A Social-cognitive Model of Environmental Risk Information Seeking in China: Toward A Better Public-oriented Risk Communication

（中国における環境リスクの社会認知的情報探索モデル
―市民主体のリスク・コミュニケーションに向けて―）

by

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to

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I dedicate this dissertation to the memory of my mother. It has been twenty years since she passed away. I keep thinking how differently life would be if she were with me. She is always staying in my memory astonishingly beautiful. Her role in my life was, and remains, immense. I am also deeply thankful to my grandmother for her love and sacrifice. She is a great woman, who raises me up and always stands by me.

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Chapter 1. Introduction

1.1 Background of This Research

The natural world provides a plenitude of resources that bolster human development. However, the endless exploration and utilization of natural treasures has brought far-reaching side effects that jeopardize human life. Environmental problems, no matter natural or man-made, become more serious in recent years and cause concerns worldwide. According to the report of the United Nations Environmental Programme (UNEP, 2012), particularly in the Asian-Pacific region, severe consequences of intensified human activities begin to hinder the development at various levels in society. It is claimed that the modern society has to confront the limitations of its ability to manage the outcomes of rapid development (Beck, 1992). Despite the achievements, human beings are taking grander challenges in the interaction with the natural world (Milstein, 2009). To achieve a sustainable future, it is critical to understand, explain, and improve the human-nature relationship, as well as maintaining an effective communication with the environment (Cox, 2013).

Environmental communication serves two major functions. One is the pragmatic function, educating people as a pedagogical instrument to deal with environmental problems; the other one is the constitutive function, mediating people's understanding and behavior associated with environmental issues via a symbolic construction of the environment (Cox, 2013). As the role of human beings has shifted from the marginal influence to the principal drive of environmental changes (UNEP, 2012), it is important to devote our efforts to better communication. Within related fields of research, communicating environmental risk is one

significant topic. Generally speaking, risk is conceptualized from three different angles. One is the technical explanation based on risk assessment that provides scientific analysis on the probability, the magnitude of potential loss, and the risk characteristics (Z. Stern, 2007). The other one is a cultural-experiential explanation that emphasizing the contextual factors (e.g., cultural settings and social norms) and personal experience on individuals' judgments of risk (Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978). The third one is from a psychological perspective, claiming that people's feelings serve as the mental shortcut to their judgments and behavior under conditions of risk (Finucane, Alhakami, Slovic, & Johnson, 2000; Kahneman, Tversky, & Slovic, 1982; Slovic, Finucane, Peters, & MacGregor, 2010). The three explanations reflect the evolution of risk communication, which starts from educating the general public, then to persuade them to engage in precautionary actions, and begins to develop public-oriented and individual-focused strategies to get the public motivated.

Specifically, the traditional way of communicating environmental risks relies on the technical explanation. Experts concentrate on delivering the results of risk assessment with the goal of educating the public to make attitude and behavior changes. However, being called an elites-to-ignorant model (Rowan, 1991), such one-way means neglects many individual-level factors but overemphasizes the knowledge gap between experts and ordinary people. As the concept of risk has shifted to a more individual-focused perspective, the psychological explanation avoids taking the public as absolute fool or irrational, expanding the technical and contextual meaning of risk and helping advance communication to a

public-oriented direction. Although it is impossible to make a perfect match between population-based information and individual needs (Berry, 2004), a dialogical way valuing the audience's response has contributed greatly to the development of communication pertaining to diverse types of risks (Covello & Sandman, 2001; Frewer, 2004).

Even without specialized knowledge and technical skills, people have the ability to decode the symbolic environment, make judgments, and guide behavior via cognitive reasoning (Bandura, 1986). This proactivity endowed with human evolution (Bandura, 2001b) is enhanced in people's learning process (Lang, 2013). For communicators and policy makers, to figure out the mechanisms of such cognitive processing is also a core mission besides transmitting information and delivering knowledge. A good environmental communication is expected to help people make better decisions and facilitate precautionary behavior (Bandura, 1994; Prati, Pietrantoni, & Zani, 2011; Schwarzer & Fuchs, 1995; Verroen, Gutteling, & Vries, 2013). Experiencing the current tense relationship between human beings and the nature, more effective action plans to improve the public's understanding of and response to environmental problems need to be explored.

In recent years, China has made considerable progress in economic growth and industrialization. However, along with the accelerating development, Chinese people's concerns over the side effects have also increased. The country is currently being affected by many serious environmental problems, such as pollutions, which are threatening people's health and quality of life. Considering the current environmental problems, it is significant to enhance the understanding of and improve the human-nature relationship for managing the

outcomes of rapid development and dealing with future threats. It should be not only the task for policy makers but also the responsibility for every section in a social system, either the public or organizations.

1.2 Aims and Significance of This Research

Following the path of risk communication evolution, it is believed that communicating risks is not just to relay scientific facts but also to represent information in specific ways that can heighten people's cognitive processing and aid personal decision-making (Anderson, 1997). It is worth mentioning a media phenomenon during the first week in March 2015, which has significantly aroused Chinese people's concerns over pollution in China and awareness of China's environmental degradation. The case involves a Chinese journalist, Chai Jing, who made an anti-pollution documentary, *Under the Dome,* to demonstrate her one-year investigation on China's air pollution. The documentary became an extremely hot topic in the Internet and social media immediately after it had been posted online. Before being taken down from major Chinese video websites, the documentary received shocking number of clicks (more than 200 million views) (Shanghaiist, 2015), igniting an unprecedented debate on environmental issues among the Chinese people.

Considering the potential impact of the information environment on individual response, this research focuses on the development of a social-cognitive model to predict individuals' risk information seeking behavior, attempting to explore a more effective way of raising awareness among the public and getting them motivated for precautions under conditions of environmental risks. By scanning a process of people's cognition, this research

is expected to shed light on both academic research and practice regarding environmental risk communication. Specifically, results of path analyses are expected to justify the validity of the proposed social-cognitive model and demonstrate an applicable framework for understanding information seeking under risks. Meanwhile, this research may also provide insightful implications for developing communication strategies, for instance, the provision of risk information and the design of message contents.

Information seeking is generally acknowledged as an important precursor of self-protective behavior (Kellens, Zaalberg, & Maeyer, 2012; Kievik & Gutteling, 2011; Mileti & Darlington, 1997; Paton & Johnston, 2001). This research has drawn insights from the social cognitive theory (SCT), a far-reaching theory for understanding the generation and change of individual behavior, to add a possibility for predicting risk information seeking. The proposed social-cognitive model takes individuals' efficacy beliefs (i.e., perceived self-efficacy and outcome expectation regarding a certain action) as the core factors, which are assumed to have the closest association with behavioral variables and the strongest predictive power on behavior change (Schwarzer & Fuchs, 1995). Information quality is supposed to be a significant contextual determinant that affects individuals' judgments and attitudes toward risks. Along with knowledge and risk perception, the three factors are suggested as sources of self-efficacy and outcome expectation according to Bandura's (1997) explanations. Therefore, they are included in the proposed model to be potential contributors that may indirectly cause information seeking. Moreover, this research concentrates on China's environmental issues that attract great interests in related fields of study but lack

profound investigation, especially concerning the air pollution case in Beijing-Tianjin-Hebei region, Shanghai, and much of the Yangtze River delta, the earthquake case in Sichuan-Yunnan area and other provinces near the north-south seismic zone in the Southwest China, and the case of nuclear radiation risk in Guangdong province where two of China's seven active nuclear power plants are located.

Lessons are learned from many failures of communication practice. To achieve a better relationship with the environment and a more effective response to environmental risks, the interdisciplinary joint efforts are needed (Li, Guo, & Ito, 2014; Turoff, Bañuls, Plotnick, & Hiltz, 2014). This research endeavors to learn the cognitive processing of risk information, provide individual-level data, and improve the mutual understanding between communicators and the public (see Figure 1, p.7). Findings of this research will be helpful for communicators regarding how to interpret different risks. More importantly, the findings will be significant to policy makers since efforts made toward the public-oriented direction might solve the dilemma for them, who want to base policy on the best scientific assessment of risk impact but also want to be responsive to public attitudes and opinions.

It is necessary to note that the social-cognitive approach for predicting risk information seeking is not particularly designed for research associated with environmental issues in China. Instead, this initial attempt is to provide implications for developing a more comprehensive framework that has the potential to be applied to different types of environmental risks in varied cultural contexts.

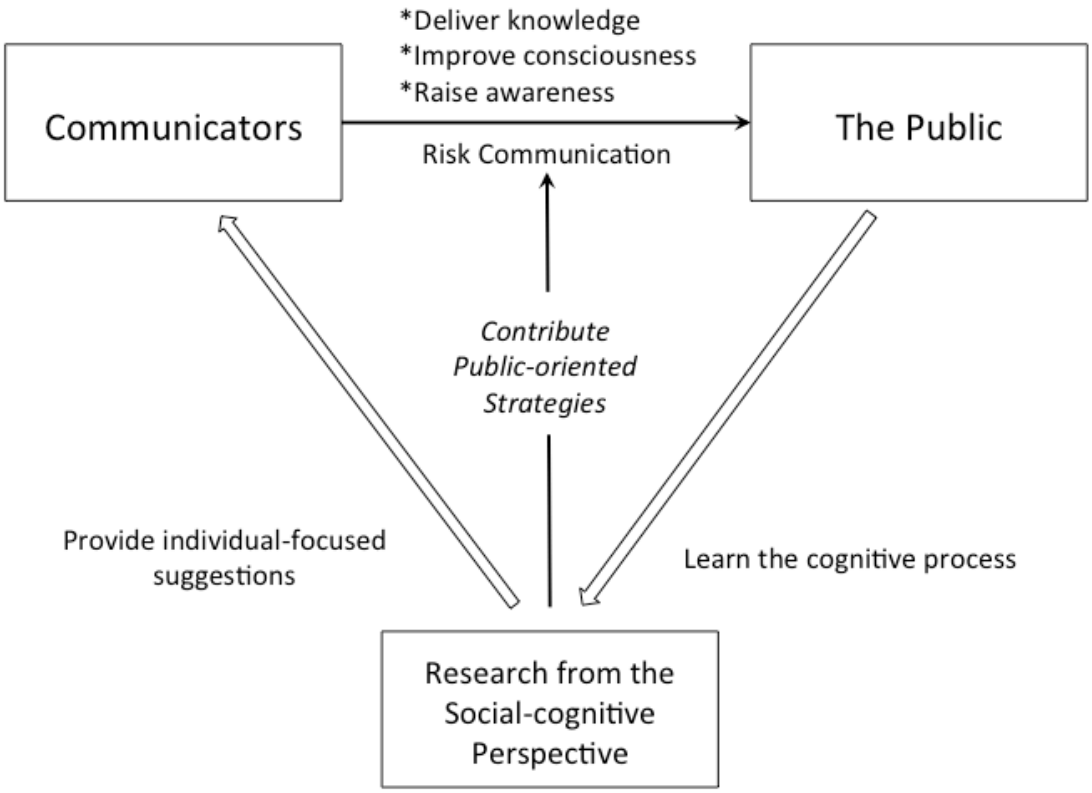

Figure 1. Expected contribution of this research to public-oriented risk communication.

1.3 Overview of the Contents

The contents of this research are arranged in five chapters. Chapter 1 is an introduction of the background, aims, and significance of this research. The rest parts of this research will be a systematical presentation of the development of the social-cognitive model, as well as findings and implications based on results of model testing (see Figure 2).

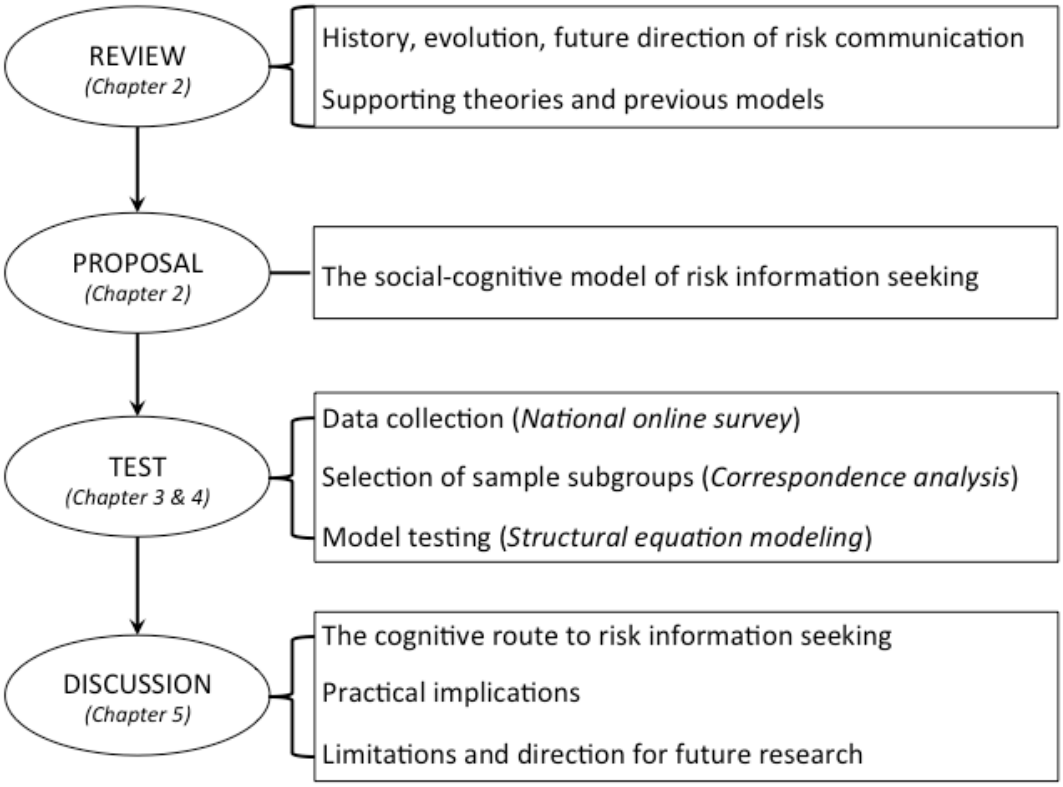

Figure 2. Main contents of the current research.

Specifically, Chapter 2 is the review of the theoretical basis and previous findings. To achieve a better public-oriented strategy, this chapter will first sketch the history and evolution of risk communication and point out the idea that why further efforts of communication should be made in a public-oriented and individual-focused direction. Then,

the literature regarding the prediction of information seeking behavior will be reviewed. Insights are mainly drawn from two famous behavioral change theories: the theory of planned behavior (TPB) and the social cognitive theory (SCT). Built upon these theories and early endeavors in model development, a social-cognitive model of risk information seeking will be proposed. An outline of proposed research questions and hypotheses will be demonstrated in this chapter.

Chapter 3 is the introduction of the methodology used in this research. Results will be reported in Chapter 4, including the profile of survey respondents, descriptive results, examination of the proposed model and the mediating role of perceived self-efficacy. Particularly, four groups of data will be analyzed to test the validity and applicability of the proposed model[1]. Results of correspondence analysis of the proximal relationship between current location, risk perception, and subjective knowledge regarding each case will be presented to justify the selection of groups.

Chapter 5 is the discussion on findings of this research. More focus will be put on the role of the information environment concerning its potential impact on individual behavior under conditions of risk. Practical implications of this research will be addressed as fully as possible in order to provide instrumental suggestions for communicators and policy makers. Limitations of this research and direction for future studies will also be acknowledged in this chapter.

[1] Data collected from Sichuan, Chongqing, Yunnan, Xinjiang, Qinghai, Gansu, Ningxia, Shandong, Hebei, Guangdong, and Fujian were used in the analysis of the earthquake risk model, n=378; data collected from Beijing, Tianjin, Hebei, and Shanghai were used in the analysis of the air pollution risk model, n=241; the national data were used in the analysis of the climate change risk model, n=1032; data collected from Guangdong, Zhejiang, Fujian, Jiangsu, Liaoning, and Beijing were used in the analysis of the nuclear radiation risk model, n=393.

Chapter 2. Literature Review

2.1 An Overview of the Development of Risk Communication

Basically, risk is defined as the potential of damage or loss caused by an activity (Brauch et al., 2011), the concept of which is frequently employed in research on health and environmental issues (Brauch et al., 2011; Cox, 2013). Considering the uncertain consequences, risk event usually draws particular attention of policy makers (Li, Guo, & Ito, 2015). For instance, as study of Witte, Meyer, and Martell (2001) suggested, when dealing with emergencies, action plans need to be prepared at the early stages for preventing and alleviating a threat; otherwise, when risk turns to a crisis, it might be more time and effort consuming to deal with the negative outcomes (Coombs, 2012). Beck (1992) asserted that the modern world confronted the limitation of its ability to manage the outcomes of rapid development. Currently, as many risks go inter organizational, no one could escape from the impact (Beck, Deng, & Shen, 2014). Such situation indicates that to be prepared becomes not only the task for policy makers but also the responsibility of each participant in a social system, either as individual or as group (Li et al., 2015). Reynolds and Seeger (2005) stated that, regardless of different types of risk, action plans had always included a significant public-targeted communication in the form of warnings, risk profile, as well as mitigation suggestions. Such process is closely associated with professional sensing and assessment of the risk. However, lessons are learned that merely delivering the scientific facts but neglecting the exchange of opinions between the communicator and the public tends to result in the failure of risk communication (Anderson, 1997; Covello & Sandman, 2001).

Risk communication has undergone a rapid development since the concept was widely discussed in the 1980s (Plough & Krimsky, 1987; Covello & Sandman, 2001). It is lead by the intention to deliver accurate and objective information to the public who need it for making personal relevant decisions. At the beginning, policy makers endeavored to educate the public with results of risk assessment (Leiss, 1996). However, the public became resistant to numbers. As Slovic (2010) criticized, such pedagogical way of communication failed to promote their willingness to concentrate on risks, which pushed risk communication to create alternative solutions to achieve the effectiveness.

In the next phase of development, risk communication began to pay attention to the public's response. Instead of throwing packages of statistical estimates to the public, policy makers realized they should figure out how to explain the data (Covello & Sandman, 2001). This two-way strategy included designing functional system for information transmission, dealing with the media, and sharing knowledge with the public. As a result, the delivery of risk information became more efficient than the early stage. However, Covello and Sandman (2001) argued that explaining the data was not enough; when people felt having control over a certain hazard, their reactions to it became voluntary. Such voluntarily might result in the optimism bias in risk response, an unrealistic optimism that makes people to believe that they are less at risk of being affected by a negative event. Frewer (2004) suggested that facing grander challenges in the modern risk society, besides satisfying the public's needs to be informed, communication should also value the partnership of the public.

According to Bandura's social cognitive theory (1986), people can actively learning

from their experience and rely on cognitive reasoning to guide behavior. From this perspective, this research concentrates on individuals' risk information seeking, a purposive, goal-directed, and significant forerunner for self-protective behavior (Kellens et al., 2012; Kievik & Gutteling, 2011; Mileti & Darlington, 1997; Paton & Johnston, 2001), attempting to discover ways of promoting the public's precautionary actions. Many empirical studies have supported the positive effects of information seeking on actual prevention behaviors regarding health and environmental risks (Moldovan-Johnson, Martinez, Lewis, Freres, & Hornik, 2014). Risk communication should be public-oriented and individual-focused. It needs to facilitate individuals' information seeking, helping them to gain more personal relevant information, get prepared, and make sound decisions under risk. Aiding individual precautionary behavior is expected to be a promising direction for future development of risk communication.

2.2 Theoretical Perspectives for Explaining Individual Behavior

2.2.1 The Theory of Planned Behavior

The theory of planned behavior (TPB) (Ajzen, 1991) is well known for its application to research on individuals' health and risk related actions. The TPB demonstrates the dynamics of human beings' cognitive structure that drives behavior (see Figure 3, p.13). As a basic rule, the TPB underscores that, the stronger the intention to engage in a behavior, the more likely should be its performance (Ajzen, 1991).

As shown in Figure 3 (p.13), behavioral intent could be predicted by three inter-correlated factors, including subjective norms, perceived behavioral control, and

attitude toward the behavior. According to Ajzen's introduction (1985), subjective norms refer to people's judgment on whether others think he or she should perform the behavior; perceived behavioral control refers to people's belief of the ease of performing a behavior; and, attitude toward the behavior refers to the extent to which people have a favorable or unfavorable outcome evaluation of a behavior (Li et al., 2015).

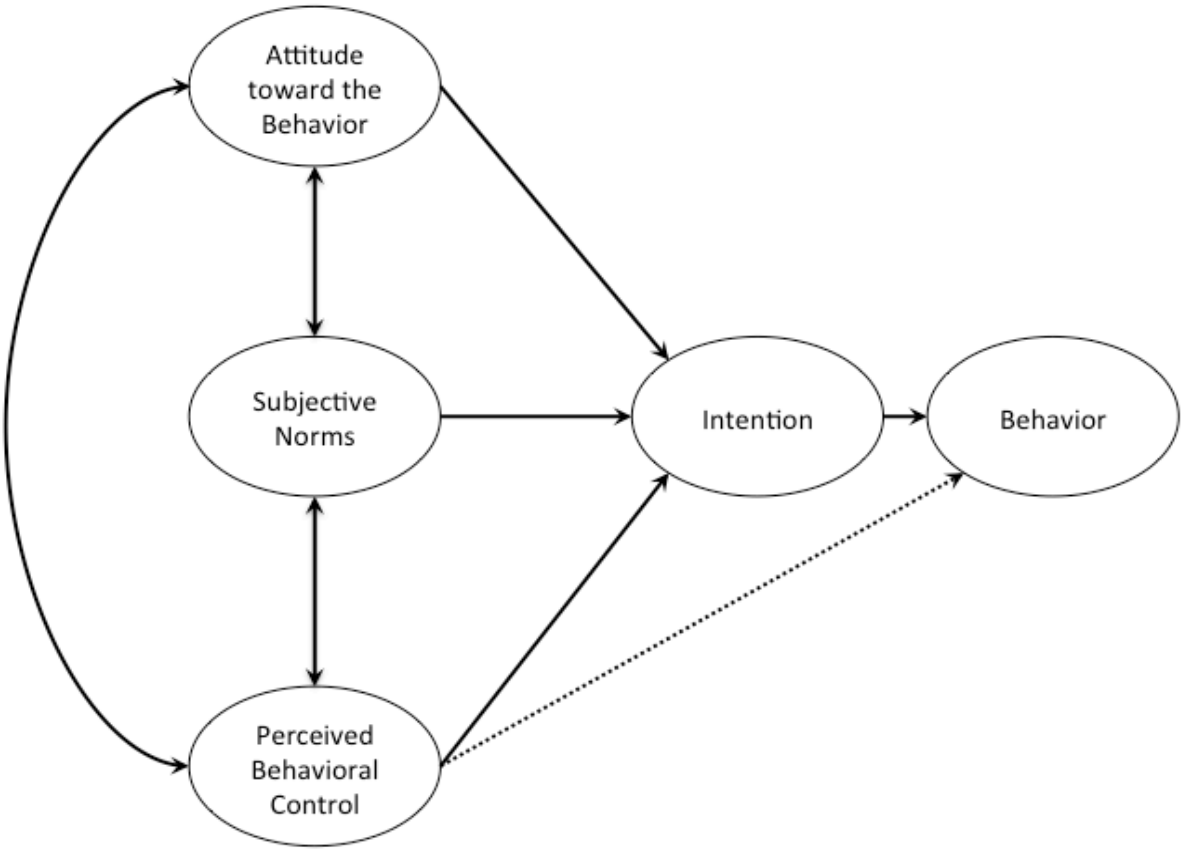

Figure 3. The theory of planned behavior (Ajzen, 1991, p. 182).

The TPB has been repeatedly used across a wide range of human actions, especially in health and risk related issues (Griffin, Dunwoody, & Neuwirthà, 1999). However, although the TPB is a valuable theoretical framework for motivating behavior, its validity and utility

have been criticized. First, McEachana, Conner, Taylor, and Lawton (2011) pointed out that findings of most of the empirical studies that support the TPB are based on analyses of the cross-sectional data collected from university students. When applying the theory to longitudinal examinations, or to samples of other populations, the predicted effect is not significant. Also, there is few experimental tests to confirm the assumptions of the TPB (Sniehotta, Presseau, & Araújo-Soares, 2014). Moreover, Conner, Godin, Sheeran, and Germain (2013) argued that the theory had an exclusive focus on rational reasoning but excludes the influence from emotional factors, which might be incompatible with research in the risk contexts (Li et al., 2015) where feelings and intuitive judgments could have considerable impact on behavior (Slovic et al., 2010).

2.2.2 The Social Cognitive Theory

Considering the limitations of the TPB, a stronger theoretical approach for predicting behavior needs to be explored. In fact, according to Ajzen (1991), founder of the TPB, much of the knowledge about the two central variables in his theory (i.e., perceived behavioral control and attitude toward the behavior) comes from Bandura's concepts of self-efficacy and outcome expectation, which are key concepts in the social cognitive theory (SCT) (Bandura, 1986). To obtain a more profound comprehension of individual behavior, this research intends to get back to the TPB's source of inspiration and develop a risk information seeking model from the social cognitive perspective.

Known as a theory of behavior change, the social cognitive theory concentrates on individuals' knowledge learning and the acquisition of behavior patterns (Denler, Wolters, &

Benzon, 2014). There are three major assumptions posited by the SCT. As shown in Figure 4, the first assumption concerns the reciprocal relationships among the environmental, personal, and behavioral determinants that act upon behavior (Bandura, 1986). In other words, at the individual level, the sets of contextual (e.g., perceived surroundings), psychological and cognitive (e.g., feelings, attitudes, knowledge), and behavioral factors (e.g., intentions) are influencing each other, and individual behavior is the product of the continuous interactions between them. The SCT claims that people can control and regulate their behavior in a purposive and goal-directed way. Through the observing and learning process, people evaluate their abilities and anticipate the outcomes of a certain behavior. The stronger people's confidence in their ability to execute a behavior, the more likely should be its performance; at the same time, if the outcome expected is valued, the frequency of behavior will increase, and when unfavorable outcomes are expected people will reduce the frequency of behavior (Bandura, 1997).

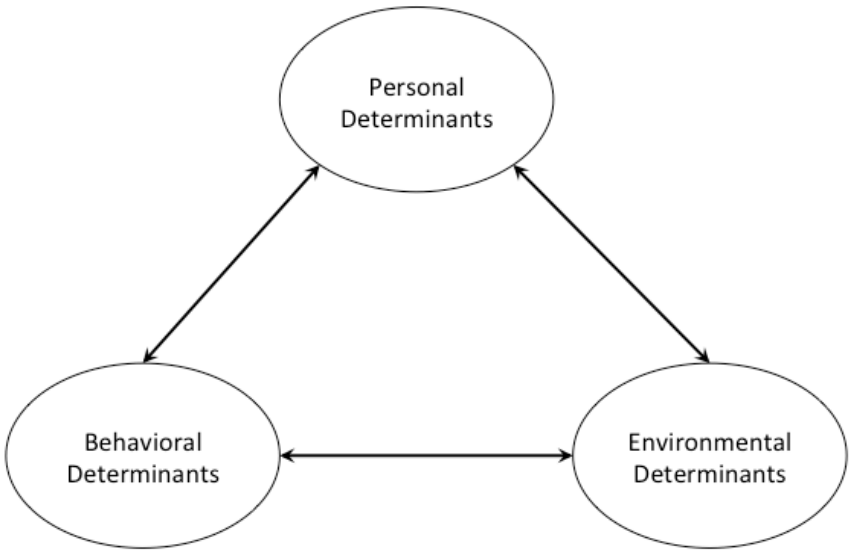

Figure 4. Schematization of the triadic reciprocal causation in the causal model of the SCT (Bandura, 2001a, p. 266).

The second assumption relates to the reconsideration about the environmental determinism advocated by many human development theories (Bandura, 1986). Conflicting with early assertions, the SCT believes that people have capabilities to influence own behavior, as well as the environment in a purposeful way (Denler et al., 2014). It is not a denial of the influence environment has on behavior, but it does question the single direction causality and underline that people can control over their environment through self-regulation (Bandura, 2001b).

The third major assumption is about the separation between learning and behaving. They may not occur at the same time because the causation between environmental, personal, and behavioral factors do not share the equal strength or happen simultaneously (Wood & Bandura, 1989). During observational learning, people often acquire various cognitive constructs such as knowledge, concepts, and values before directly mastering the behavior.

Within the SCT, there are four central concepts, including observational learning, outcome expectation, self-efficacy, and goal setting, which explain how people regulate themselves for developing (Denler et al., 2014). Learning takes place in a social context as a result of observation. By watching and imagining the consequences of a particular behavior, people may sketch their own outcomes and set goals to help them envision the future and generate action plans. The concept closely related to outcome expectation is people's perceived self-efficacy. It is a prominent discussion point, referring to people's beliefs in their ability to execute a certain behavior. A summary of major assumptions and central concepts in the SCT is presented in Figure 5 (p.17).

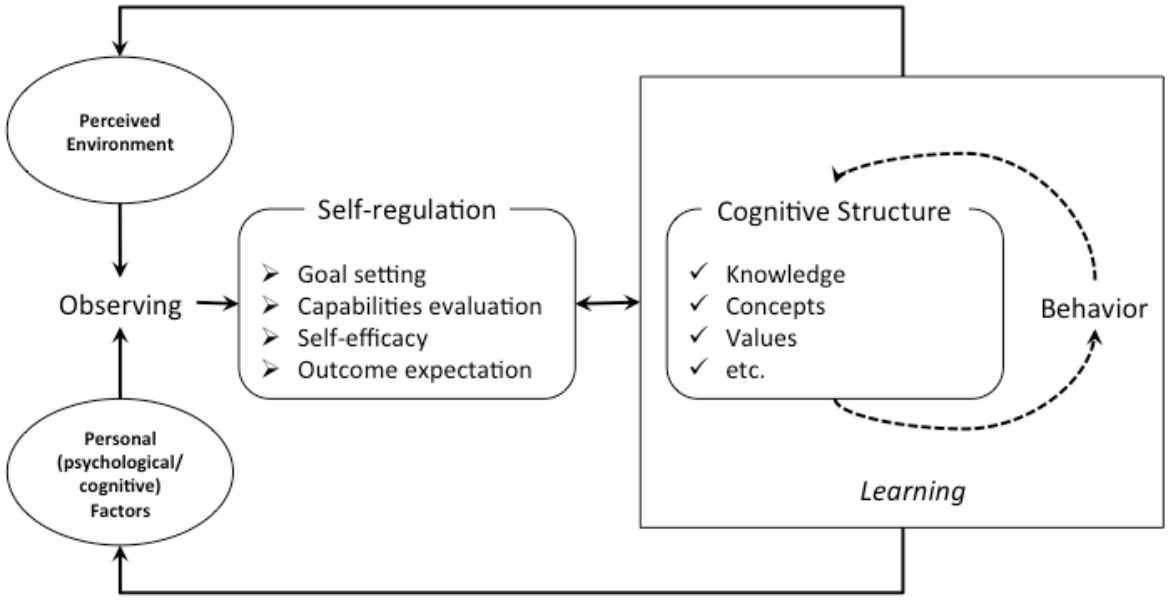

Figure 5. A summary of major assumptions and central concepts in the SCT.

The assumptions and key concepts of the SCT have been broadly adopted to research in diverse areas of human functioning (Denler et al., 2014). Bandura (1995, 2001b) claimed that among numbers of factors affecting human behavior, none could be more powerful than self-efficacy. This has been supported by many empirical studies showing that self-efficacy has the closest association with behavioral variables, and it is the strongest predictor of behavior change (Schwarzer & Fuchs, 1995). The concept of self-efficacy has been extensively adapted to research associated with health and risk related behaviors.

For instance, study of Martin, Bender, and Raish (2007) showed that efficacy beliefs significantly influenced homeowners' mitigation behaviors against wildfire risk. Study of Kievik and Gutteling (2011) suggested that higher perceived self-efficacy lead to higher levels of information seeking and the intention to engage in self-protective behavior against flood risk. Moser, Bruppacher, and Mosler (2011) had invited the concept of self-efficacy to

study on German residents' intentions to cope with risk from the diffusion of information and communications technology (ICT). They found that perceived coping efficacy largely increased people's intentions to search for ICT-related information and to take political actions against ICT risk. Bubeck, Botzen, and Aerts (2012) reviewed the factors that influenced individuals' flood mitigation behavior. They concluded that perceived self-efficacy showed great potential in driving flood mitigation behavior. Guerra, Cumsille, and Martínez (2014) analyzed data from a longitudinal project on adolescents' emotional response to the 2010 earthquake in Chile. Their findings indicated that the sense of personal efficacy would reduce the post-traumatic stress symptoms associated with the earthquake, which provided implications for preventive interventions for subsequent mental diseases.

2.3 Previous Models Predicting Risk Information Seeking

Information seeking is acknowledged as a process of purposive knowledge acquisition (Johnson & Johnson, 1997). Thus, people engage in such process when they intend to change their state of knowledge (Marchionini, 1997). Individuals' information seeking behavior has attracted great interests of risk communication research (Z. J. Yang et al., 2014). Focus has been put on the cognitive processing of risk information to explain how people understand and interpret the risk, as well as to explore the way of getting the public motivated for precautions. Previous studies have provided valuable findings on the prediction of individuals' information seeking behavior. The most insightful models are the risk information seeking and processing model (RISP) (Griffin, Dunwoody, & Neuwirth, 1999) and the planned risk information seeking model (PRISM) (Kahlor, 2007, 2010), which have

been repeatedly employed by following research (Z. J. Yang, Aloe, & Feeley, 2014). Previous findings based on the two models have enriched our knowledge about determinants of information seeking. Particularly, the individual-level determinants come to the fore.

The risk information seeking and processing (RISP) model was developed by Griffin et al. (1999) to predict individuals' seeking and processing of health risk information (see Figure 6). The RISP was built upon the adaptation and synthesis of the heuristic systematic model (Chaiken, Liberman, & Eagly, 1989) and the TPB (Ajzen, 1991), striving to construct an audience-based model that could be helpful for the development and maintenance of preventive health behavior among the public.

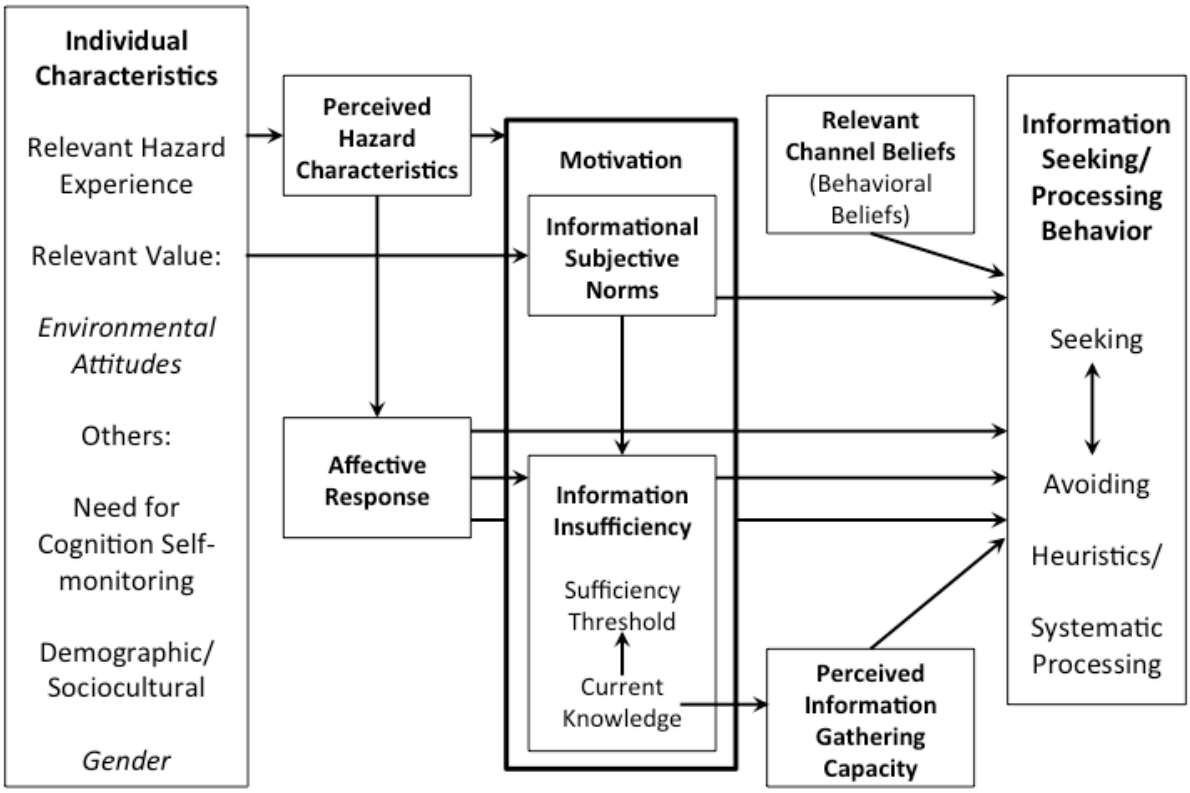

Figure 6. Risk information seeking and processing model (Griffin, Dunwoody, & Neuwirth, 1999; Z. J. Yang et al., 2014, p. 23).

Focusing on the individual-level predictors, as shown in Figure 6, the RISP proposed seven factors that having potential impact on information seeking and processing: individual characteristics, perceived hazard characteristics, affective response, information subjective norms, information insufficiency, behavioral beliefs, and perceived information gathering capacity. Results of model testing showed that behavioral beliefs, perceived information gathering capacity, affective response to hazard, informational subjective norms, and perceived information sufficiency had direct effect on information seeking and processing behavior. The model also suggests the important role of current knowledge, as significant predictor of both perceived information sufficiency and perceived information gathering capacity.

Following the primary assumptions of the RISP, Kahlor (2007, 2010) developed the planned risk information seeking model (PRISM) for predicting health risk information seeking (see Figure 7, p.21). The PRISM was first introduced as an augmented version of the RISP (Kahlor, 2007), which treated risk information seeking as a deliberate (planned) behavior. Based on a thorough review of main concepts of previous models (see Figure 7, p.21), the PRISM has been built by underlining the role of individual-level factors in order to predict information seeking behavior across contexts (Kahlor, 2007; Moldovan-Johnson et al., 2014).

The resulting integrated model indicated that attitude toward seeking and perceived seeking control were significant direct predictors of the intention of health risk information seeking. However, different from the RISP, the PRISM didn't demonstrate significant

influence of perceived knowledge on the outcome variable. The results imply that the insufficiency of information and knowledge may not directly and necessarily trigger people's information seeking. Even though people feel lack of knowledge and information, as long as they have a positive attitude toward information seeking, at the same time being confident in their information gathering capacity, they are likely to engage in information seeking.

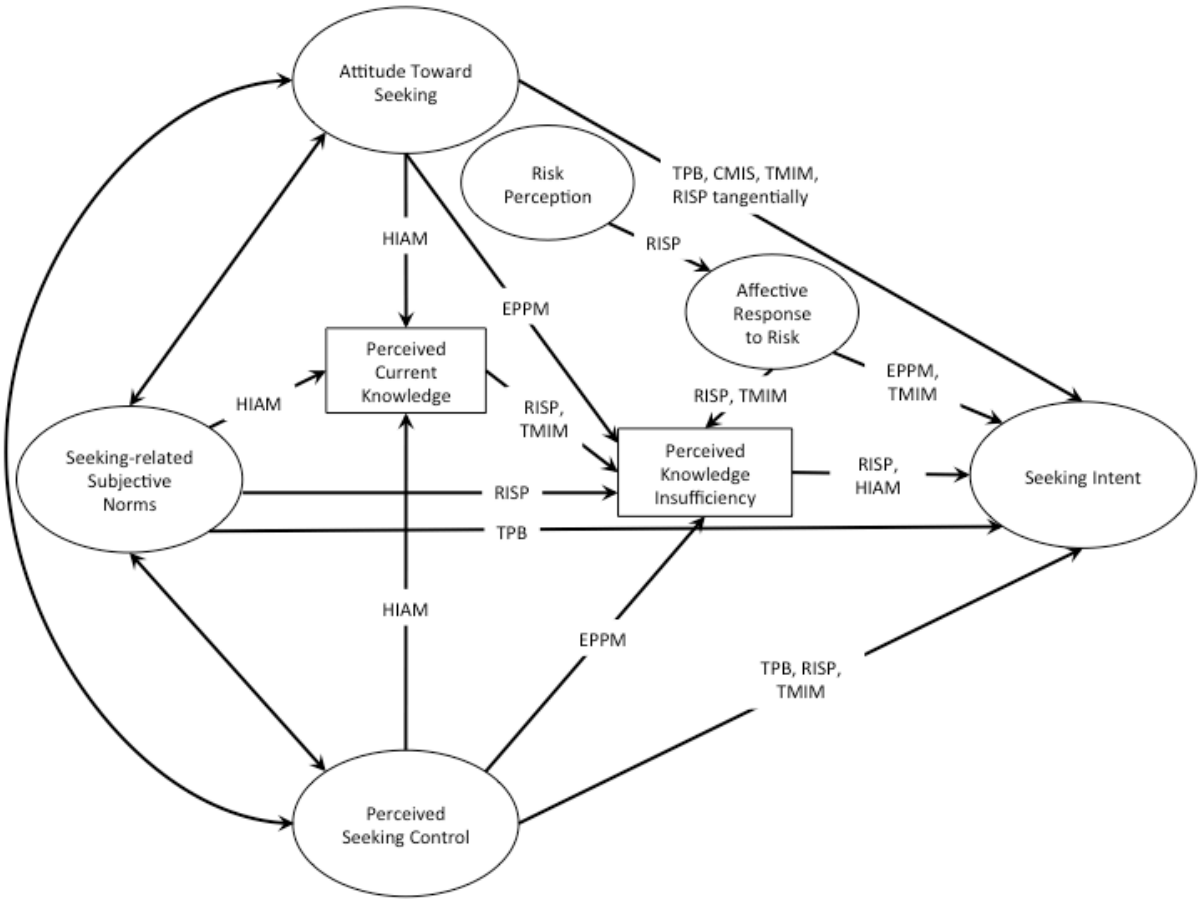

Figure 7. Planned risk information seeking model (Kahlor, 2010, p. 346).
Note. HIAM=the health information acquisition model (Freimuth, Stein, & Kean, 1989); EPPM=the extended parallel processing model (Witte, 1998); TMIM=the theory of motivated information management (Afifi & Weiner, 2004); CMIS=the comprehensive model of information seeking (Johnson & Meischke, 1993); TPB=the theory of planned behavior (Ajzen, 1991); RISP=the risk information seeking and processing model (Griffin, Dunwoody, & Neuwirth, 1999).

2.4 Model Development from A Social-cognitive Perspective

2.4.1 Key Factors

According to the literature, both of the risk information seeking and processing model and the planned risk information seeking model were developed on the basis of the theory of planned behavior (TPB). As reviewed before, comparing with the TPB, the social cognitive theory focuses more on the intrinsic cognitive functioning of human beings, which could aid a more profound understanding of how individual behavior is shaped and affected. Therefore, a social-cognitive model of risk information seeking is developed, attempting to obtain a more parsimonious but more incisive explanation of individuals' cognitive route to risk information seeking.

In general, with the purpose of contributing insights to the public-oriented risk communication, this research pays great attention to the role of the information environment since it is a major force behind the social construction of risk (Kull, Ramsay, & Lewis, 2003), determining individuals' interpretation and judgment of risks, as well as a main source of individuals' risk-related knowledge (Miles & Morse, 2007). Key factors that have been invited to the social-cognitive model are introduced as the following.

Risk Perception

Risk perception generally refers to the intuitive judgment of risk among laypeople, those who are supposed to have little professional knowledge about certain hazardous event (Finucane et al., 2000; Loewenstein, Weber, Hsee, & Welch, 2001; Slovic et al., 2010). The concept is most commonly used in reference to people's perception toward environmental

and health threats (Berry, 2004; Cox, 2013; Fischhoff, 1995; Slovic, Fischhoff, & Lichtenstein, 1982). Previous research suggests that laypeople subjectively define risks by their feelings that serve as a mental shortcut to guide people's judgments (Slovic et al., 2010). There is a wide array of personal (e.g., experience) (Barnett & Breakwell, 2001; Kung & Chen, 2012), social (e.g., the media) (Wahlberg & Sjöberg, 2000) and cultural (e.g., values) (Peters & Slovic, 1996; Wachinger, Renn, Begg, & Kuhlicke, 2013) factors to influence people's feelings about risks.

Through identifying these feelings, risk perception can be quantified (Slovic, 1987). In the pioneer research of Fischhoff et al. (1978), nine feelings (i.e., voluntariness of risk, immediacy of effect, knowledge of laypeople and scientists, control over risk, newness, chronic-catastrophic, common-dread, and severity of consequences) were used to indicate perceptions of 30 actual or acceptable risks. By factor analysis, they grouped these feelings into two factors, which were later labeled dread risk and novelty risk by Sjöberg (2003), to explain how people perceived numerous threats in daily life. The basic operations of such psychometric approach have been replicated many times to map the cognitive structure of different risks. Examples are not only found in the Western contexts (Coles & Hodgkinson, 2008; Lazo, Kinnell, & Fisher, 2000; Slovic, 1987) but also in studies using Chinese samples (Kung & Chen, 2012; Lai & Tao, 2003; J. Zhang, 1994).

Kasperson et al. (1988) explained risk perception as a result of social amplification. A single risk event would be encoded by different stations (e.g., experts, organizations and public agencies, news media, peers and relatives) in a network of socially mediated

communication channels (Masuda & Garvin, 2006). Within information flow in this network, a series of signals carried by messages about the risk are intensified or weakened, causing amplification or attenuation of people's risk perception. Such perspective has been summarized as a theoretical framework, which is known as the social amplification of risk framework (SARF) (Kasperson et al., 1988). Figure 8 presented a highly simplified representation of the SARF, which could be adapted to explaining the generation of interpretations of risk and the subsequently ripple effects in a society.

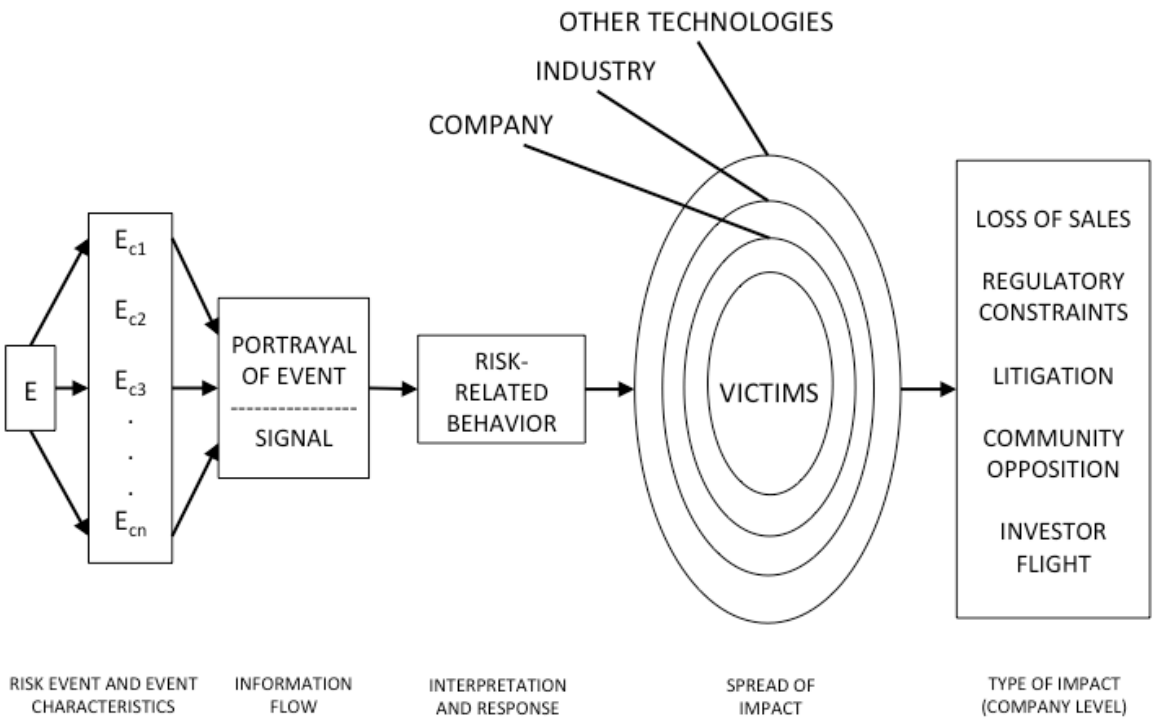

Figure 8. A highly simplified representation of the SARF (Kasperson et al., 1988, p. 182).

Information Environment, Information Quality, and Knowledge of Risk

According to Beck's (1992) assertion, risks are socially effective only within knowledge (Adam, Beck, & Loon, 2000). How people know a risk largely decides how the risk is conceptualized and how the characteristics of the risk are identified (Böhme, 1997; Böhme & Stehr, 1986; Stehr, 1994). Hence, the risk society is seen as a knowledge society

(Beck, 1992), in which we need to think over the production of knowledge that gives birth to risks, and the debate between different types of knowledge that characterizes risks (Strydom, 2002). In the modern society, the media plays an outstanding role in producing, spreading, and interpreting knowledge comparing with other communication channels (Kasperson et al., 1988; Kitzinger, 1999; P. C. Stern & Fineberg, 1996), owing to which the risk society can be seen as a communication society (Delanty, 1999). As the advancement of telecommunication technologies, the media becomes a major source of risk-related knowledge for the public (Dahlstrom, Dudo, & Brossard, 2012; Miles & Morse, 2007; Wahlberg & Sjöberg, 2000).

Both knowledge and information will help people to form the image of risks. As one of the significant predictors among diverse personal and outside determinants, knowledge is widely included in discussions. It was originally assumed that, a large volume of risk-related knowledge people have could lead to a low level of risk perception because knowledge might ensure a more comprehensive evaluation of risks to reduce people's sense of uncertainty. However, most of the existing evidence has rejected such assumption and suggested that knowledge about risks increase people's risk perception (Wachinger et al., 2013). These results could be interpreted by considering knowledge as an incentive that induces more people's efforts to imagine the consequences, especially the negative outcome, of risks. Hence, the more people know about the risk, the higher their risk perception will be. Considering the influence of the information environment, the role of information features cannot be ignored. For instance, quality is one important aspect of information features. A sufficient amount of high-quality information with easy access, from credible sources,

understandable, and showing the complete information is very likely to compensate for people's shortage of risk-related knowledge.

Self-efficacy and Outcome Expectation

This research proposes that perceived self-efficacy and outcome expectation regarding risk information seeking closely associate with and will considerably cause the actual behavior. Based on the explanation of sources of efficacy beliefs (Bandura, 1997), perceived information quality, risk perception, and subjective knowledge are invited as major sources of perceived self-efficacy and outcome expectation in this research.

Bandura (1997) stated that, among the individual-level factors, mastery experience and psychological state could be two major contributors of people's self-efficacy and outcome expectation. Accordingly, the more high-quality information people receive and the more knowledge people think they have, the stronger their sense of mastery will be. High-quality information and knowledge people obtained with the exposure to the information environment will provide the most authentic evidence to assure them that they will succeed in future information seeking and knowledge learning. Meanwhile, high level of risk perception will play the role of psychological stimulus, changing people's psychological states and persuading them to instill more beliefs to boost precautionary behavior.

Based on the literature, assumed relationships among key factors that could affect individuals' risk information seeking are presented in Figure 9 (p.27).

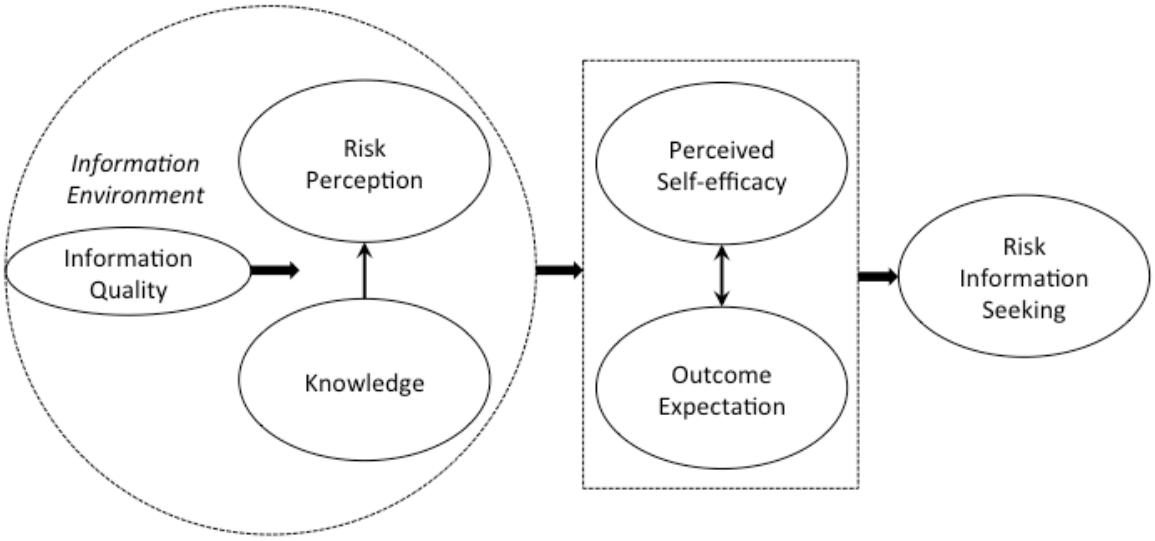

Figure 9. Assumed relationships among key factors that could affect individuals' risk information seeking.

2.4.2 Model Construction and Hypotheses

In order to explore how Chinese people's information seeking is generated with their exposure to the information environment, this research proposes the social-cognitive model and hypotheses in Figure 10 (p.29).

H1: Chinese people's perceived information quality will increase their environmental risk perception.

H2: Chinese people's knowledge about environmental risks will increase their environmental risk perception.

H3: Chinese people's perceived information quality will increase their knowledge about environmental risks.

H4-1: Chinese people's environmental risk perception will increase their perceived self-efficacy regarding information seeking.

H4-2: Chinese people's environmental risk perception will increase their outcome expectation regarding information seeking.

H5-1: Chinese people's perceived information quality will increase their perceived self-efficacy regarding information seeking.

H5-2: Chinese people's perceived information quality will increase their outcome expectation regarding information seeking.

H6-1: Chinese people's knowledge about environmental risks will increase their perceived self-efficacy regarding information seeking.

H6-2: Chinese people's knowledge about environmental risks will increase their outcome expectation regarding information seeking.

H7: Chinese people's perceived self-efficacy regarding information seeking will increase their behavior.

H8: Chinese people's outcome expectation regarding information seeking will increase their behavior.

In addition, according to Bandura (1995), outcome expectancy depends largely on individuals' judgments of how well they can perform in given situations (perceived self-efficacy). However, other empirical studies imply contradictory causation between self-efficacy and outcome expectation (Williams, 2010). Therefore, this research assumes a bidirectional relationship between the two variables and proposes the following hypothesis:

H9: Chinese people's perceived self-efficacy regarding information seeking is significantly associated with their outcome expectation.

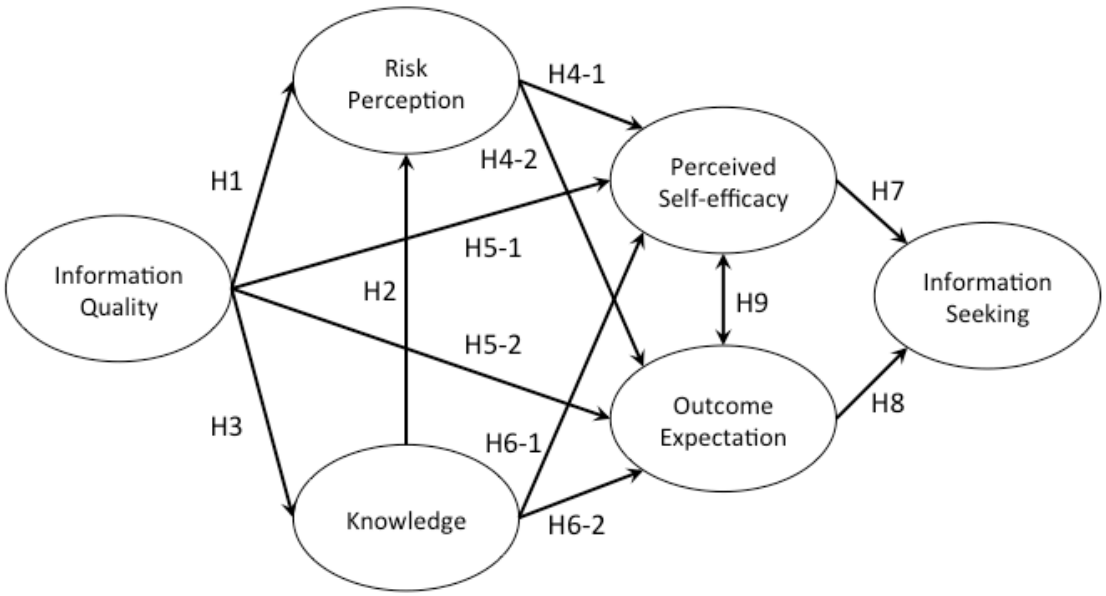

Figure 10. Construction of the social-cognitive model and hypotheses in this research.

2.4.3 Case Selection for Model Testing

Some of the environmental issues are resulting from natural causes and difficult to predict, such as earthquake, flood, landslide, drought, etc.; some are non-natural occurrences that are resulting from human decisions and activities, such as air pollution, chemical waste, unsafe food, urbanization, etc.; some are resulting from both natural forces and human influence and therefore classified as hybrid disasters (Shaluf, 2007), such as climate change, freshwater shortage, species extinction, nuclear radiation, etc.

Previous studies often indicate two types of environmental hazards: the natural-caused ones and the man-induced ones (Duan, 2005; Z. Yang, Seong Nam, & Lindell, 2009; J. Zhang, 1994; L. Zhang, He, Mol, & Lu, 2013). However, researchers should be aware of the significance of studying events that own the combined features of natural and man-made hazards. For instance, in the Great East Japan Earthquake, the most powerful earthquake ever

recorded to have hit Japan triggered powerful tsunami waves that caused serious nuclear accidents. A series of losses made it the costliest natural disaster in world history (Kim, 2011) and raised the awareness of threats from both earthquake and nuclear radiation. Environmental hazards with combined features are worth investigating because human activities are now the principal drive of many environmental changes (UNEP, 2012) that makes dealing with environmental issues a more difficult task than before.

In order to examine the proposed social-cognitive model with different types of environmental hazards, four cases that representing natural hazards, man-made hazards and hazards with combined features are selected (i.e., earthquake risk, air pollution risk, nuclear radiation risk, and climate change risk). Earthquake is selected as a typical natural hazard. Located between two largest seismic belts (the Circum-Pacific seismic zone and the Alpine-Humalayan seismic zone), China is a country experiencing many earthquakes that happen frequently and intensely. Earthquake is seen as a major natural threat to China and causes increasing public concerns especially since the 2008 Wenchuan Earthquake and the Great East Japan Earthquake happened in the neighbor country. Air pollution is one serious man-made problem, causing health-harmful living conditions in many cities in China. A study (Chen, Ebenstein, Greenstone, & Lie, 2013) on the impact of sustained exposure to air pollution on life expectancy showed that air pollution had made the residents of the Northern China to have a life expectancy about 5.5 years shorter than the residents of other regions. In recent years, perceptions of risk from air pollution become a major preoccupation among Chinese people who have paid much more attention than before on information associated

with air pollution. In addition, to test whether the social-cognitive model is applicable to the context of hazards with combined features of natural hazards and man-made hazards, nuclear radiation risk and climate change risk are also selected by this research. To justify the selection of data groups for analyzing cases of earthquake risk, air pollution risk, and nuclear radiation risk, correspondence analysis of the proximal relationship between current locations of the respondents, risk perception, and subjective knowledge regarding each case has been conducted, and the results are presented in the fourth chapter of this dissertation.

Note:

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Chapter 3. Methodology

3.1 Data Collection

Data used in this research were collected via a public opinion survey on media use and environmental risks that was conducted from September 10 to 13, 2013 among mainland Chinese people. Participants were recruited from a panel of NTT Communications. The panel contains people in six areas of mainland China (i.e., the East China, the Northeast China, the North China, the South Central China, the Northwest China, and the Southwest China).

An invitation email with the URL link of the web-based questionnaire was sent to 12026 Chinese people. There were 2889 people answered the questionnaire. Finally, a total of 1032 valid questionnaires were gathered from 22 provinces[2], 4 province-level municipalities[3], and 4 autonomous regions[4] in mainland China (response rate=8.58% and questionnaire completion rate=35.7%). The response rate is acceptable if the demographic characteristics of the survey respondents were balanced according to the population under study (Valenzuela, Park, & Kee, 2009). The sample for this research was considered representative of the China adult population as reported in the 2013's data from the National Bureau of Statistics of China (NBS, 2013).

To examine the proposed model in the context of earthquake risk, air pollution risk, nuclear radiation risk and climate change risk, this research analyzed four groups of data. Specifically, data collected from Sichuan, Chongqing, Yunnan, Xinjiang, Qinghai, Gansu,

[2] Anhui, Fujian, Jiangsu, Jiangxi, Shandong, Zhejiang, Heilongjiang, Jilin, Liaoning, Hebei, Shanxi, Henan, Hubei, Hunan, Guangdong, Hainan, Gansu, Qinghai, Shaanxi, Guizhou, Sichuan, and Yunnan
[3] Beijing, Tianjin, Shanghai, and Chongqing
[4] Inner Mongolia, Xinjiang, Ningxia, and Guangxi

Ningxia, Shandong, Hebei, Guangdong, and Fujian (*n*=378) were used to test the model with earthquake risk. Data collected from Beijing, Tianjin, Hebei, and Shanghai (*n*=241) were used to test the model with air pollution risk. Data collected from Guangdong, Zhejiang, Fujian, Jiangsu, Liaoning, and Beijing (*n*=393) were used to test the model with nuclear radiation risk. The complete dataset (*n*=1032) was used to test the model with climate change risk.

3.2 Measurements

This research has adopted and revised scales in previous studies to measure the variables in the proposed model (see Table 1, p.34). Figure 11 (p.35) illustrates the variables, components and paths of the proposed path model under the estimation of structural equation modeling (SEM).

Table 1

Measurements of Variables in the Proposed Social-cognitive Model

Variable	Item
Risk Perception	*Perceived Riskiness (R)*: How risky do you consider the hazard to be?
	Perceived Dread (D): How scared do you feel when you think of the hazard?
	Perceived Catastrophe (C): How much do you think the hazard will be harmful?
	Worry (W): How much are you worried about the hazard?
Information Quality (IQ)	*IQ1:* Information from media is easily accessible.
	IQ2: Information from media is credible.
	IQ3: Information from media is understandable.
	IQ4: Information from media is sufficient.
	IQ5: Information from media is comprehensive.
Knowledge	How much knowledge do you think you have about the hazard?
Self-efficacy (SE)	*SE1*: I have confidence in my ability to understand relevant information.
	SE2: I have confidence in my ability to search for relevant information.
	SE3: I have confidence in my ability to evaluate the credibility of relevant information.
Outcome Expectation (OE)	*OE1*: I believe that, by information seeking, my knowledge will be increased.
	OE2: I believe that information seeking will make me alert to the hazard.
	OE3: I believe that information seeking will help me to be well prepared for the impact from the hazard.
Information Seeking (IS)	*IS1*: I have intentions to search for relevant information.
	IS2: I often attend to relevant information.
	IS3: I often search for relevant information.

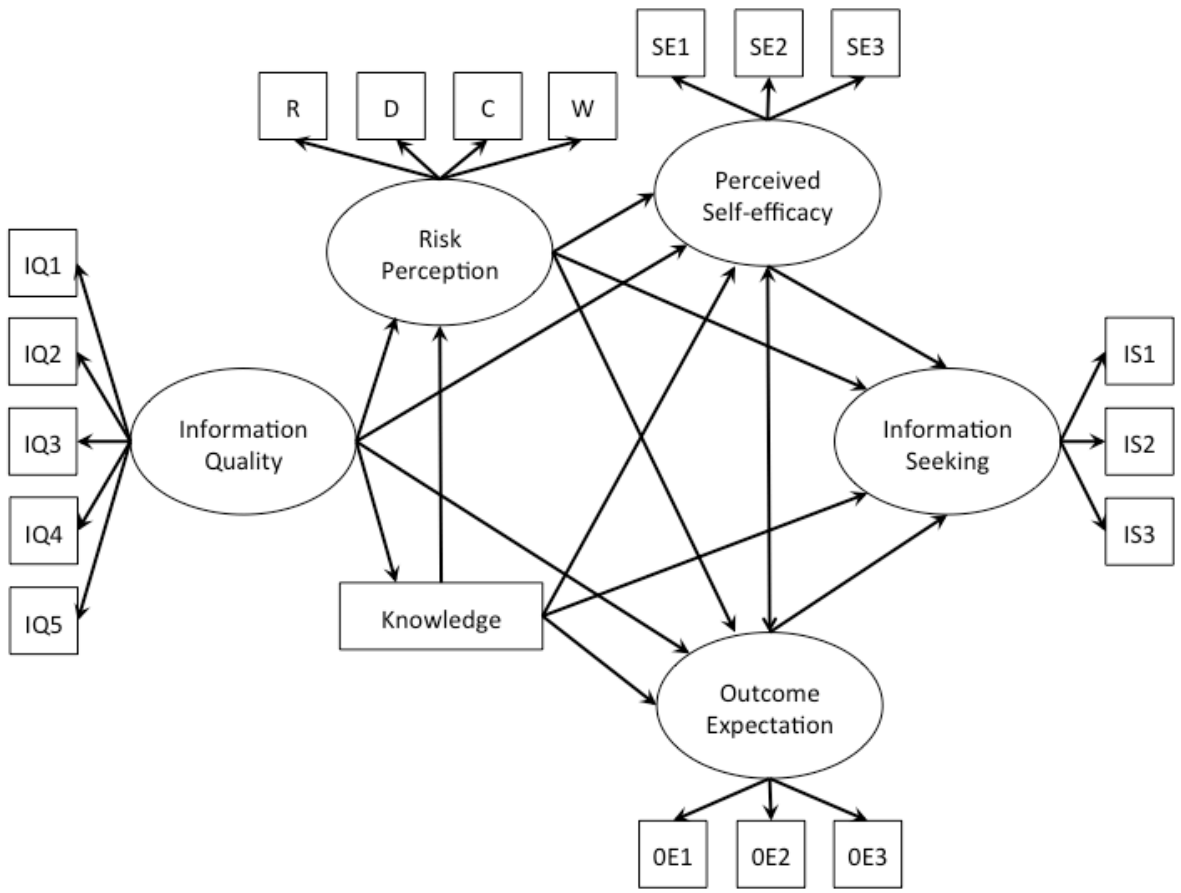

Figure 11. Variables, components, and paths under the structural equation modeling (SEM) framework.
Note. IQ=perceived information quality; R=perceived riskiness, D=perceived dread, C=perceived catastrophe, W=worry; SE=perceived self-efficacy; OE=outcome expectation; IS=risk information seeking.

Environmental Risk Perception

As reviewed in the second chapter, risk perception is conceptualized as laypeople's intuitive judgments on the impact of risk. It can be quantified by assessing their feelings about risks. This research has selected four characteristics of risk-related feelings from previous research that have been frequently employed in studies associated with environmental risk (Barnett & Breakwell, 2001; Duan, 2005; Fischhoff, 1995; Lai & Tao, 2003; Slovic, 1987; Wachinger et al., 2013; L. Zhang et al., 2013). For each case, participants were asked to estimate how they felt risky (R), dreadful (D), catastrophic (C), and worried

(W) about a specific hazard. All the items were rated on 7-point scales (1=*not at all* and 7=*extremely*).

Information Quality (IQ)

Quality is one significant aspect of information features that has potential impact on perception and behavior of the audience. For each case, information quality was measured by asking the participants to evaluate the accessibility (IQ1), credibility (IQ2), understandability (IQ3), sufficiency (IQ4), and comprehensiveness (IQ5) of information they received. These five categories were modified from previous studies (Dutta, Pfister, & Kosmoski, 2010; Wang & Strong, 1996). All the items were rated on 7-point scales (1=*not at all* and 7=*extremely*).

Knowledge

Knowledge was measured by asking the participants how they thought they knew the hazard (1=*none* and 7=*a great deal*). Therefore, knowledge evaluated in this research reflected the Chinese people's perception of their knowledge about environmental risks. Although the actual knowledge level is supposed to be more persuasive than self-reported knowledge in explaining the public's environmental consciousness and behavior, subjective knowledge could have tighter association with media information, which is one of the major hypotheses this research intends to confirm.

Perceived Self-efficacy (SE)

Perceived self-efficacy was invited as a vital factor in the proposed social-cognitive model to predict risk information seeking behavior. Adapted and modified from previous

findings (Griffin, Dunwoody, & Neuwirth, 1999; Kahlor, 2007, 2010; Kellens et al., 2012; Z. J. Yang et al., 2014), three items were designed to measure perceived self-efficacy regarding risk information seeking. For each case, participants were asked to what extent they had confidence in their abilities to understand (SE1), search for (SE2), and evaluate the credibility of (SE3) information they got from the media. All the items were rated on 7-point scales (1=*not at all* and 7=*extremely*).

Outcome Expectation (OE)

Outcome expectation is another key concept of the social cognitive theory, which has a close relationship with perceived self-efficacy and directly determines individuals' behavior pattern. Three items were designed based on the social cognitive theory (Bandura, 1986) and used to measure outcome expectation regarding risk information seeking. For each case, participants were asked how they believed information seeking would increase their knowledge (OE1), make them alert to (OE2), and let them be well prepared for (OE3) environmental risks. All the items were rated on 7-point scales (1=*not at all* and 7=*extremely*).

Risk Information Seeking (IS)

Information seeking in this research is viewed as behavioral response to environmental risks, presenting the totality of actions motivated by individuals' recognition of insufficient knowledge. Three items were used to measure risk information seeking (Kuhlthau, 1991). For each case, participants were asked to what extent they had intentions (IS1), attended to (IS2), and searched for (IS3) risk information. All the items were rated on 7-point scales (1=*not at*

all and 7=*extremely*).

3.3 Analytical Strategy

Basic statistical analyses are performed by using SPSS, including descriptive reports of the respondents' profile, correlations among variables, regressions that examining hypothesized causality, and dimension reduction that reducing variables to limited numbers of factors.

For model testing, AMOS is used to perform the structural equation modeling (SEM), which is to test the fit between a hypothesized model and a dataset. SEM can examine assumed causal relationships by multiple regressions and explore latent structural relations among variables. In speaking of the parameters, X^2 value will be reported as an index of model adequacy, where a nonsignificant value suggests good model fit. However, the value of X^2 is sensitive to sample size (Bollen, 1989). If it is significant, the model should be seen as unacceptable. However, when the sample size exceeds 200, and other indices indicate acceptable model fit, the significance of X^2 value can be disregarded (Moss, 2009). In such situation, the ratio of X^2 divided by the degree of freedom (*df*) may be reported, where a value less than five also suggests acceptable model fit (Kline, 2011).

Moreover, the comparative fit index (CFI), Tucker-Lewis index (TLI), standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA) will be reported, which demonstrate how well the specified model explains the data. Values of CFI and TLI range from 0.00 to 1.00, where 0.90 and above represents good fit. SRMR equal to or less than 0.05 means good fit, and the smaller the SRMR, the better the

model fit. RMSEA value from 0.08 to 1.00 suggests reasonable error of approximation, and the value less than 0.06 indicates perfect model fit.

In order to test the hypothesized mediation effects, maximum likelihood bootstrapping will be performed. The amount of mediation is measured by the size of the indirect effect. Indirect effect size can be obtained by multiplying the coefficients for each subpath from the predictor variable to the outcome variable. The statistical significance of the indirect effect can be found in the estimation results of structural equation modeling.

Chapter 4. Results

4.1 Profile of Survey Respondents

A total of 1032 valid responses were collected through the national online survey. Among the respondents, there are 511 male (49.5%) and 521 female (50.5%) with age ranging from 18 to 65 years old (*M*=33.78, *SD*=9.22). Regarding socioeconomic status, 23.3% of the respondents have a monthly income which is equal to or less than 3,000 RMB, 55.4% of the respondents have a monthly income at the level of 3,001 to 8,000 RMB, and 21.4% of the respondents report they have a monthly income which is more than 8,000 RMB. A majority of the respondents (68.0%) have a university degree, and 6.0% of the respondents have a master's degree or doctorate. Most of the respondents (55.2%) indicate they are working for an enterprise or company as managers or general staff. General statistics for the demographic characteristics of respondents are presented in Table 2a (p.41) and Table 2b (p.42).

Table 2a

Statistics for the Demographic Characteristics of Respondents (1)

Variable	Option	*n*	%
Gender	Male	511	49.5
	Female	521	50.5
Age	18-30 years old	411	39.8
	31-40 years old	414	40.1
	41-50 years old	153	14.9
	51-65 years old	54	5.2
Location*	East China	324	31.4
	Northeast China	96	9.3
	North China	141	13.7
	South Central China	282	27.3
	Northwest China	73	7.1
	Southwest China	116	11.2

Note. *East China: Anhui, Fujian, Jiangsu, Jiangxi, Shandong, Zhejiang, and Shanghai; Northeast China: Heilongjiang, Jilin, and Liaoning; North China: Hebei, Shanxi, Inner Mongolia, Beijing, and Tianjin; South Central China: Henan, Hubei, Hunan, Guangdong, Hainan, and Guangxi; Northwest China: Gansu, Qinghai, Shaanxi, Ningxia, and Xinjiang; Southwest China: Chongqing, Guizhou, Sichuan, Yunnan, and Tibet. However, no data were collected from Tibet.

Table 2b

Statistics for the Demographic Characteristics of Respondents (2)

Variable	Option	*n*	%
Income	None	52	5.0
	Bellow 500 yuan	10	1.0
	501-1,000 yuan	16	1.6
	1,001-1,500 yuan	26	2.5
	1,501-2,000 yuan	32	3.1
	2,001-3,000 yuan	104	10.1
	3,001-5,000 yuan	304	29.5
	5,001-8,000 yuan	267	25.9
	Above 8,000 yuan	221	21.4
Educational attainment	Primary school and below	1	0.1
	Junior high school	5	0.5
	Senior high school/Vocational and technical schools	60	5.8
	Junior college	202	19.6
	University	702	68.0
	Postgraduate (Master's degrees and Doctorates)	62	6.0
Occupation	Students	81	7.8
	Leaders and cadres of Party and government organizations and public institutions	15	1.5
	General staff of Party and government organizations and public institutions	66	6.4
	Senior and middle management of enterprises or companies	313	30.3
	General staff of enterprises or companies	257	24.9
	Specialized technical personnel	182	17.6
	Employees of commercial service industry	16	1.6
	Workers of manufacturing and productive enterprises	25	2.4
	Self-employed entrepreneurs or self-employed persons	37	3.6
	Migrant workers from rural areas	1	0.1
	Laborers in agriculture, forestry, animal husbandry and fishery	3	0.3
	Retirees	15	1.5
	Jobless/laid-off/unemployed people	7	0.7
	Others	14	1.4

4.2 Descriptive Results

4.2.1 Risk Perception and Subjective Knowledge

To demonstrate how earthquake risk, air pollution risk, nuclear radiation risk and climate change risk are viewed in Chinese people's eyes, Table 3 first presents rankings of the four events in terms of people's feelings about them. According to the results, Chinese people worried a lot about nuclear radiation and air pollution risks. These hazards were rated as very perilous that people were highly afraid of and thought the impact of them were most harmful. Earthquake was rated less risky, dreadful, and catastrophic, which caused less concerns among the Chinese people. People viewed climate change risk not very risky or dreadful, and they thought it slightly harmful, which didn't cause too much worry among them. Table 4 (p.44) then shows a ranking of the four environmental hazards on Chinese people's subjective knowledge of them. In general, all the four cases were rated above the neutral level.

Table 3

Rankings of the Four Cases on Four Dimensions of Environmental Risk Perception

Ranking	Riskiness (R)	Dread (D)	Catastrophe (C)	Worry (W)
1	Air pollution (M=5.46, SD=1.24)	Nuclear radiation (M=5.38, SD=1.61)	Nuclear radiation (M=5.86, SD=1.23)	Air pollution (M=5.41, SD=1.32)
2	Nuclear radiation (M=5.43, SD=1.58)	Earthquake (M=5.03, SD=1.49)	Air pollution (M=5.66, SD=1.14)	Nuclear radiation (M=5.38, SD=1.56)
3	Earthquake (M=5.29, SD=1.30)	Air pollution (M=4.90, SD=1.45)	Climate change (M=5.35, SD=1.25)	Earthquake (M=5.01, SD=1.57)
4	Climate change (M=4.94, SD=1.31)	Climate change (M=4.27, SD=1.61)	Earthquake (M=5.22, SD=1.45)	Climate change (M=4.99, SD=1.46)

Note. n=1032.

Table 4

Rankings of the Four Cases on Subjective Knowledge

Ranking	Subjective Knowledge	*M*	*SD*
1	Air pollution	4.83	1.23
2	Climate change	4.58	1.24
3	Earthquake	4.57	1.25
4	Nuclear radiation	4.08	1.45

Note. n=1032.

4.2.2 Proximal Map of Risk Perception, Subjective Knowledge, and Locations of Respondents

To further justify the selection of data groups for the analyses of earthquake risk, air pollution risk, and nuclear radiation risk, correspondence analysis was conducted. Such analysis is often used to determine the proximal relationships among two or more categorical variables. A key part of correspondence analysis is the multi-dimensional map as part of the output (Starkweather, 2014). The map allows researchers to visualize the relationships spatially on dimensional axes, showing which categories are close to other categories on empirically derived dimensions (Starkweather, 2014). Two-dimensional maps of symmetrical normalization regarding the three cases (i.e., earthquake, air pollution, and nuclear radiation) were obtained. Points represent the levels of risk perception and subjective knowledge about each case (an aggregated index). Circles represent locations of respondents.

Earthquake Case

According to the China Seismic Information (CSI) (2014), China's seismic activities mainly take place in 23 seismic belts in five areas. Besides Taiwan and its nearby sea areas, the other four areas include the Southwestern China (Tibet, Sichuan, Yunnan), the

Northwestern China (Gansu, Hexi Corridor, Qinghai, Ningxia, Tian Mountain areas), the Northern part of China (two sides of Taihang Mountain, river beds of Fen river and Wei river, Yin Mountain-Yan Mountain area, Shandong-Bo Hai Bay), and the Southeastern coast of China (Guangdong, Fujian). Therefore, eleven provinces were first identified from the areas mentioned above in mainland China, including Sichuan, Chongqing, Yunnan, Gansu, Xinjiang, Qinghai, Ningxia, Hebei, Shandong, Guangdong, and Fujian. Then, as shown in Figure 12 (p.46), results of correspondence analysis regarding the earthquake case indicate that most of the pre-identified provinces have close connections with high levels of risk perception and subjective knowledge of earthquake risk.

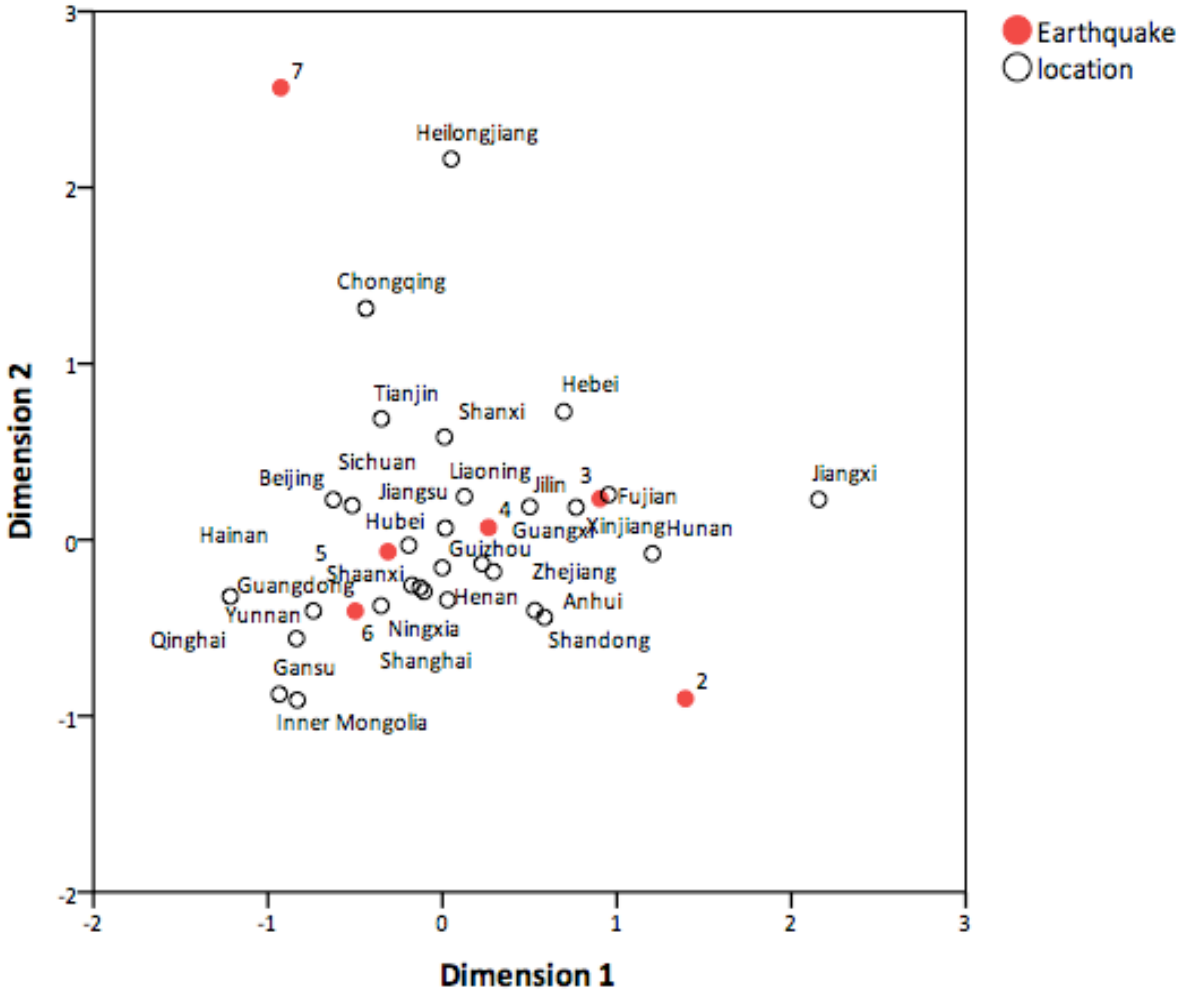

Figure 12. Two-dimensional map presenting the proximal relationship between current location, earthquake risk perception, and subjective knowledge of earthquake risk.
Note. *n*=1032. Points represent earthquake risk perception and subjective knowledge of earthquake risk (aggregated index, 1=*not at all* and 7=*extremely*). Circles represent locations of respondents. It is necessary to note that the dimensions are statistically derived axes and not simply the variables entered into the analysis (Starkweather, 2014).

Air Pollution Case

A 2013's report on air quality of 74 Chinese cities shows that, among the top 10 cities in the ranking of the annual average PM2.5 level, seven of them are located in Hebei province (Blatt, 2014). The average of the maximum daily PM2.5 level in Langfang, Hebei province, even reached 772 micrograms per cubic meter, which was the highest among 74 cities. Hazardous smog in Beijing-Tianjin-Hebei region, Shanghai, Nanjing and much of the

Yangtze River delta has caused rising complaints about government measures to combat air pollution (Blatt, 2014). As important international business centers of China, Beijing and Tianjin are suffering greatly from air pollution caused by coal burning in coal power plants. Another victim drawing attention is Shanghai, one of China's most vibrant economies. *Shanghai Daily* (Anonymous, 2013) reported that, during the first three months of 2013, almost 40% days were evaluated hazardous to health, particularly in January, the city experienced the worst air quality in its history. Therefore, Beijing, Tianjin, Hebei and Shanghai were identified as exemplars to test the proposed model of information seeking regarding air pollution risk. Result of correspondence analysis suggested very close relationships between the four locations and high levels of risk perception and subjective knowledge of air pollution risk, which supported the selection (see Figure 13, p.48).

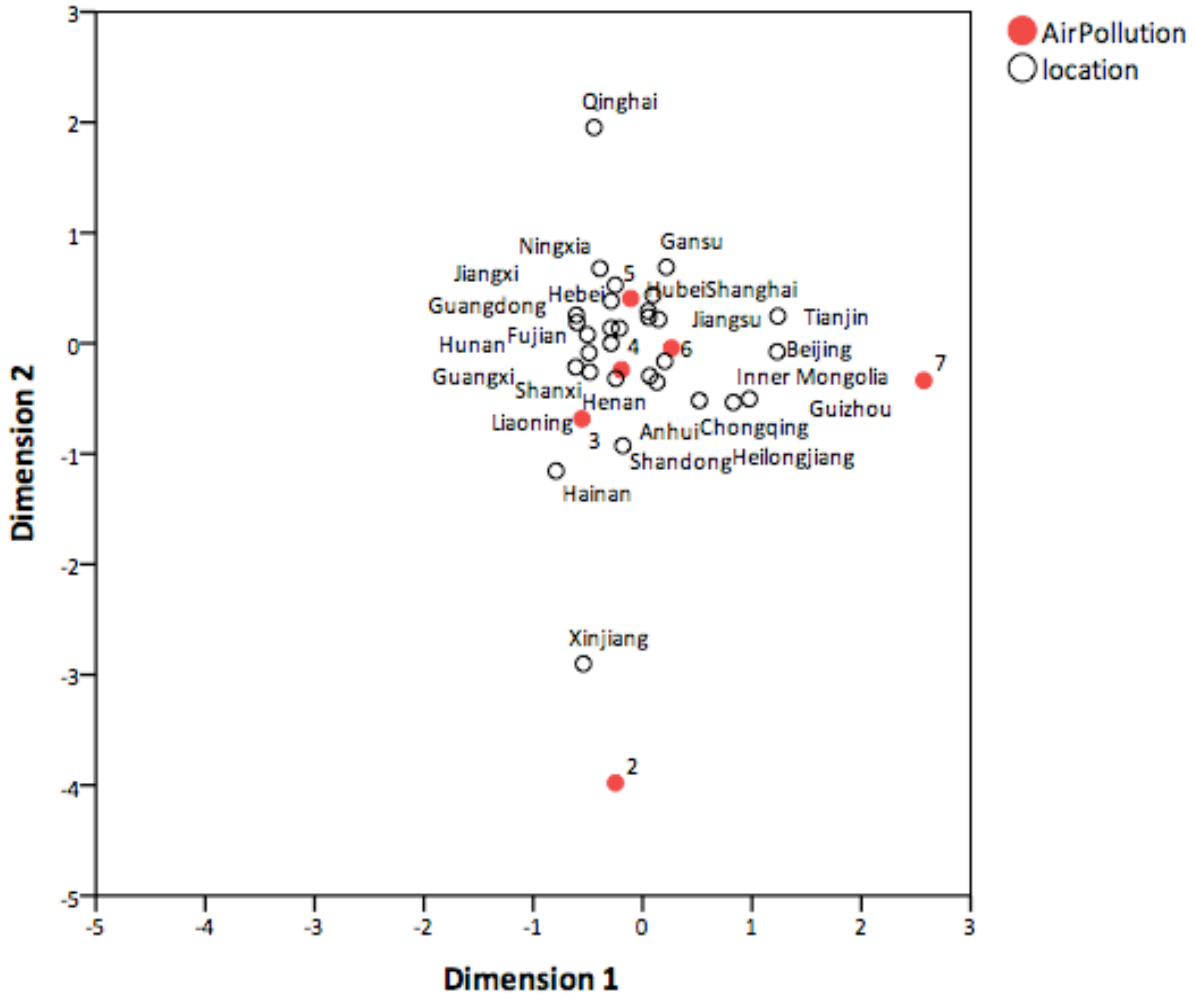

Figure 13. Two-dimensional map presenting the proximal relationship between current location, air pollution risk perception, and subjective knowledge of air pollution risk.
Note. n=1032. Points represent air pollution risk perception and subjective knowledge of air pollution risk (aggregated index, 1=*not at all* and 7=*extremely*). Circles represent locations of respondents. It is necessary to note that the dimensions are statistically derived axes and not simply the variables entered into the analysis (Starkweather, 2014).

Nuclear Radiation Case

Concerning the nuclear radiation risk, six areas were identified beforehand including Guangdong, Zhejiang, Fujian, Jiangsu, Liaoning, and Beijing. This is based on information provided by the China Nuclear Energy Association (CNEA, 2014) that, till September of 2013, ten nuclear power plants were in operation, among which three were in Guangdong (Daya Bay Nuclear Power Plant and Ling Ao Nuclear Power Plant Phase 1 & Phase 2), three

were in Zhejiang (Qinshan Nuclear Power Plant Phase 1, Phase 2, & Phase 3), one was in Fujian (Ningde Nuclear Power Plant Phase 1), one was in Jiangsu (Tianwan Nuclear Power Plant Phase 1), one was in Liaoning (Hongyanhe Nuclear Power Plant Phase 1), and one was in Beijing (China Experimental Fast Reactor). Result of correspondence analysis illustrated in Figure 14 (p.50) suggests that Guangdong, Zhejiang, Jiangsu, and Beijing have close relationships with high levels of risk perception and subjective knowledge of nuclear radiation risk; Liaoning and Fujian are close to moderate levels of risk perception and subjective knowledge of nuclear radiation risk. Therefore, the selection of group for testing the nuclear radiation model is supported.

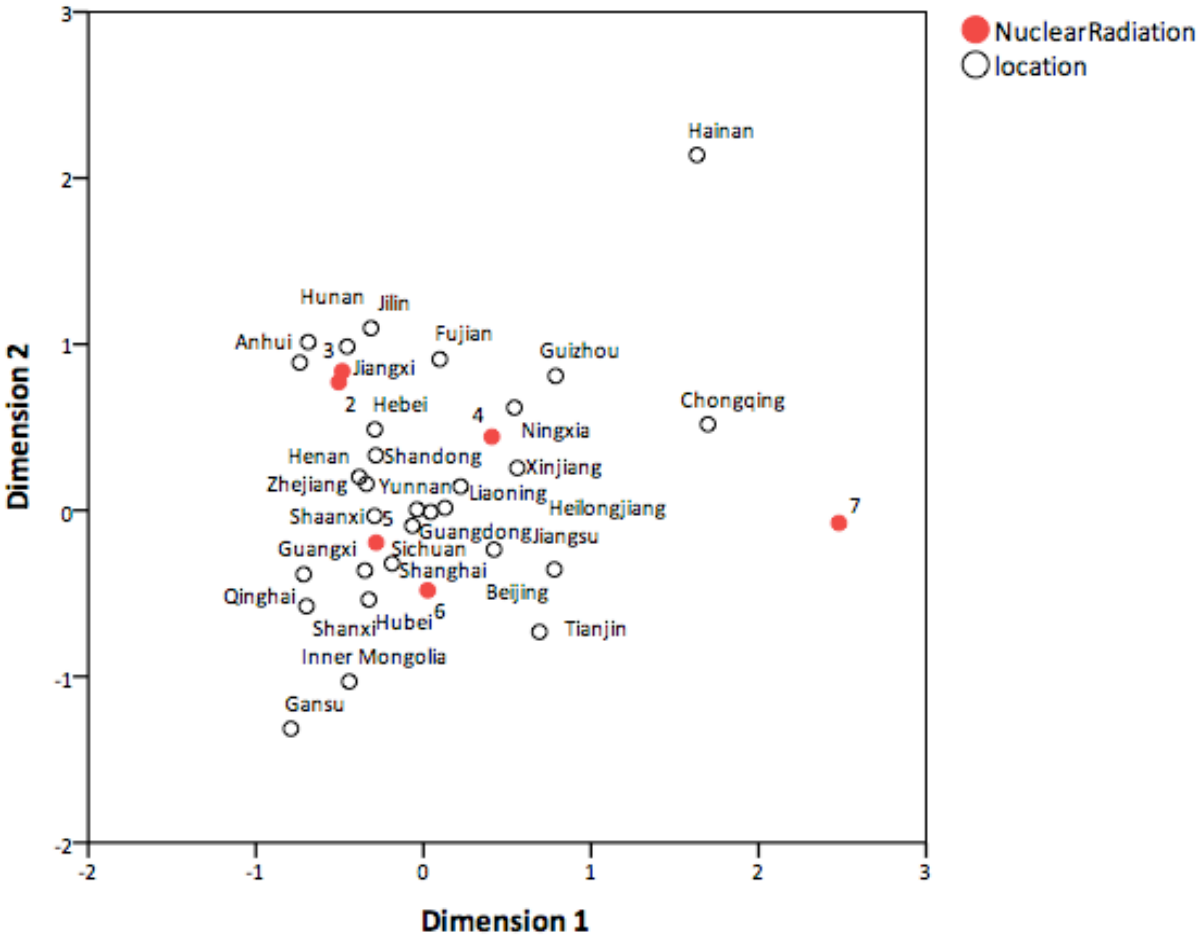

Figure 14. Two-dimensional map presenting the proximal relationship between current location, nuclear radiation risk perception, and subjective knowledge of nuclear radiation risk.

Note. *n*=1032. Points represent nuclear radiation risk perception and subjective knowledge of nuclear radiation risk (aggregated index, 1=*not at all* and 7=*extremely*). Circles represent locations of respondents. It is necessary to note that the dimensions are statistically derived axes and not simply the variables entered into the analysis (Starkweather, 2014).

4.3 Examination of the Proposed Social-cognitive Model

4.3.1 The Earthquake Model

In the model of earthquake risk, results of path analysis indicate good model fit (see Figure 15, p.51): n=378>200, X^2 (141)=389.834, p=.000, X^2/df=2.765<5, CFI=.956, TLI=.947, SRMR=.043, RMSEA=.068 (90% CI=.060~.077). The earthquake model explained 74.2% of the variance in risk information seeking.

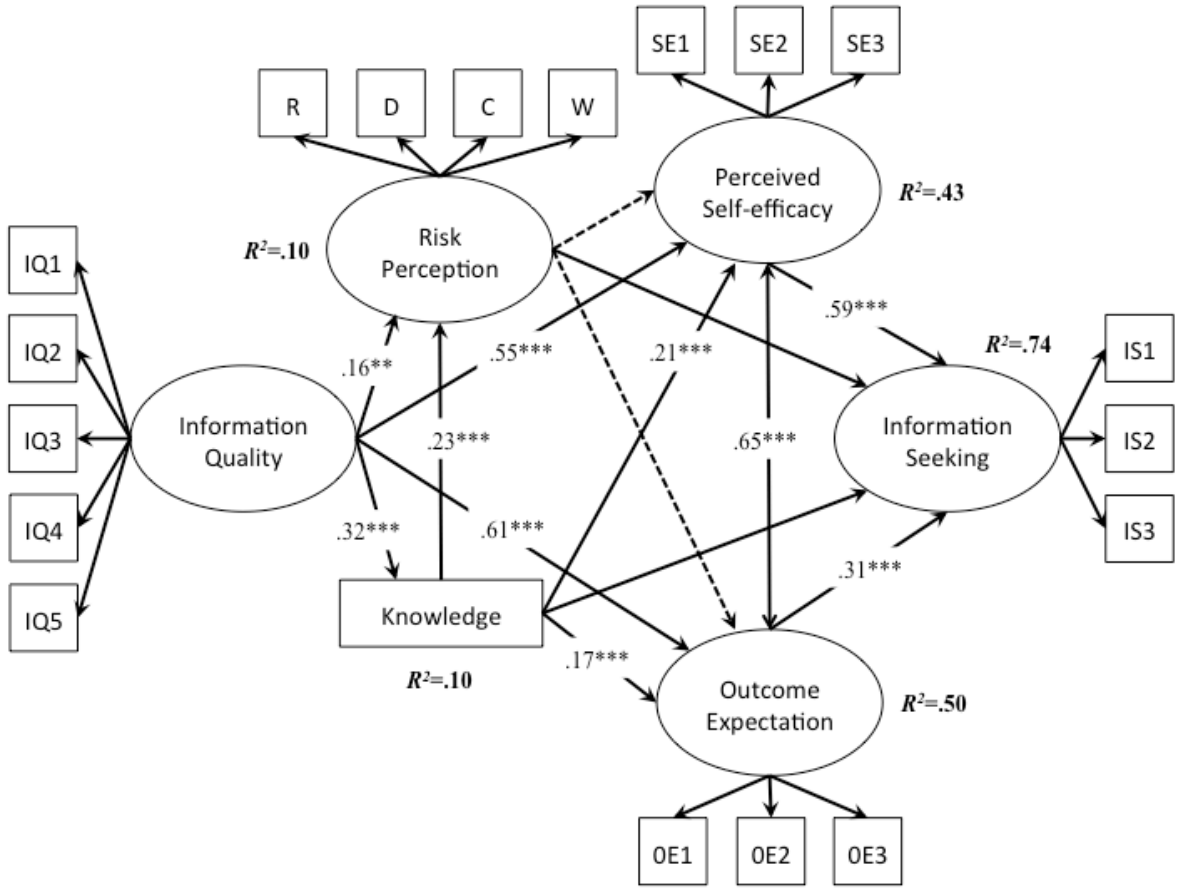

Figure 15. Resulting path model in the context of earthquake risk.
Note. IQ=perceived information quality; R=perceived riskiness, D=perceived dread, C=perceived catastrophe, W=worry; SE=perceived self-efficacy; OE=outcome expectation; IS=risk information seeking. Estimates are standardized coefficients of regression, ***p*<.01, ****p*<.001. Dash line represents the nonsignificant relationship.

Perceived self-efficacy (β=.59, p<.001) and outcome expectation (β=.31, p<.001) considerably increased information seeking (cumulative R^2=.74). Information quality and perceived knowledge were suggested as significant sources of people's sense of self-efficacy (information quality, β=.55, p<.001; knowledge, β=.21, p<.001) and outcome expectation (information quality, β=.61, p<.001; knowledge, β=.17, p<.001). However, perception of earthquake risk didn't show any power in generating people's self-efficacy and outcome expectation regarding information seeking. In the earthquake model, the assumed relationships among information quality, perceived knowledge, and risk perception have been

supported. Results demonstrate strong impact of information quality (β=.16, p<.01) and knowledge (β=.23, p<.001) on risk perception (cumulative R^2=.10), and suggest a significant role of information quality (β=.32, p<.001) in individual's knowledge accumulation (R^2=.10).

Key findings regarding the case of earthquake risk are highlighted: (a) perceived self-efficacy and outcome expectation regarding information seeking have directly, significantly, and largely contributed to risk information seeking; (b) information quality and risk perception are supported as generators of self-efficacy and outcome expectation regarding risk information seeking; (c) earthquake risk perception cannot contribute to self-efficacy and outcome expectation; and (d) information quality has greatly caused the increase in perceived knowledge, and both of the two factors have significantly raised the level of earthquake risk perception. These findings reinforce the view that media is a major source of knowledge for ordinary people and an influential environment giving birth to the lay understanding of risks.

4.3.2 The Air Pollution Model

Concerning the example of man-made hazard, the case of air pollution risk, results of path analysis show acceptable model fit (see Figure 16, p.53): n=241>200, X^2 (141)=376.144, p=.000, X^2/df=2.668<5, CFI=.949, TLI=.938, SRMR=.050, RMSEA=.083 (90% CI=.073~.094). The air pollution model explained 84.7% of the variance in risk information seeking.

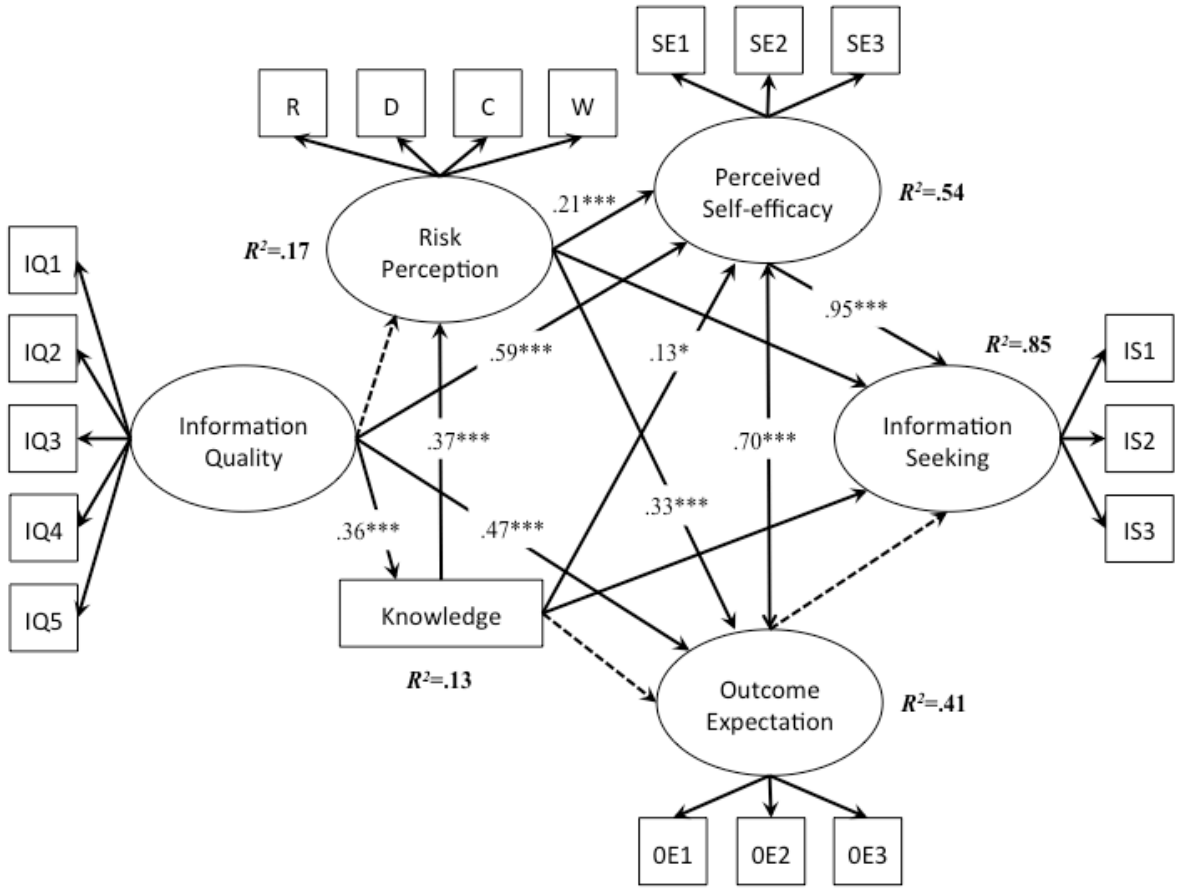

Figure 16. Resulting path model in the context of air pollution risk.
Note. IQ=perceived information quality; R=perceived riskiness, D=perceived dread, C=perceived catastrophe, W=worry; SE=perceived self-efficacy; OE=outcome expectation; IS=risk information seeking. Estimates are standardized coefficients of regression, **p*<.05, ****p*<.001. Dash line represents the nonsignificant relationship.

Different from the earthquake risk model, only perceived self-efficacy (β=.95, p<.001) greatly increased information seeking (R^2=.85). Information quality, perceived knowledge, and air pollution risk perception were all supported as important predictors of perceived self-efficacy (information quality, β=.59, p<.001; perceived knowledge, β=.13, p<.05; risk perception, β=.21, p<.001) and outcome expectation (information quality, β=.47, p<.001; risk perception, β=.33, p<.001), except that perceived knowledge didn't show significant influence on outcome expectation. Results also indicate that, although information quality failed to increase air pollution risk perception directly, its effect on risk perception was

significantly strengthened though the mediation of perceived knowledge.

Key findings regarding the case of air pollution risk are highlighted. First, only perceived self-efficacy contributed to risk information seeking. This implies that people's behavior largely depends on their confidence in approaching to related information but has little connection with how they think such information would be helpful. And, information quality, perceived knowledge, and risk perception are all supported as generators of perceived self-efficacy. Second, air pollution risk perception can only be determined by perceived knowledge that is greatly accumulated via individuals' exposure to high-quality information.

4.3.3 The Climate Change Model

The case of climate change was used to examine whether the proposed model would have predictive power under risks with combined features of natural and man-made hazards. The resulting model indicates perfect model fit (see Figure 17, p.55): n=1032>200, X^2 (141)=645.328, p=.000, X^2/df=4.577<5, CFI=.970, TLI=.963, SRMR=.033, RMSEA=.059 (90% CI=.055~.064). The climate change model explained 75.4% of the variance in risk information seeking.

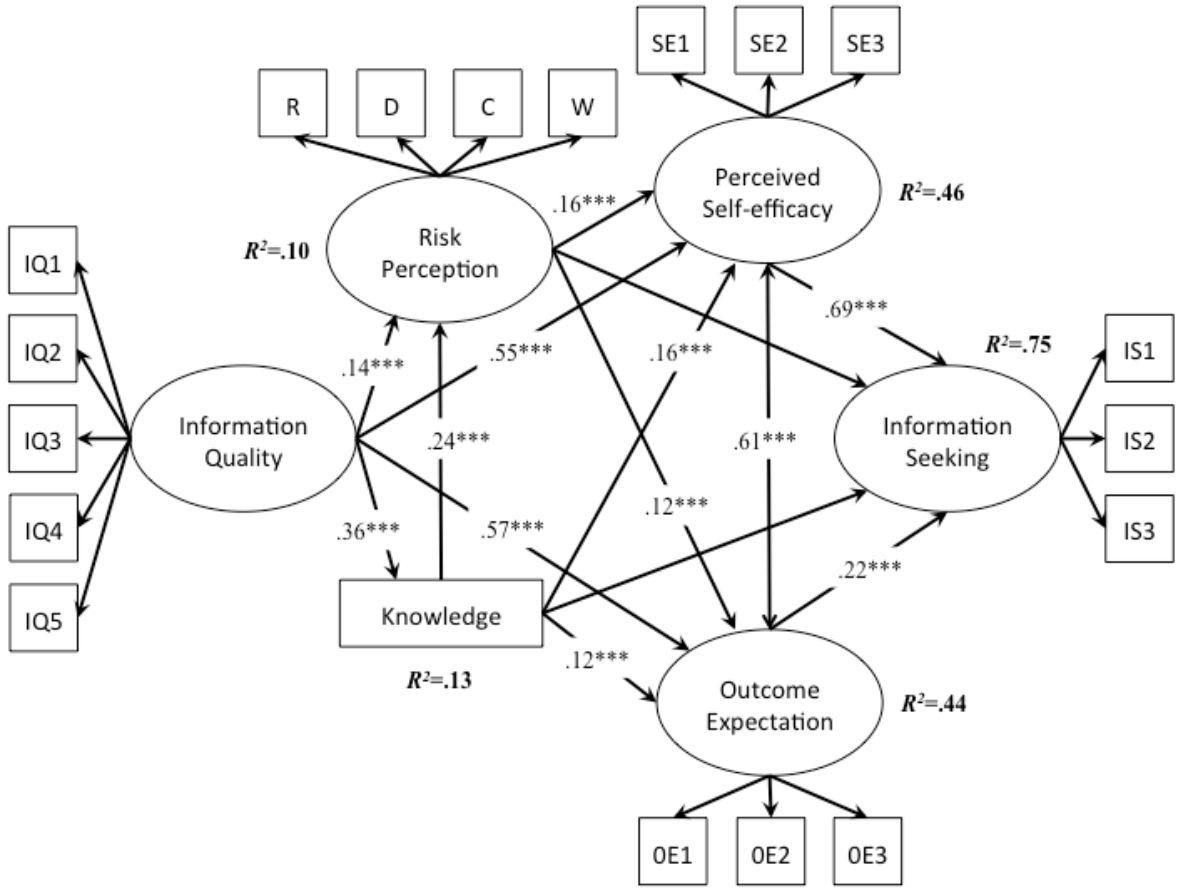

Figure 17. Resulting path model in the context of climate change risk.
Note. IQ=perceived information quality; R=perceived riskiness, D= perceived dread, C=perceived catastrophe, W=worry; SE=perceived self-efficacy; OE=outcome expectation; IS=risk information seeking. Estimates are standardized coefficients of regression, ***p<.001. Dash line represents the nonsignificant relationship.

Perceived self-efficacy (β=.69, p<.001) and outcome expectation (β=.22, p<.001) considerably increased information seeking (cumulative R^2=.75). Information quality, perceived knowledge, and risk perception were all suggested as significant sources of perceived self-efficacy (information quality, β=.55, p<.001; knowledge, β=.16, p<.001; risk perception, β=.16, p<.001) and outcome expectation (information quality, β=.57, p<.001; knowledge, β=.12, p<.001; risk perception, β=.12, p<.001). In the climate change model, the assumed relationships among information quality, perceived knowledge, and risk perception have been supported. Results demonstrate strong impact of information quality (β=.14,

p<.001) and knowledge (β=.24, p<.001) on risk perception (cumulative R^2=.10), and suggest significant impact of information quality (β=.36, p<.001) on individual's knowledge (R^2=.13).

Key findings are highlighted: (a) perceived self-efficacy and outcome expectation regarding information seeking are direct and significant predictors of risk information seeking; (b) information quality, perceived knowledge, and risk perception are all supported as sources of individuals' self-efficacy and outcome expectation regarding risk information seeking; and (c) information quality has greatly increased perceived knowledge, and both of the two factors have significantly increased the level of climate change risk perception. Same with the case of earthquake risk, this finding also supports the media's role in providing risk-related knowledge and influencing people's subjective judgment of risk.

4.3.4 The Nuclear Radiation Model

Nuclear radiation risk, another pre-identified risk with combined features of natural and man-made hazards, was invited to further test the proposed model. Data were collected from residents in areas where nuclear power plants are in operation. Results of estimation showed good model fit (see Figure 18, p.57): n=393>200, X^2 (141)=454.206, p=.000, X^2/df=3.221<5, CFI=.950, TLI=.939, SRMR=.042, RMSEA=.075 (90% CI=.068~.083). The nuclear radiation model explained 75.5% of the variance in risk information seeking.

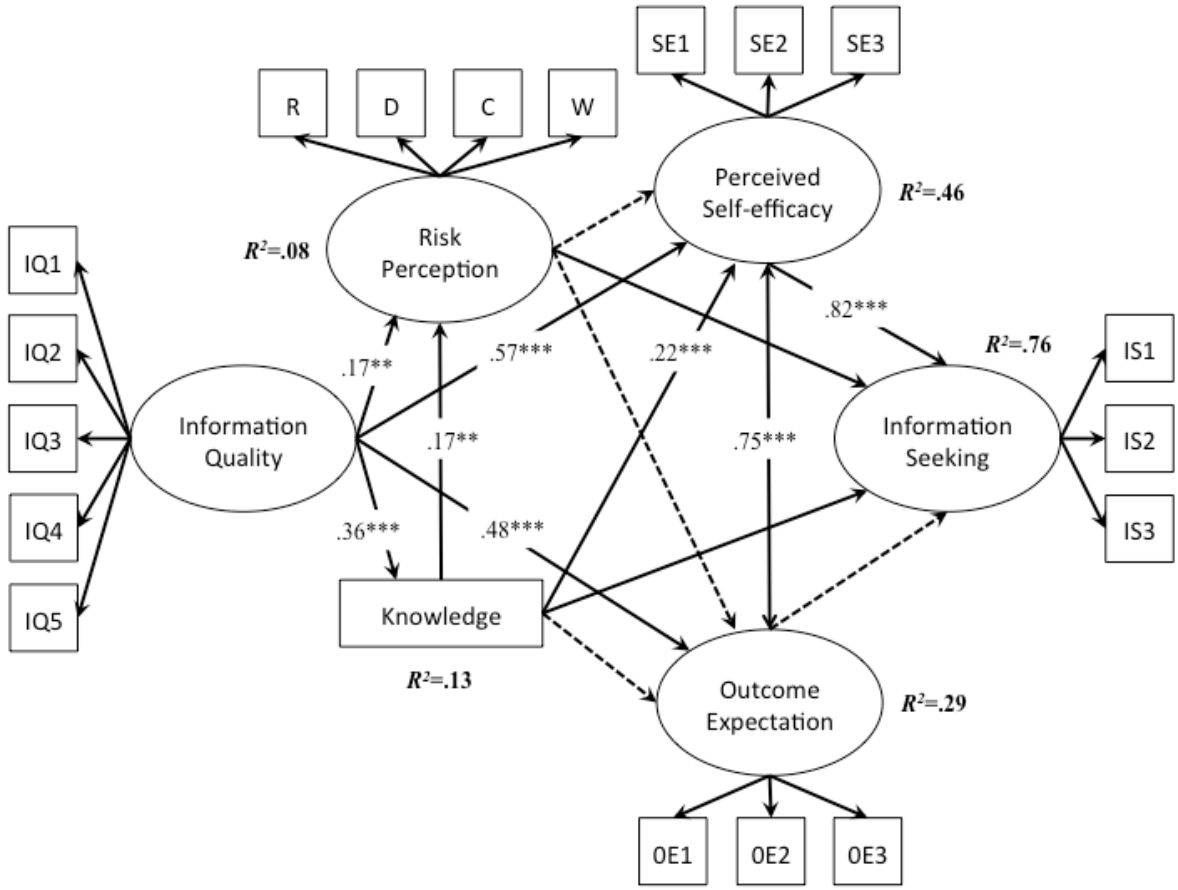

Figure 18. Resulting path model in the context of nuclear radiation risk.
Note. IQ=perceived information quality; R=perceived riskiness, D=perceived dread, C=perceived catastrophe, W=worry; SE=perceived self-efficacy; OE=outcome expectation; IS=risk information seeking. Estimates are standardized coefficients of regression, ***p*<.01, ****p*<.001. Dash line represents the nonsignificant relationship.

Different from the model of climate change risk, only perceived self-efficacy (β=.82, p<.001) significantly increased information seeking (R^2=.76). Information quality and perceived knowledge were suggested to be sources of perceived self-efficacy (information quality, β=.57, p<.001; perceived knowledge, β=.22, p<.05), while risk perception showed no significant effect. With respect to relationships among information quality, perceived knowledge, and risk perception, results supported the assumed causal paths, indicating that both information quality (β=.17, p<.01) and perceived knowledge (β=.17, p<.01) increased perception of nuclear radiation risk, and information quality (β=.36, p<.001) considerably

contributed to individuals' knowledge of nuclear radiation (R^2=.13).

Key findings are highlighted: (a) risk information seeking is largely determined by perceived self-efficacy that mainly comes from information an individual receives and related knowledge the person believes to have; and (b) as expected, information quality greatly increased perceived knowledge, and both of the two factors significantly increased perception of nuclear radiation risk. Together with the model of earthquake risk and the model of climate change risk, these findings further support the media's role in providing risk-related knowledge and increasing risk perception.

4.4 Summarized Results of Hypotheses Testing and the Mediating Role of Perceived Self-efficacy

The first three hypotheses (H1, H2, and H3) concern the relationships among Chinese people's evaluation of the quality of risk information, their knowledge about environmental risks, and their environmental risk perception. In the individual-focused model of risk information seeking, the three hypotheses were put forward to see how Chinese people's subjective response to environmental risks changed with their exposure to related information. In models regarding earthquake risk, climate change risk and nuclear radiation risk, consistent results were demonstrated, showing Chinese people's risk perception was greatly increased by their evaluation of information quality and perceived knowledge which also came from people's perceived information quality. In the model of air pollution risk, a unique pathway was indicated that the effect of information quality on people's perception of air pollution risk was completely mediated by perceived knowledge. To sum up, H1, H2, and H3

were supported under the contexts of natural hazard and hazard with combined features of natural and man-made hazards; under the context of man-made hazard, H2 and H3 were supported while H1 was rejected.

The following six hypotheses (H4-1, H4-2, H5-1, H5-2, H6-1, and H6-2) were proposed to explore predictors of individuals' self-efficacy and outcome expectation on searching for risk information. First of all, in all the four models, people's evaluation of information quality was supported as a significant contributor of perceived self-efficacy and outcome expectation regarding risk information seeking. Subjective knowledge was confirmed to be a significant predictor of perceived self-efficacy in all the four models. Meanwhile, it was a significant predictor of outcome expectation in the models of earthquake risk and climate change risk, but not in models of air pollution risk and nuclear radiation risk. Considering the impact of risk perception, results of path analyses suggested that risk perception greatly contributed to self-efficacy and outcome expectation in models of air pollution risk and climate change risk, but it failed to increase efficacy beliefs in models of earthquake risk and nuclear radiation risk. In general, H4-1 and H4-2 were supported under the context of man-made hazard but rejected in the model of natural hazard. Concerning risks with combined features, the outcome depended on case. All the four models supported H5-1 and H5-2. H6-1 was confirmed across the four models. H6-2 was supported in the model of natural hazard, rejected in the model of man-made hazard, and the outcome depended on case when considering hazards with combined features.

H7 and H8 were proposed on the basis of previous findings to examine whether

individuals' efficacy beliefs were the closest and strongest predictor of information seeking. Results of path analyses in the four models confirmed H7, supporting the powerful predicted effect of perceived self-efficacy. On the other hand, outcome expectation showed its predictive power in the model of natural hazard but didn't show significant influence in the model of man-made hazard. In models of hazards with combined features, the results depended on case. Therefore, H8 was not perfectly supported by the results of model testing. H9 was to explore the relationship between perceived self-efficacy and outcome expectation. Although Bandura (1997) claimed that self-efficacy would greatly cause expectation toward the outcome of a certain behavior, some studies suggested the mutual effect between perceived self-efficacy and outcome expectation. Results of the current research also indicated potential bidirectional causal relationships between the two variables. Table 5 (p.61) summarized the results of hypotheses testing.

Table 5

Summarized Results of Hypotheses Testing

Hypothesis	Earthquake Model	Air Pollution Model	Climate Change Model	Nuclear Radiation Model
H1	✓	×	✓	✓
H2	✓	✓	✓	✓
H3	✓	✓	✓	✓
H4-1	×	✓	✓	×
H4-2	×	✓	✓	×
H5-1	✓	✓	✓	✓
H5-2	✓	✓	✓	✓
H6-1	✓	✓	✓	✓
H6-2	✓	×	✓	×
H7	✓	✓	✓	✓
H8	✓	×	✓	×
H9	✓	✓	✓	✓

The four resulting models all support the salient position of perceived self-efficacy in the social-cognitive model and indicate potential mediating roles of perceived self-efficacy, perceived knowledge and risk perception in the prediction of risk information seeking. Summaries of direct pathways among relevant variables regarding the four selected cases were shown in Figure 19 (p.62), Figure 20 (p.62), Figure 21 (p.63), and Figure 22 (p.63). To examine the hypothesized mediating roles, analyses of indirect effects in the four summarized models (Figure 19 to Figure 22) have been performed. Table 6 (p.64) presents the results of mediation analyses, suggesting that all indirect effects tested in this research are statistically significant, which offers further support for the workings of the social-cognitive model.

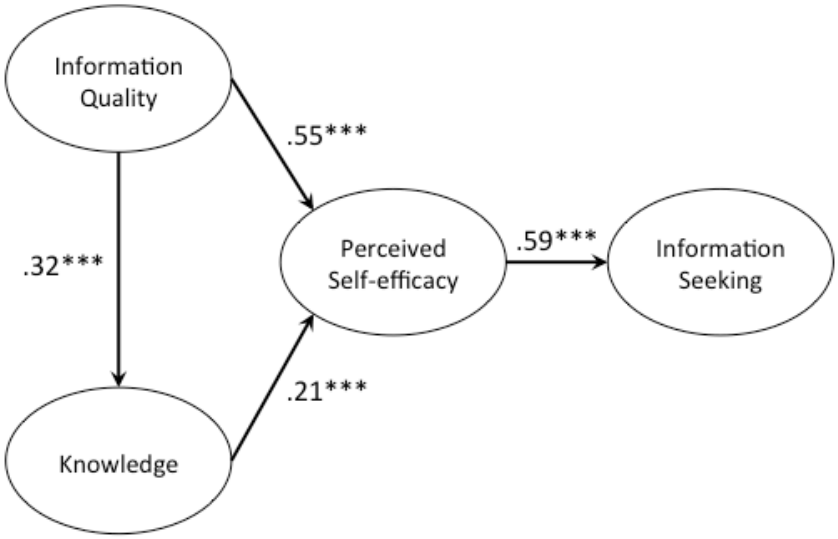

Figure 19. Paths to risk information seeking: excerpt from the resulting model of earthquake risk.
Note. ***p<.001.

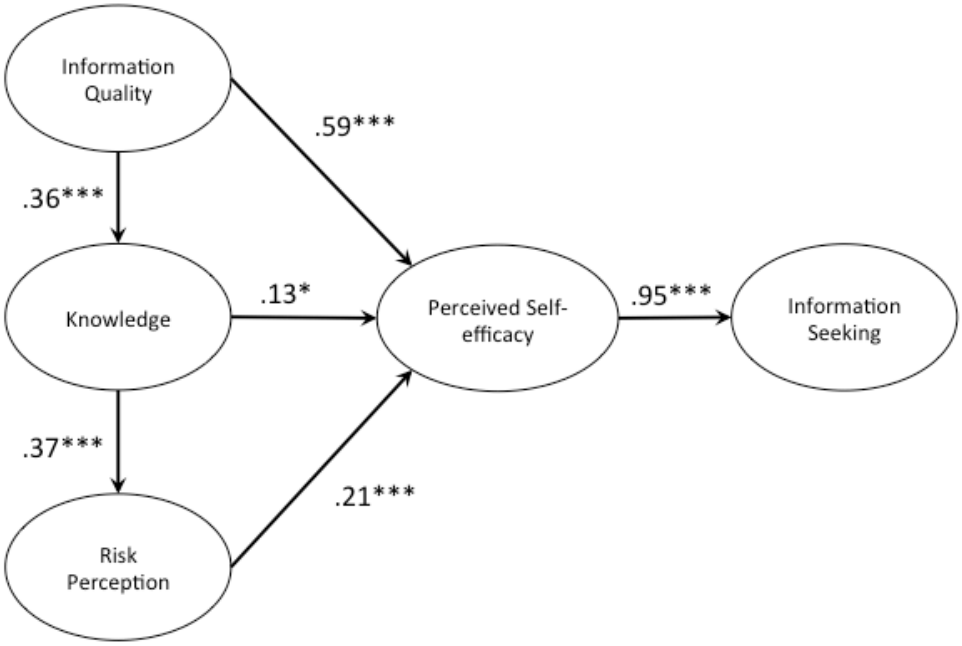

Figure 20. Paths to risk information seeking: excerpt from the resulting model of air pollution risk.
Note. *p<.05, ***p<.001.

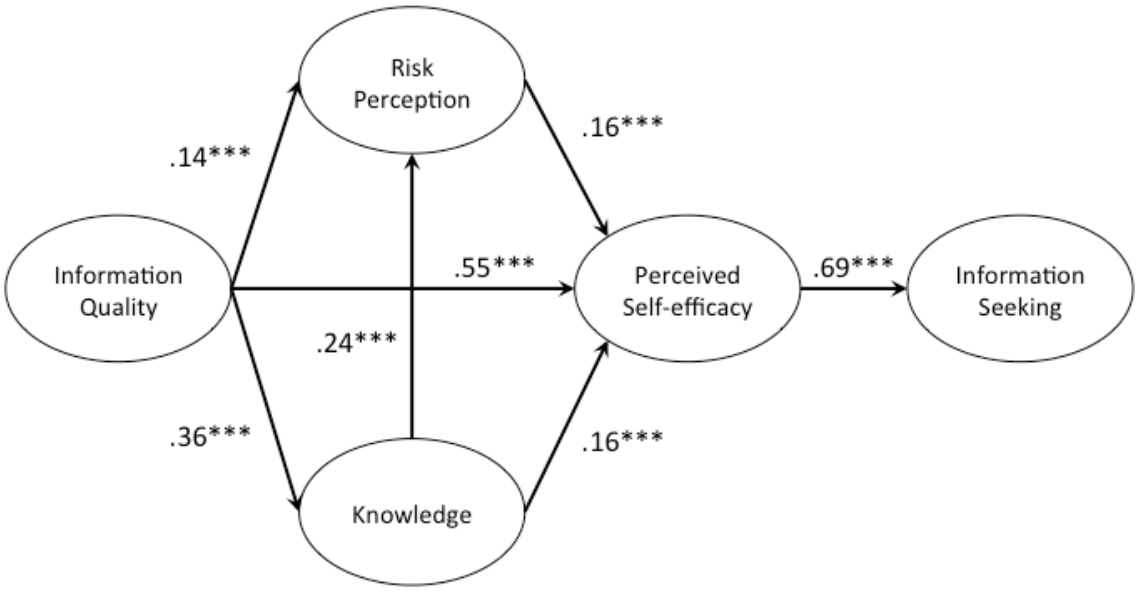

Figure 21. Paths to risk information seeking: excerpt from the resulting model of climate change risk.
Note. ***p<.001.

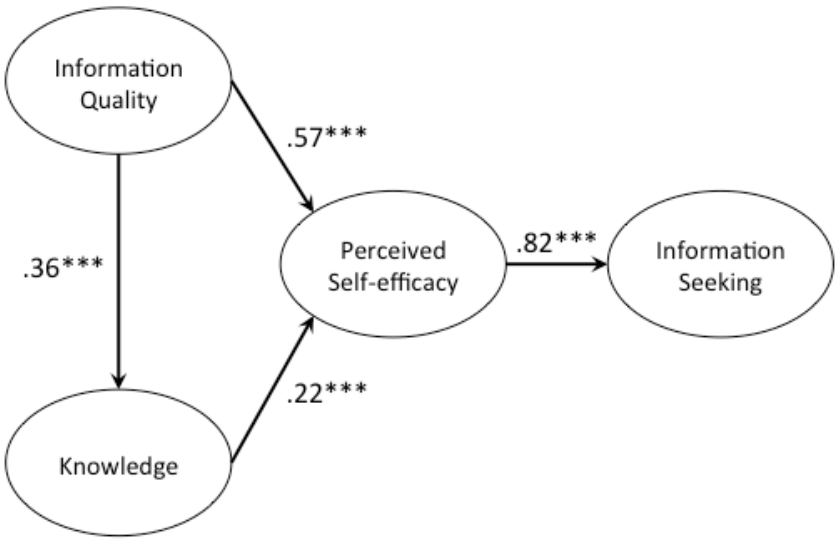

Figure 22. Paths to risk information seeking: excerpt from the resulting model of nuclear radiation risk.
Note. ***p<.001.

Table 6

Analyses of the Mediating Role of Perceived Self-efficacy

Pathways	Indirect Effect
The Earthquake Risk Model	
IQ ⟶ SE ⟶ IS	0.32**
IQ ⟶ knowledge ⟶ SE ⟶ IS	0.04**
Knowledge ⟶ SE ⟶ IS	0.12**
The Air Pollution Risk Model	
IQ ⟶ SE ⟶ IS	0.56**
IQ ⟶ knowledge ⟶ SE ⟶ IS	0.04**
IS ⟶ knowledge ⟶ RP ⟶ SE ⟶ IS	0.03**
Knowledge ⟶ SE ⟶ IS	0.12**
Knowledge ⟶ RP ⟶ SE ⟶ IS	0.07**
RP ⟶ SE ⟶ IS	0.20**
The Climate Change Risk Model	
IQ ⟶ RP ⟶ SE ⟶ IS	0.02**
IQ ⟶ SE ⟶ IS	0.38**
IQ ⟶ knowledge ⟶ SE ⟶ IS	0.04**
IQ ⟶ knowledge ⟶ RP ⟶ SE ⟶ IS	0.01**
Knowledge ⟶ SE ⟶ IS	0.11**
Knowledge ⟶ RP ⟶ SE ⟶ IS	0.03**
RP ⟶ SE ⟶ IS	0.11**
The Nuclear Radiation Risk Model	
IQ ⟶ SE ⟶ IS	0.47**
IQ ⟶ knowledge ⟶ SE ⟶ IS	0.06**
Knowledge ⟶ SE ⟶ IS	0.18**

Note. IQ=perceived information quality; RP=risk perception; SE=perceived self-efficacy; OE=outcome expectation; IS=risk information seeking. **p<.01.

Chapter 5. Discussion

5.1 The Cognitive Route to Risk Information Seeking

As reviewed in the second chapter of this dissertation, previous models have focused on individual-level predictors of risk information seeking, attempting to explain the largest proportion of the variance in the proactive and self-directed behavior. This research is no exception and draws more insights from another far-reaching behavior theory, the social cognitive theory (SCT).

In various fields of research, including organizational management (Wood & Bandura, 1989), education (Schunk, 2004), mass communication (Bandura, 2001a), and health intervention (Bandura, 1994), assumptions and key concepts of the SCT have been widely discussed and studied. As shown in Figure 23 (p.66), early findings highlight a cognitive operation of human beings for acquiring behavior and demonstrate the salient roles of self-efficacy and outcome expectation in such process.

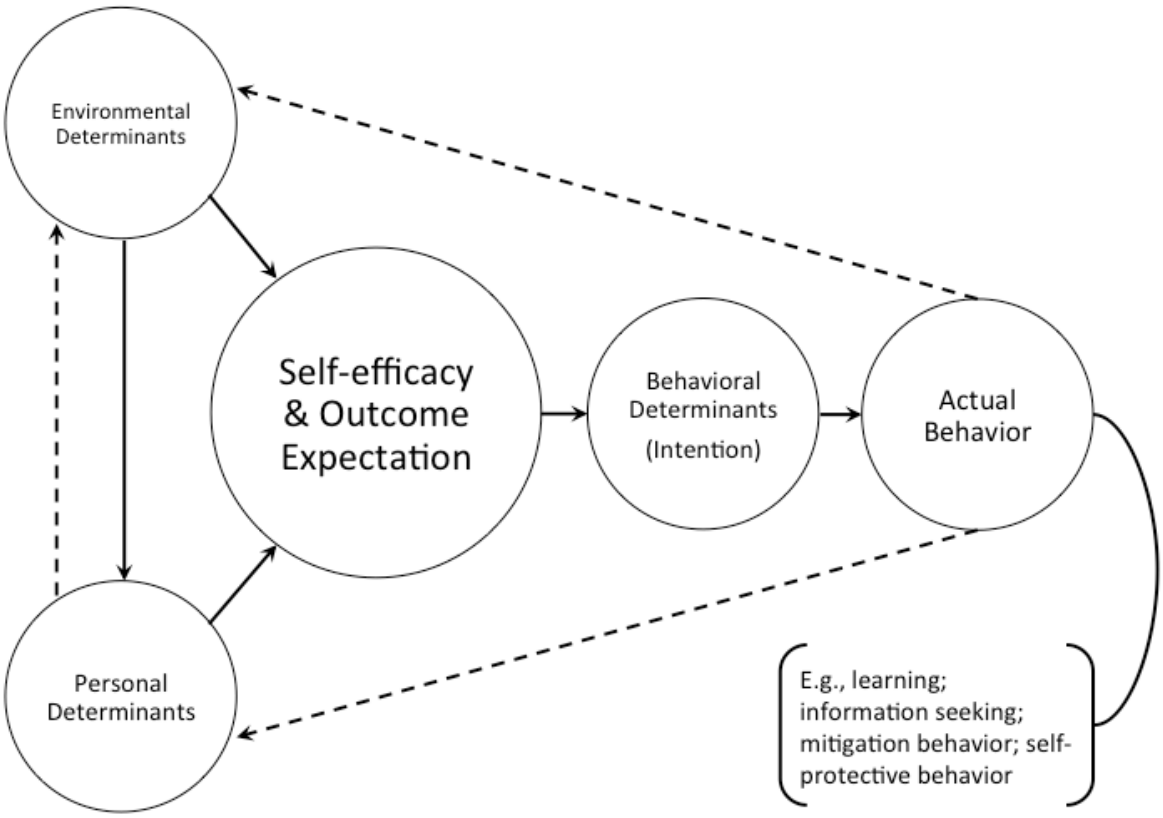

Figure 23. Summary of previous findings associated with the SCT.
Note. Solid line indicates causal relationships confirmed by early studies; dash line indicates potential effects that may occur in a longitudinal process.

Regarding the present research, consistent with early findings, results supported the proposed social-cognitive model and revealed the direct and significant impact of perceived self-efficacy on risk information seeking under the contexts of four selected cases. Concluded from the results, Chinese people's confidence in risk information seeking (perceived self-efficacy) mainly came from: (a) their evaluation of the information environment (as an environmental factor) and (b) their belief in their knowledge about the risk (as a personal factor). Meanwhile, how Chinese people evaluated risk information they received greatly influenced their perception of related knowledge they had.

Findings of the present research reinforce the view that the information environment incubated in a network of varied communication channels is a major source of risk-related knowledge for the public and a significant contributor of their cognitive and behavioral reactions to risks. Quality of information serves as a primary criterion for evaluating the information environment. Information of high quality is very likely to create a positive impression on the audience, letting people believe they know well about the event and potential threats. Hence, they may intend to learn more in order to get better informed and prepared for future impact.

Risk perception was supposed to be another significant source of perceived self-efficacy. However, probably owing to different characteristics of different cases, this assumption was not perfectly supported by all the four models examined. Despite this, the potential impact of risk perception on self-efficacy and outcome expectation should not be underrated. Kahneman (2012), the 2002's Nobel winner in economics, wrote in his best-selling book, *Thinking, Fast and Slow,* that under uncertain conditions people depend more on a subconscious process as mental shortcut to reduce the cognitive load for thoughts and actions. This perspective of cognitive psychology could explain how risk perception is formed in human brains: people usually rely on feelings of risk that occurred automatically after a contextual stimulus to make judgments and conduct behavior (Slovic et al., 2010). Slovic (2010) also emphasized that reliance on feelings could be an easier and more efficient way to navigate in a complex and uncertain world. Therefore, risk perception that constructed by varied feelings of risk (Fischhoff et al., 1978) would be an effective psychological

stimulus to boost efficacy beliefs in information seeking, persuading an individual to be more confident in gaining risk-related knowledge for precautions.

Concerning different types of environmental risks, as exploratory in nature, this research selected four environmental cases based on the results of correspondence analyses to test the applicability of the proposed model. Although estimates of all the four models suggested satisfactory fit, each model presented a unique path to risk information seeking. Figure 24 illustrates a summary of causal pathways that have been examined in this research.

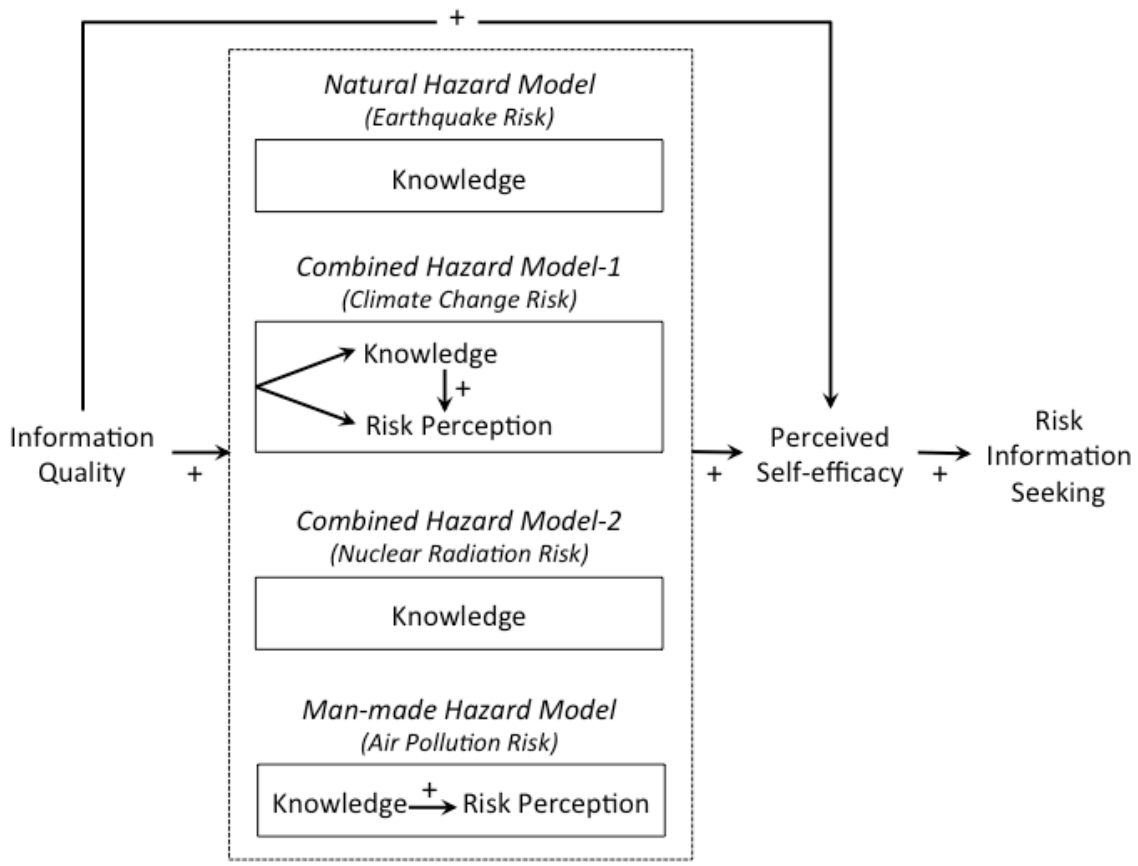

Figure 24. Summary of resulting pathways examined in this research.
Note. Natural hazard model: earthquake risk; combined hazard model-1: climate change risk; combined hazard model-2: nuclear radiation risk; man-made hazard model: air pollution risk.

As mentioned before, disparity mainly lies in the predictive power of risk perception. In the natural hazard model (case of earthquake risk), risk perception didn't show significant contribution. As natural disaster that is out of human control, perceived risk from earthquake probably lacks power to stimulate individuals' self-efficacy. In the combined hazard models (case of climate change risk and case of nuclear radiation risk), risk perception only demonstrated its predictive power in the model of climate change risk. Conclusion cannot simply be made that the lower the risk perception is, the weaker its predictive power will be. Results may vary according to different cases and different measurements of perception of these cases. In the man-made hazard model (case of air pollution risk), risk perception would increase perceived self-efficacy. However, unlike the other three models, in the model of air pollution risk, information quality didn't affect risk perception directly but contributed to its increase through the perfect mediation of knowledge.

5.2 Implications for the Public-oriented Risk Communication

Focusing on risk information seeking, which is an important indicator of learning and individual precautions, findings of this research are expected to contribute practical insights to risk communication. The communication of risk should be information-oriented, facilitating individuals' information seeking and helping them to gain more knowledge and personal relevant information, so that they could make better decisions under conditions of risk for their best interest.

The fundamental aim of risk communication is to deliver knowledge to the public to improve their understanding of risks and aid better individual action plans to deal with

potential threats. Media information could be the most appropriate and convenient carrier of knowledge in the modern communication society. The provision of risk information has diverse effects, particularly concerning its impact on risk perception and a range of individual decisions (Viscusi & Magat, 1987). Taking earthquake risk as an example, background information is important for the public to have a comprehensive impression of earthquake (e.g., causes, frequency of occurrence in local area, possibility and potential degree of impact, etc.). Similar strategy can also be applied to man-made and technology-related risks such as pollution and genetically modified food. The more people know the nature of the risk, the more proactively they will choose to avoid or accept it. Risk communication may play a prominent role in hazard education by using the media, especially when the prosperous development of information and communications technologies (ICTs) makes information more accessible to the public.

Furthermore, the design of information content could target at changing individuals' risk perception. For instance, affective information may greatly act upon individuals' feelings of risks, changing their psychological state and moderating the influence of information environment on individual perception. When the affective elements of risk information that causing fear, anxiety, nervousness, etc. are at high level, the role of information in increasing risk perception would be further enhanced because people's feelings have been amplified by the intensification of negative signals that are part of the information (Kasperson et al., 1988). In such situation, by applying the fear appeal strategy, risk information could function as a warning to raise people's awareness and consciousness of potential impact.

The implications mentioned above highlight the role of media information in promoting individuals' knowledge acquisition and precautions against risk. Findings of this research also imply a tendency of categorization analysis, which could contribute more knowledge regarding the influence of information with different characteristics and different levels of quality. Setting media's agenda during risk communication could be one effective strategy to achieve the public-oriented goal. This brings up another question that, among varied media formats, which one is the best channel for applying the social-cognitive approach proposed in this research?

In recent years, there has been a dramatic increase in studies on the application of the Internet and social media to crisis and risk communication (Goolsby, 2010; Sutton, Palen, & Shklovski, 2008). The Internet is a huge database carrying an extremely large number of network services, which assures the richness of information. Over the Internet, social media, a highly interactive platform, offers more opportunities for users to gain heterogeneous information from different sources (Kietzmann, Hermkens, McCarthy, & Silvestre, 2011; Yin, Lampert, Cameron, Robinson, & Power, 2012). Because of these features, the Internet and social media are expected to have a salient impact on individuals' judgments and actions. Moreover, with the advantages of low cost and easy access of Internet-based media, people tend to believe and have a high expectation that they will find useful information by online searching. Thus, the Internet-based media could be the primary channel for risk communication and individuals' information seeking.

However, in many cases, Internet-based media has been observed to lack effectiveness

in attracting sustained attention, stimulating awareness and encouraging precautions, especially considering the social media environment. The 2014 New Year's Eve Shanghai Stampede that caused 36 people killed and 49 injured (BBC, 2015) only appeared among the hottest topics on *Weibo* (the most popular micro blogging website in China) less than three days. Although this incident was extensively covered by verified accounts of government and official media to draw public attention to prevention, it had been quickly overshadowed by other topics. It is not hard to imagine that a potential threat might easily be perceived less serious and personal relevant in the online environment.

It is arguable that to what extent information disseminated via web-based communities actually increases people's awareness. From the perspective of cognitive psychology, too much information will exceed the limits of an individual's cognitive ability, causing difficulties for the person to make judgment and take actions when thinking of how to get prepared (C. C. Yang, Chen, & Honga, 2003). At the same time, information concerning various aspects of daily life is rapidly on and off the list of hot topics. The audience may just find a risk event not more attractive than other issues. As a result, the richness of information does not necessarily lead to the audience's consciousness of risk prevention. People may avoid risk information to reduce the cognitive burdens, which will accordingly make them underestimate the risk and attenuate their precautions. Although almost nothing can compete with the effectiveness of the Internet in disseminating information, the disadvantages of using it and potential barriers to its effectiveness are worth investigating.

Besides information overload, other unfavorable effects should also be considered. For

instance, the third-person effect (TPE) caused by media messages creates a biased perception among the audience that people tend to perceive certain impact is greater on others than on themselves; therefore, they tend to act against the messages' influence (Davison, 1983). The TPE might be a moderator to buffer the predicted effect of risk information on individuals' awareness of risk, impeding individuals' information seeking and precautionary behavior, especially considering the synergy between information overload and the TPE. This suggests that future investigations need to be done on functions of different media formats to obtain a more judicious evaluation of their roles in risk communication. For example, as a long-term strategy, traditional media could be used for providing knowledge, strengthening memory of past disasters and crises, and teaching coping skills. In general, the joint efforts of different communication channels should be valued to achieve further improvement in risk communication.

To sum up, effective risk communication needs collaborations of cross-disciplinary researchers and practitioners. From the social-cognitive perspective, the current research intends to provide useful information about the public side for policy makers, managers, communicators, and media practitioners. As Chai Jing invoked in her documentary, *Under the Dome*, solving environmental problems is everybody's responsibility. A prospect of the collaborative risk communication is demonstrated in Figure 25 (p.74). Specifically, observations and investigations of individual response by the social-cognitive research could be the basis of policy makers and managers' decision making, providing suggestions for them concerning how and what kind of knowledge and information should be communicated

(framing). When risk-related information enters into the communications network, communicators and media practitioners are suggested deliberately tailoring the contents of messages to get people influenced through the voluntary (e.g., actively choosing) or involuntary exposure (e.g., normally receiving) to the information environment. As a result, in the real-time situation, response with the joint efforts is expected to be more efficient and effective. Experiences learned from the real-time response, as the feedback of the action plan, will help the next phase of improvement in risk communication.

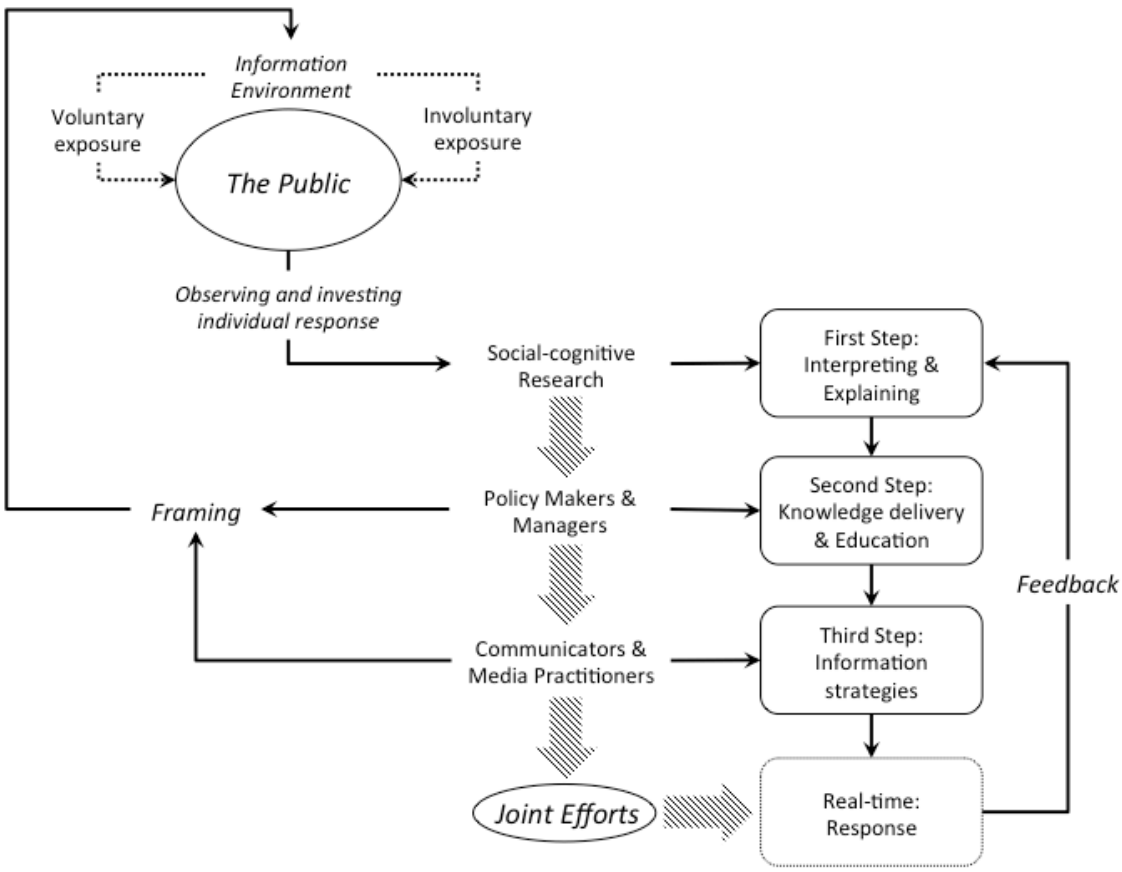

Figure 25. A prospect of the collaborative risk communication.

5.3 Limitations and Direction for Future Research

It is necessary to note in the first place that, although using the sample of Chinese, this research doesn't intend to limit the discussion to the Chinese context. The primary aim is to develop an approach that owns potential universal usefulness in predicting individual precautions against environmental risks. As in an early phase in the exploration of the social-cognitive approach, the current research might be applied to different social and cultural backgrounds to examine further its validity and conduct comparative studies. To apply findings of this research, scholars need to have a sound observation of the society's information environment, to identify representative features of information, and to anticipate potential unfavorable influence from the given information environment. Joint efforts from different disciplines, including psychology and cognitive psychology, media communication, management, and natural sciences, should be spent on improving the social-cognitive approach for better environmental risk communication.

As important as the findings and implications, several limitations of this research need to be acknowledged. The most important one relates to individuals' knowledge of environmental risks. This research measured knowledge by asking the survey participants how much they thought they knew the risk. Results reflect the subjective knowledge of environmental risks, which might differ from the actual knowledge level of the respondents. In future research, small tests should be included in the questionnaire to evaluate participants' knowledge. Analyses of the high-knowledge group of people and the low-knowledge group of people are suggested to examine further the role of knowledge in predicting information

seeking as well as other precautionary behavior. Fieldwork such as interviews could also be considered to investigate the disparity of the lay and expert understanding of environmental issues.

The second one relates to the measurement of risk perception. Taking the case of earthquake risk as an example, result of the current research indicated that, comparing with the other hazards, the impact of earthquake was perceived at relatively lower levels of riskiness and catastrophe, and people felt less worried about it (see Table 3, p.43 and Table 4, p.44). However, this result is inconsistent with that of Zhang et al.'s (2013) study on public perceptions of environmental risk in China, suggesting potential impacts were considered the highest for natural disasters. This inconsistency might be owing to the scales of risk perception used in this research. Perception of the four risks was measured by perceived riskiness, perceived dread, perceived catastrophe, and worry. However, perception of natural disasters such as earthquake and flood may own more distinctive characteristics, for instance, perceived likelihood. Therefore, future studies should design questionnaire that applicable to the survey on several environmental hazards. Studying on risks with differentiated characteristics separately will be better for the social-cognitive model being applied to various conditions. Moreover, future studies may consider in-depth interview to achieve a more thorough explanation of risk perception.

The third one is about the role of outcome expectation in the structural relationships among variables. In the current research, the model of air pollution risk and the model of nuclear radiation risk didn't support the hypothesized mediation effect of outcome

expectation. This might be because of unique features of the two cases. Although identified to have combined features of natural and man-made hazards by factor analysis, nuclear radiation risk is particularly known for the nature of technology-related that seldom discussed in the everyday conversation of ordinary people. It is true that, in China, air pollution is one of the hottest topics in the current public discourse, and nuclear power has been developed since decades before. However, there seems not sufficient professional knowledge of such hazards conveyed via media information. The public may not have a high expectation of finding helpful information. Given this, it is worth noting that outcome expectation may not be a predictor as important as perceived self-efficacy in the social-cognitive model. Its role may more depend on which hazard is under discussion. Therefore, the observation of the media context concerning certain hazard should be considered before adapting the social-cognitive approach. Content analysis of media information is suggested in future studies.

Methodologically, this research used cross-sectional data for hypotheses and model testing. However, static analysis can indicate potential causal relationships but is not persuasive enough to determine the causation. Therefore, a series of longitudinal studies are suggested, especially considering the changes in knowledge of environmental issues through information seeking. Here, it is worth noting that future studies on knowledge change may consider inviting college students as research subjects. The reason for using samples of college students is not only because they are easy to reach, but also because they normally pay a high level of attention to social issues, which is likely to guarantee the efficiency of

data collection and a satisfactory survey participation. Also, large-scale surveys are usually time and money consuming. Although the Internet survey is a relatively economical way of collecting data, it could bring concerns about the response rate.

Moreover, the focus of future studies should be put on functions of different media formats in risk communication to explore how the social-cognitive approach can be applied to the complex information environment. In general, the mechanism of the cognitive route is complicated, which requires continuous endeavors in the development of frameworks and methods. This research provides a possible perspective for researchers engaged in studies on public-oriented risk communication. Findings of this research allow future studies to examine further the impact of the information environment on individuals' cognitive and behavioral reactions to risks.

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