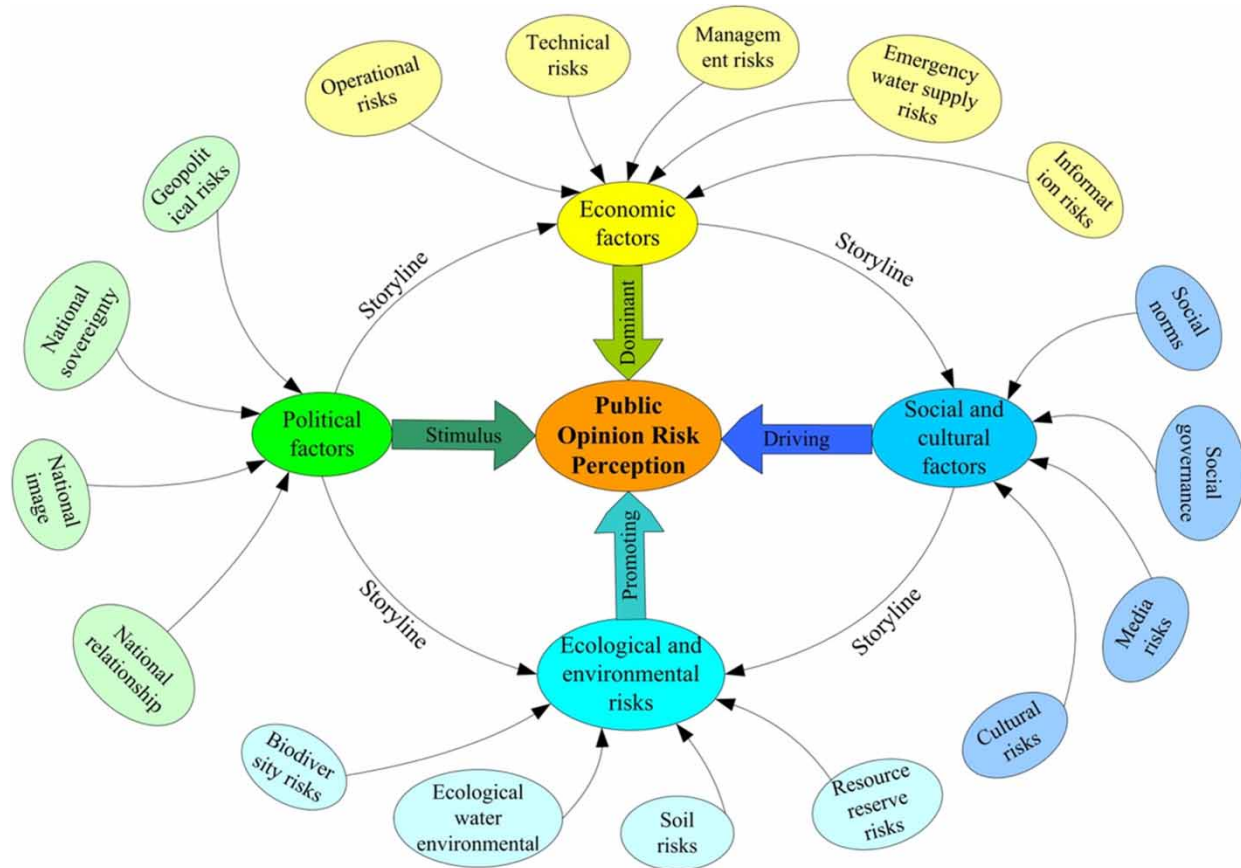


Figure 2 | Model of influencing factors for perception of public opinion risk.

and emergency water supplement risk. In cross-border basins, negative public opinion information related to operations, technology, and management can lead to higher decision-makers' perception, and the negative information is more likely to spread and have a broader impact, promoting the formation of decision-makers' perception of public opinion risk (Wirz *et al.* 2023). For example, 'In relevant media reports, I will pay attention to the possible economic losses in drought-stricken areas, such as agriculture and fisheries, caused by water shortage. This information will deepen my awareness.' 'In the context of basin drought, information on emergency water supplement-related technologies, navigation technologies, and the transparency of emergency water supplement information that is spread by the media will affect my subjective perception of this type of risk.' Regarding emergency water supplement risk, Zhang & Lu (2016) used China's emergency water supplement in the Lancang-Mekong River Basin as a case study and found that the implementation of emergency water supplement produced a series of impacts on China's economic development. Among them, economic risk factors can trigger higher decision-makers' perceptions of emergency water supplement risk. The study found that the implementation of emergency water supply increases the coordination costs of personnel and departments, the abandonment of electricity during the water supplementation process reduces power generation revenue, and emergency water supplementation generates derivative risks. These risk factors are important contents of the formation of decision-makers' perception of public opinion risks. For example, 'When we implement emergency water supplement downstream to alleviate droughts, we will face economic loss risks of increased cost and decreased revenue, as well as risks of water supplement efficiency and other derivative risks. The network dissemination of this risk information will increase our perception of public opinion risk and affect emergency water supplement decision-making behaviors.'

4.3. Ecological and environmental public opinion risk

Ecological and environmental public opinion risk refers to the potential ecological and environmental problems and their impact resulting from emergency water supplementation events in transboundary basins. These risks are therefore subject

to the influence and control of future risks such as biodiversity, ecological water environmental risks, soil risks, and resource reserve risks. Ecological and environmental public opinion risks enhance decision-makers' risk perceptions during emergency water supplementation decision-making processes, playing a certain promotional role. Biodiversity risk and ecological water environmental risk are the core factors that shape decision-makers' risk perception, which directly affects decision-makers' public opinion risk perception during emergency water supplementation processes. For example, interviewees believe that 'future plant and animal diversity within transboundary watersheds is our focus of concern, and the international public opinion hotspot of the formed 'ecological threat theory' is enough to stimulate our overall perception level, and we need to pay attention to the trend of such public opinion'. 'The international public opinion of the formed 'environmental threat theory' will also affect my perception level towards such risks. We will take public opinion response measures to minimize the risk.' Moreover, soil risk in areas seriously affected by disasters, as well as water resource reserve risks in various countries within the watershed, also impacts decision-makers' public opinion risk perception during emergency water supplementation decisions. For example, 'the information of public opinions regarding severe drought in countries or regions of concern, which face riverbed erosion, farmland salinization, and reservoir drying up, increases our subjective awareness of such risks and stimulates us to take effective measures to alleviate the disaster.'

4.4. Social and cultural public opinion risk

Social and cultural public opinion risk refers to the possibility of social and cultural conflicts, crises of social stability, and misjudgments caused by emergency water supplement events in cross-border basins. Social and cultural public opinion risk directly affects the formation of decision-makers' perception of public opinion risk and plays a promoting role in the process. It mainly includes four factors: social norms, social governance, media risk, and cultural risk. The media amplifies the accessibility of public opinion risk to enhance decision-makers' perception of public opinion risk. Risk information on the media has a reinforcing effect on decision-makers' perception of public opinion risk, thus leading to a perception of overestimated risk (Choi *et al.* 2017). Zhu & Liu (2021) believed that the media played a key role in forming and influencing public opinion risk perception. This study found that the nature of media institutions, the number of news reports, and the attention of netizens to events would affect decision-makers' control of public opinion trends and influence the formation of their own perception of public opinion risk. For example, interviewees stated that 'negative media reports on the emergency water supplement event in the basin caused panic and affected social stability. These weakened the effectiveness of emergency water supplement and brought us 'angry' emotions, significantly enhancing our perception of public opinion risk.' Cultural theory has been widely used to explain the changes in perception of public opinion risk. Differences in cultural concepts and religious customs in different countries in cross-border basins directly affect decision-makers' perception of public opinion risk (Kim & Jung 2019; Parsons & Lykins 2023). In addition, decision-makers' perception of public opinion risk in cross-border basin emergency water supplement is also influenced by the degree of social norms and social governance of countries in the basin. For example, 'The social structure characteristics, social stability, social livelihood issues, and public psychology in various countries in the basin will directly or indirectly influence my judgment of network public opinion risk information, and these risk sources have a certain promoting effect on the formation of my own perception of public opinion risk.'

5. CONCLUSIONS AND DISCUSSION

In order to identify the influencing factors of decision-makers' perception of public opinion risk in transboundary watershed emergency water supply, this study used grounded theory to conduct in-depth interviews and coding analysis with 25 officials and experts with relevant backgrounds, as shown in Table S3 in the Supplementary Material. Through the three-level coding of grounded theory and the test of theoretical saturation, we finally identified 4 main categories, 17 subcategories, 187 initial concepts, and the core category of 'factors influencing decision-makers' perception of public opinion risk'. At the same time, we obtained a more complete logical storyline: the factors influencing public opinion risk formed under the manifestations of political, economic, ecological environment, and socio-cultural factors collectively affect decision-makers' perception of public opinion risk in transboundary water resource emergency allocation. The study found that the factors influencing decision-makers' perception of public opinion risks include four types: political public opinion risk, economic public opinion risk, ecological and environment public opinion risk, and social and cultural public opinion risk. These four types of risk directly affect the formation of decision-makers' perception of public opinion risks. Political opinion information perceived by decision-makers has international and sensitive characteristics, which have a stimulating effect on the formation of their

perception of public opinion risk. Economic opinion information is the main demand target of the governments and public of various countries in the basin, and this type of opinion risk plays a dominant role in the formation of decision-makers' perception of public opinion risk. 'Ecological threat theory' and 'environmental threat theory' are the main forms of international public opinion regarding water resource conflicts in transboundary watersheds, and these risk factors drive the formation of decision-makers' perception of public opinion risk. During transboundary watershed emergency water supply, social and cultural information demands expressed by the public of various countries in the basin promote the formation of decision-makers' perception of public opinion risk. Therefore, this study identified four types of public opinion risk that affect the perception of public opinion risk by decision-makers in transboundary water resource emergency allocation and constructed a model framework for the influencing factors of decision-makers' perception of public opinion risk.

This study has achieved valuable results in identifying the influencing factors of public opinion risk perception among decision-makers in transboundary emergency water supplementation in river basins and in understanding the formation mechanism of decision-makers' public opinion risk perception. Firstly, through qualitative research on interview data of decision-makers in transboundary water resource emergency allocation and using the grounded theory research method. This study has microscopically depicted and explored the influencing factors of decision-makers' public opinion risk perception. At the same time, we have also constructed and developed a relatively systematic theoretical model of the influencing factors of decision-makers' public opinion risk perception. Secondly, this study identifies four types of influencing factors of decision-makers' public opinion risk perception from the forms of public opinion risk, and clarifies the interrelationships and mechanisms of action among the four types of public opinion risk. We have supplemented and enriched the research on the influencing factors of public opinion risk perception, as well as enriched the research on the public opinion risk perception of decision-makers in transboundary water resource emergency allocation. Finally, the research conclusions also provide reference value for transboundary water resource managers in formulating public opinion response strategies. In the formulation of public opinion response strategies, basin managers should strengthen the guidance and control of public opinion in politics, economy, ecological environment, and social culture.

Based on interview data and using the grounded theory approach, this study identified four types of factors that influence decision-makers' perception of public opinion risks in transboundary water resource emergency allocation, and constructed a model of the influencing factors of decision-makers' perception of public opinion risks. Previous literature has focused more on the study of decision-makers' risk perception, with relatively less exploration of decision-makers' perception of public opinion risks (Bubeck *et al.* 2012; Wang *et al.* 2021). This paper focuses on the subjective cognitive psychology of decision-makers' perception of public opinion risks, thus broadening the research boundaries of decision-makers' risk perception. The study summarized and analyzed the manifestations of public opinion risks and clarified the connotations and extensions of political, economic, ecological and environmental, and social-cultural public opinion risks, providing innovative insights into the study of public opinion risk types. This paper applies the grounded theory research method and utilizes its coding technique to identify the types of influencing factors on decision-makers' public opinion risk perception. Furthermore, it refines the theoretical framework of decision-makers' public opinion risk perception influencing factors in transboundary emergency water resource allocation. The research results enrich the theoretical methods of decision-makers' public opinion risk perception research. In conclusion, this paper identifies the types of influencing factors on decision-makers' public opinion risk perception in transboundary emergency water resource allocation. It then constructs a model of influencing factors on decision-makers' public opinion risk perception, revealing the mechanism of formation of decision-makers' public opinion risk perception.

Although there are important discoveries revealed by these studies, there are also limitations. First, this study only conducted in-depth interviews with decision-makers for China's transboundary water resource emergency allocation, without considering decision-makers from the entire watershed. In future research, we intend to include decision-makers from the entire watershed to obtain more comprehensive research data. Second, this study identified influencing factors based on interview data and used the ideas of grounded theory, but did not explore the complex relationships between various factors. In the future, we will use qualitative comparative analysis to explore the complex causal mechanisms of decision-makers' perception of public opinion risk influenced by multiple factors.

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AUTHOR CONTRIBUTIONS

C. W. wrote the original draft, developed the methodology, edited the article, rendered support in data curation, and conceptualized the whole article; H. Z. conceptualized the whole article, developed the methodology, validated the article, wrote the review, rendered support in funding acquisition, and investigated the article; L. L. and Y. Z. edited the article, developed the methodology, rendered support in data curation and regulatory, and arranged the resources. All authors have read and agreed to the published version of the manuscript.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

CONFLICT OF INTEREST

The authors declare there is no conflict.

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