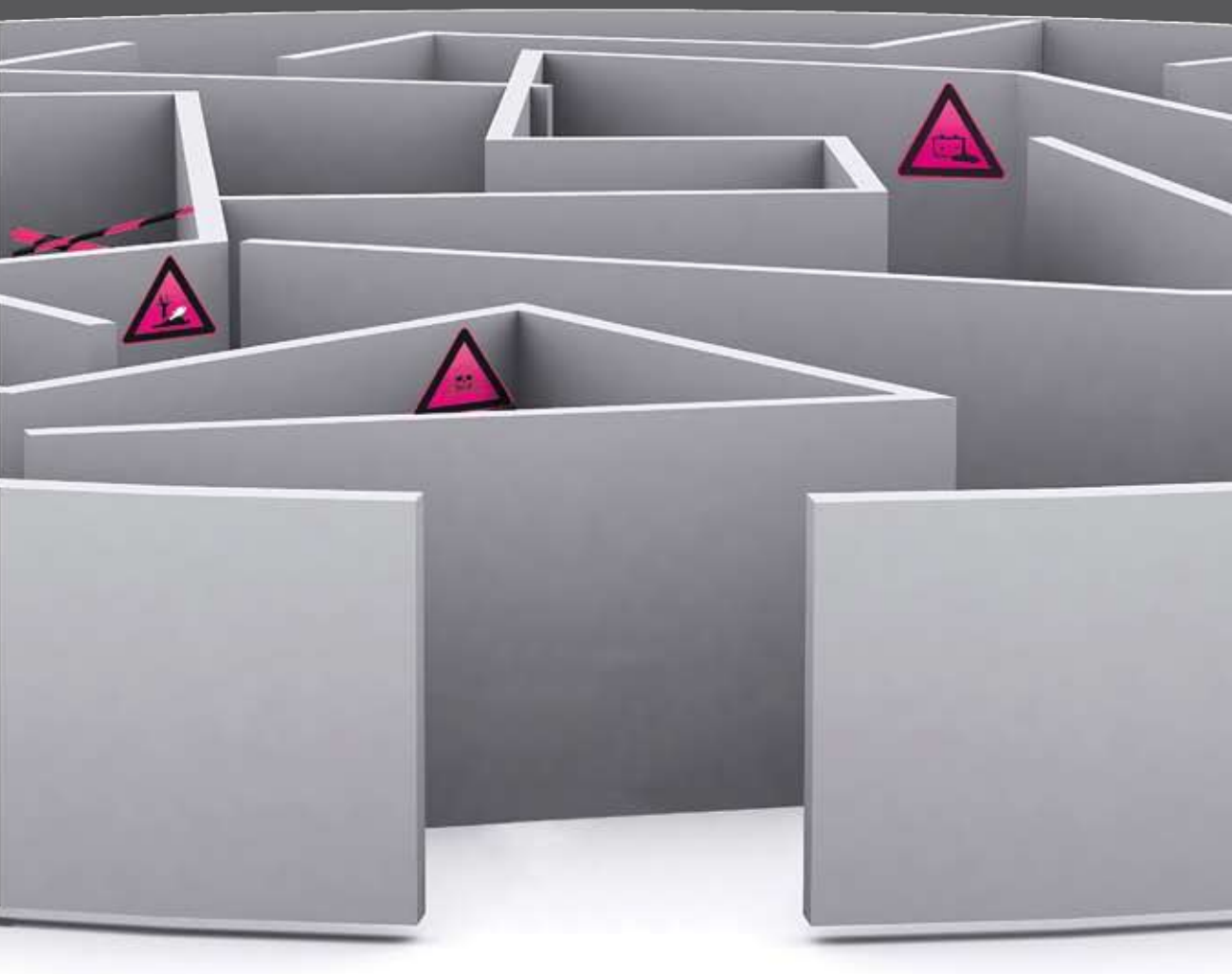
information seeking in a risky world

The Theoretical and Empirical Development of FRIS:
A Framework of Risk Information Seeking



e.f.j. ter huurne

INFORMATION SEEKING IN A RISKY WORLD

THE THEORETICAL AND EMPIRICAL DEVELOPMENT OF FRIS:
A FRAMEWORK OF RISK INFORMATION SEEKING

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INFORMATION SEEKING IN A RISKY WORLD

THE THEORETICAL AND EMPIRICAL DEVELOPMENT OF FRIS:
A FRAMEWORK OF RISK INFORMATION SEEKING

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1

General Introduction

Communication regarding industrial hazards and the risks involved for humans and their assets is subject to major changes in contemporary society. Changing views on risk communication have recently triggered a new era of risk communication approaches that move beyond alerting or reassuring the public about potential hazards (Trettin & Musham, 2000; Leiss, 1996). This era involves stimulating interest in industrial risk issues, increasing public knowledge, and addressing the public's beliefs, opinions and feelings towards potential hazards. Risk communication efforts should be aimed at assisting people in the acquisition of the information they need to make informed choices about the risks they face (Wade et al., 1992). The development of modern communication media, such as the online digital risk maps recently developed and launched in the Netherlands, provides the opportunity to make relevant risk information permanently available and accessible to the general public. Such information can be consulted by any member of the general Dutch audience who has access to the Internet. However, very little is known about what motivates the individual citizen to actually use such information supplies. These developments increase the need for a new theoretical framework aimed at understanding the individual citizen's risk information-seeking behavior.

The ultimate goal of this thesis is to develop such a model. This model, referred to as the Framework of Risk Information Seeking (FRIS), may provide a better understanding of public response to risks. It may also provide ways to persuade the public to utilize information provided on the Internet and other daily information sources. The FRIS is novel in its focus on the individual's active role as a seeker of risk information and is applied here to external safety risks. The new perspective this model provides is important, as it may contribute to the development of more effective risk communication efforts with the general public.

1.1. The Motive

One dramatic change in people's outlook on life in recent years is their growing awareness of and concern about the risks they encounter in everyday life. Risk has become a topic of almost universal importance in modern, highly industrialized countries (Hampel, 2006). Certain industrial activities that are necessary to society also pose possible threats to their surrounding environments and could lead to major accidents. External safety concerns these risks to the surrounding environment related to the handling (e.g., use, storage, and transport) of hazardous materials. Public opinion polls consistently demonstrate substantial levels of concern for chemicals in the environment (Hadden, 1991; Franssen et al., 2004). Many people link serious health risks to toxic chemicals and view them as major problems in modern industrial society (Bord & O'Connor, 1992). In addition, the public is becoming increasingly distrustful of hazardous waste management activities (Williams, Brown, & Greenberg, 1999). Risk experts generally express less concern about these risks than members of the general public.

One consequence of this growing public awareness and concern has been an increase in pressure on the designers and regulators of hazardous enterprises to inform people about the risks that they face (Gutteling & Kuttschreuter, 2002; Slovic, 1999). An increase in public knowledge and awareness of external safety issues by means of risk communication could enhance preventive behaviors as well as avoid excessive panic in the event of an accident involving hazardous substances. Many governments are therefore obliged to communicate with citizens about external safety risks. The process of effective risk communication, however, seems to be a problematic one (Ng & Hamby, 1997). Given the complexity of most industrial risks, risk experts and communication practitioners still struggle with the issue to effectively communicate external safety risks to the public.

Why is it so difficult for governments and other stakeholders to effectively communicate external safety risks? Several answers to this question have been suggested (Gutteling & Wiegman, 1996; Gutteling & Kuttschreuter, 2002), one of which is of particular relevance to this study. It focuses on the incongruence between the public's need for information and the time elapsed before the delivery of risk information by governments or other sources of risk information. A critical issue is that risk information is usually made available to the public when authorities consider it necessary, but is rarely available or is difficult to seek out when the public feels a need for it in everyday living. Such ways of "communication" intrinsically comprise the notion of a top-down, one-way form of communication. A possible spin-off is that the audience is not well-informed and therefore lacks the knowledge of what to do in case of an accident. Consequently, the audience becomes dissatisfied and frustrated with the information supplies and distrustful towards risk management agencies (Gough & Hooper, 2003). Moreover, this could lead to an increase in risk perceptions and public opposition towards possible hazards (Groothuis & Miller, 1997). Risk communication is supposed to refer to a social process by which people become informed about hazards in a context where risk awareness, risk preparedness, and behavioral change are expected to increase

(Nathan, Heath, & Douglas, 1992; Rohrmann, 2000). Therefore, the focus on a more receiver-oriented approach, which assumes that individuals will seek information when they perceive it will be relevant and useful to them in some way, has recently gained stronger support (Sjöberg, 2002).

1.2. The Risk: External Safety Hazards

External safety is about the industrial control of risks that come with the use, production, and transportation of hazardous materials. As defined by the Netherlands Ministry of Housing, Spatial Planning, and the Environment (VROM, 2008) external safety matters include: (1) production, storage, and use of hazardous materials; (2) transport of hazardous materials on roads, water, railways, and through pipelines; (3) use of airports; and (4) activities of defense forces, including the storage of ammunition. As the Netherlands is a relatively small yet densely populated country with numerous industrial activities and transportation of hazardous chemicals, the safety of residents in relation to accidents with industrial chemicals or their release is referred to as external safety. The level of external safety is dependent on the nature of the activity, the probability of an accident occurring, and the environmental conditions (Passchier-Vermeer et al., 2001). The concern for safety in industrial activities, both inside the establishments and in their surroundings, has a long history in the Netherlands (Ale, 2002). As a result, many rules and regulations have been formed. An external safety policy has been developed and implemented in the Netherlands since the early 1980s that uses a risk-based approach involving quantitative criteria for the tolerability of risk (Bottelberghs, 2000). However, disasters are not always preventable. According to the Ministry of VROM, risks are simply a part of daily life. For example, the only way to completely avoid the risk of a plane crash would be to stop flying altogether, which is clearly unrealistic.

The subject of external safety is a special case. As long as there are no serious accidents, public interest in the subject wanes and the willingness to invest in safety declines, thereby making it more difficult to maintain public and governmental awareness. Conversely, a major accident inspires renewed efforts and top-priority attention (VROM, 2008). For example, after the fireworks disaster on May 13, 2000, the Dutch government overhauled its external safety policy. In addition to new safety requirements, risk management activities, and the development of emergency plans, the communication of risks with the general public currently has garnered major governmental attention. As a result, a focus on and improvement of public information supplies has become a major topic in risk management and safety policy.

Equitable and easy access to information is important so that people may deal with uncertain or risky situations that arise in daily life (Pettigrew, Durrance, & Unruh, 2002). For example, the fact that neither the citizens nor the government were aware of the fireworks facility in the neighborhood of Enschede has been postulated as one of the primary reasons for the quantity of human casualty and material damage inflicted by the explosion in 2000. Since the end of

2005, each Dutch province has provided an online 'risk map', allowing Dutch citizens to evaluate any potentially hazardous companies operating in their area. The use of digital maps to convey information on environmental burden and accident risks is increasing (Moen & Ale, 1998). With the development of such online risk information sources, the Internet will soon play a crucial role in risk information provision and communication with the general public. Along with faster connectivity, wider variety of enabled devices, and accelerated growth of users (83% of Dutch households have access to the Internet in 2007; CBS, 2008), the Internet allows new ways for governments and other purveyors of risk information to facilitate the public's daily information needs. The growing use of such bottom-up approaches to risk information provision solves a number of communication problems, but also introduces others (Moen & Ale, 1998). Some fear that providing such information to the public only fuels anxiety. Research on the effects of the information provided on the risk maps indicates, however, that although the (amount of) information provided on the maps does increase the public's perception and awareness of potential hazards, it does not affect their state of anxiety (Beerepoot et al., 2004).

1.3. The Approach: Towards a more Receiver-Oriented Risk Communication

Risk communication may serve different goals, varying from increasing knowledge to influencing behavior (Meijnders, Midden, & Wilke, 2001). The focus usually lies on situations where risk awareness and preparedness are to increased, but it could also be employed to reduce public concerns (Rohrmann, 2000). Renn & Levine (1991) have listed various functions that a risk communication program may seek to fulfill, including: enlightenment role (aiming to improve risk understanding among target groups); right-to-know (designed to disclose information about hazards to those who may be exposed); attitude modification role (to legitimize risk-related decisions, to improve the acceptance of a specific risk source, or to challenge such decisions and reject specific risk sources); legitimate function (to explain and justify risk management routines with the aim of enhancing the trust in the competence and fairness of the management process); risk reduction role (to enhance public protection through information regarding individual risk reduction measures); and a behavioral change role (to encourage protective behavior or supportive actions towards the communicating agency).

The concept of 'risk communication' was first mentioned in the literature in 1984 (Leiss, 1996). The predominant paradigm in risk management and risk communication in the 1980s was that the lay public was heavily dependent on the industries and institutions responsible for risk management to protect area residents from possible harm (Woudenberg, 1997). During this period, risk communication was primarily the domain of policy makers and risk experts at large industrial plants, such that industries were exclusively obliged to inform the government of the risks accompanying their products and production processes (Otway, 1987). Communicating risks to the general public in the past tended to be driven by expert conceptualizations of public information needs (Griffin, Dunwoody, & Neuwirth, 1999; Frewer et al., 2002). A general assumption is that most people do not

possess sufficient knowledge of science and technology to be capable of judging risks and benefits (Gregory & Miller, 1998). To judge possible threats, the public has to rely on information provided by experts (Earle & Cvetkovich, 1995). Furthermore, the public is known to judge risks in a different fashion than the experts. Any possible discrepancy between the audience's risk perceptions and the experts' risk estimates has in the past been treated as 'public misperception' and been viewed as the product of public ignorance or stupidity (Bennett, 1999). Such an approach is not an ideal basis for effective communication (Lang et al., 2001).

A major draw-back of such approaches to risk communication is the dominating focus on educating the public. This top-down approach lacks the capacity for interacting or actually communicating with the public, and generally neglects the role of the receiver (Fessenden-Raden, Fitchen, & Heath, 1987). As a consequence, citizens are often frustrated and disappointed by the risk information provided by governments, which (to them) conveys disinterest in the public's concerns and reluctance or unwillingness to allow the public to participate in risk management (Covello, McCallum, & Pavlova, 1989). Moreover, this technical perspective on risk communication (Botterill & Mazur, 2004) was insufficient as systems grew in complexity and making socially acceptable risk decisions became more problematic (Beck, 1986) given rising public opposition.

Fortunately, this stance is gradually changing. It is now acknowledged that public reactions to risk often have a rationale of their own, as opposed to these reactions being dubbed 'public misperceptions' (Bennett, 1999). A two-way process of risk communication, one in which 'expert' and 'lay' perspectives inform each other, is therefore merited to risk communication (Lang et al., 2001; Bennett, 1999; Rowan, 1994; Gurabardhi, 2005). Communicating risks, therefore, is more than just providing the public with information the experts deem necessary. It is instead an ongoing process involving active listening to public reasoning about risk (Walker et al., 1999), and is highly dependent on the context in which communication takes place (Hampel, 2006; Walker et al., 1999). By the late 1990s, newer models of risk communication were emerging (Petts & Leach, 2000). This trend has primarily arisen in response to risk management becoming increasingly politicized and contentious (Slovic, 1999). There is now a growing body of research that argues against the older paradigm of risk communication characterized by a passive role of the individual and a dominant role of the information sources (such as government agencies), advocating instead for more democratic approaches (Botterill & Mazur, 2004). In light of this, the time when it was possible to take a 'we know best' approach by simply informing the public that a risk has been identified, telling people not to worry, and stating the intended solution, have in most cases disappeared (Coles, 1999). As such, a more bottom-up, receiver-oriented approach is gaining more support over the last few years (see for example Gutteling, 2002; Griffin, Dunwoody, & Neuwirth, 1999).

The bottom-up approach holds that risk communication is bound to fail unless the information provided is forthcoming to the audience's perceptions, feelings, and information needs (Rowan, 1996; Slovic, 1999; Griffin, Dunwoody, & Neuwirth, 1999). Risk communication practitioners should therefore better understand how non-experts (i.e., the lay public) evaluate risks and risk

information, and how they subsequently use that information to make decisions about risks. When people seek information, these search processes are often biased by previously held beliefs, expectations, and desired outcomes (Jonas et al., 2001). If an information seeking effort does not lead to satisfactory outcomes, people may abandon the search process (Case, 2007). A mass-media campaign stimulating people to search for personally relevant risk information is therefore more likely to be effective when the information provided approaches the individual seeker's needs and expectations. This new perspective is important, because it may provide a solution to earlier problems related to communicating risks effectively to the general public, beginning with public concerns and the audience's needs for risk communication (Rowan, 1994). Providing the audience with personally relevant risk information that can easily be accessed contributes to the adoption of risk-related behaviors in the long run (Kahlor, 2007), and is more likely to establish long-term effects (Turner et al., 2006). Therefore, an in-depth understanding of what motivates the audience to attend to and seek personally relevant risk information is required in order to develop more effective risk information supplies such as the Internet.

1.4. The Behavior: Information Behavior

Information behavior "encompasses information seeking as well as the totality of other unintentional or passive behaviors (such as glimpsing or encountering information), as well as purposive behaviors that do not involve seeking, such as actively avoiding information" (Case, 2007, p. 5). It also includes the processing, using, and transferring of that information (Wilson, 1999). As such, the seeking or avoidance of information is part of a larger entity termed "information behavior". Wilson (1999) explains that within the general field of information behavior, a series of nested subfields can be distinguished: (1) information behavior, which captures the more general field of investigation, focusing on the totality of various responses to information as well as different information behaviors; (2) information-seeking behavior, which studies the processes and methods underlying one's motivation to seek information; and (3), information searching behavior, which is concerned with the interaction between users and the media, including the examination of different stages within the actual information searching activity (see Figure 1.1). The current study focuses on risk-related information seeking (and avoiding) behavior.

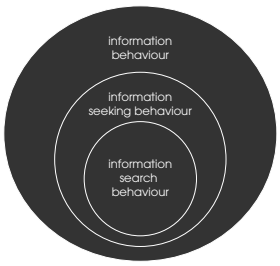

Figure 1.1. Wilson's 1999 nested model of information behavior

1.4.1. Information-seeking behavior

Information seeking can be considered a response to some problematic task or situation facing an individual (Ford, 2004). Information-seeking behavior is an area of research surrounded by a theoretical breadth and depth of current interest that is studied in many disciplines, such as information and library science, medicine, or psychology (Afifi & Weiner, 2002). Various approaches to studying information seeking apply to this behavior. According to Johnson (1997), information seeking can be described as "the purposive acquisition of information from selected information carriers" (p. 26). Machionini (1995) provided a more specific definition: "A process in which humans purposefully engage in order to change their state of knowledge" (p. 5). Thus, information-seeking behavior can be viewed as the totality of behaviors or actions motivated by the recognition of "missing" information (Case, 2007).

Researchers classify information-seeking behavior in different ways. Information retrieval studies approach information seeking either by a system-centered approach or a person-centered approach (Ellis et al., 2002; Ford, 2004). According to Ford (2004), the system-centered approach focuses on information seeking that is related to information channels and sources of information. In general, two methods are generally applied in system-centered information retrieval research: statistical methods and linguistic methods. A paradigm shift towards a more person-centered approach arose in the 1980s (Wilson, 2000). This perspective relates to phenomena such as attitudes, emotions, self-efficacy, and anxiety, and focuses on the "person in context". Ford (2004) explains that this "context" addresses "the purposes for which information is sought" (p. 769). Ingwerson (1992) views the person-centered approach as a more cognitive viewpoint in the information science that is involved with the representation, storage, search, and finding of information that is relevant to retrieving the information required by the user.

Other classifications that have been described in the literature refer to the intensity of information seeking (Kahlor, 2007). That is, information seeking could occur through the expenditure of differing levels of effort in the information search process, ranging from very little (i.e., passive seeking) to quite a lot of effort (i.e., active seeking; Kahlor et al., 2006). In everyday living, it is likely that most of the information received is gathered in a relatively passive fashion (Afifi & Weiner, 2002) or by more ritual-based behavior (Kahlor et al., 2006) such as scanning the newspaper or watching the evening news on TV (i.e., accidentally encountering information). In contrast, active information seeking describes more goal-driven behavior, and is characterized as going beyond routine or habitual behavior, for example, using Internet search engines or visiting the library to search for information (Kahlor et al., 2006). The intensity of information seeking may vary during this process. During an information seeking episode, people may move from one strategy to another (Belkin et al., 1995). That is, during the seeking of information a person's knowledge and goals may change. One could therefore decide to move from a more active, focused information-seeking mode towards a more passive, routine information-seeking mode, or vice versa. The focus of this thesis can be described as a person-centered active information-seeking behavior, and therefore uses the following definition of information-seeking behavior

proposed by Case (2007): "Information seeking is a conscious effort to acquire information in response to a need or gap in your knowledge" (p.5).

Considering information-seeking behavior as a starting point for developing risk communication efforts that are focused on a more receiver-oriented approach to risk information supplies requires a solid and ongoing interaction between the communicator and recipient. A two-way communication of risks includes an evaluation of the communication efforts executed, preferably by actively listening to the audience's needs and desires (Walker et al., 1999). The recipient, therefore, should be considered a central position in the communication process (see Figure 1.2) and should address the social context the person is part of. The communication process must acknowledge and elaborate on the notion that risk responses and risk-related information behavior are not purely individual, but occur in a "social dynamic, with multiple sources of information, channels of information flow, confirmatory and challenging mechanisms, and linkage with other social issues" (Kasperson, 1986, p. 131).

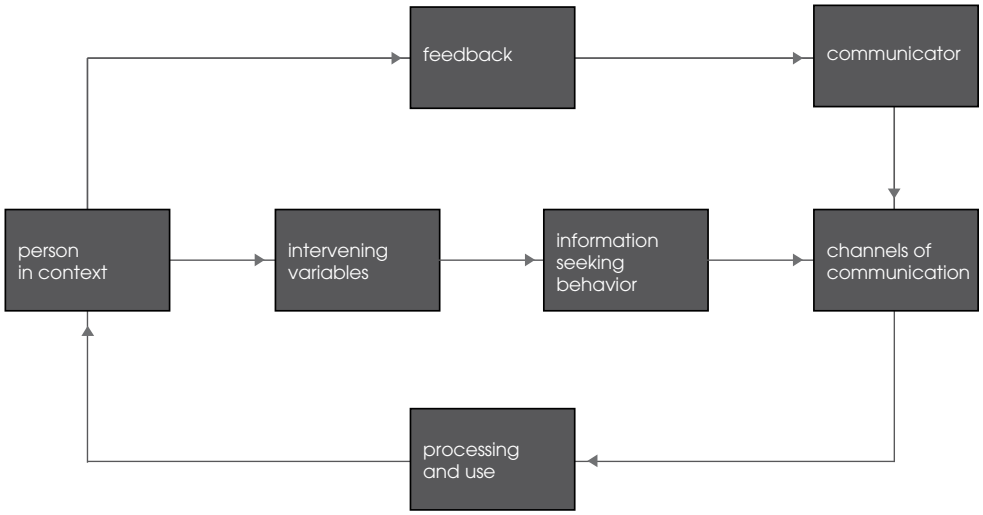

Figure 1.2. Linking information seeking and communication (based on Wilson, 1999)

1.4.2. Information Avoidance Behavior

Although it is often assumed that individuals will seek, or at least pay attention to, information, they may decide not to search for risk information at all, but, alternatively, decide to actively avoid additional information. From the information behavior science perspective, the main reason for avoiding information is assumed to stem from the perceived size of the knowledge gap an individual holds about a topic. That is, a gap perceived to be either too big or too small may lead to information avoidance (Godbold, 2006). The knowledge gap is perceived to be too big, when the individual feels he or she is unable to close or reduce the gap by additional

information, for example when one fears the emotional risk involved in the information to be gathered (i.e., fear of bad news, fear of failure, fear of increased uncertainty; Godbold, 2006). On the other hand, a gap too small in size will instantly discourage information seeking behavior. This could be explained based on Eagly & Chaiken's (1993) principle of least effort, which asserts that people prefer less effortful information behavior and not doing anything about the information shortcoming wherever possible. In such cases, individuals do not feel the urge to seek information for the following reasons: (1) they know there is a gap, but they feel they can deal with it; (2) people tell them there is a gap, but they can justify to themselves there is no gap; and (3) when the relative importance of the gap can be minimized (Godbold, 2006).

According to some authors, information avoidance is not merely a lack of a motivation to seek information; rather, it is conceptually distinct from information seeking behavior, as it refers to actively and consciously rejecting information (cf. Kahlor et al., 2006; Case, et al., 2005). With regard to the risk context, information avoidance might be associated with uncertainty and unpleasant feelings. Whereas information obtainment is primarily been forwarded as reducing uncertainty, it could also increase uncertainty (Case et al., 2005). Research indicates that people might avoid information for self-protection purposes (Lion, Meertens, & Bot, 2002), for example when the topic is distressing (Brashers et al., 2000). Shunting away and not knowing about the risks enables people to retain the idea of the world around them being a safe place to live. Feeling incapable of making adequate decisions and fear of getting more confused by additional information are other reasons for not wanting risk information. A danger may be felt that more information would increase uncertainty and enlarge the information gap in a manner beyond the individual's power to navigate. A person may then take steps to avoid receiving such information. The extended parallel process model (EPPM; Witte, 1992, 1994) proposes that high levels of fear can produce risk information avoidance if coupled with a sense of inefficacy in dealing with the hazard. In such a case, people might be scared of the possible content or outcomes of risk information, like learning that a topic is far more threatening or difficult to control than a person already knows.

1.5. The Motivator: Information Needs

When setting out to track down for information, one often perceives an information need. Unless a need for information is perceived, a person will not be energized to actively seek for information. A need could be characterized as an 'inner motivational state' (Grunig, 1989, p. 209). These motivational states bring about thought and action (Case, 2007). But what exactly is an information need? The awareness of an information need typically arises as the consequence of the perception of a lack of information. It is proposed that it is the sense of an information lack that provokes one to develop a need for it (Campbell, 2000). According to Campbell (2000), trying to define information needs is problematic, in a sense that information one does not currently possess is information that one cannot describe in its entity. That is, it is only the fact

that something is missing that can be recognized, but the specific information perceived to be lacked can neither be known nor described. He states that an information need is that which is lacking, and therefore the lacking information should be sought in order to satisfy the information need. According to Forsythe and colleagues (1992), no explicit consensus in the literature exists regarding the meaning of "information needs" and information needs are usually defined according to the interests of the author. The distinctions made among varieties of "need" can be bewildering (Case, 2007). As the concept is hardly defined, different authors hold different approaches to the concept of information needs, with generally overlapping views considering the recognition of an information shortcoming as the basic principle.

Some scholars focus on the cognitive nature as a factual knowledge shortcoming, driven by rational judgment, and view information as objective reality (Case, 2007). Examples include the information seeking theory (IST; Atkin, 1973), anomalous state of knowledge theory (ASK; Belkin, 1980), the model of the information search process (ISP; Kuhlthau, 1991), the uncertainty reduction theory (URT; Berger & Calabrese, 1975), and the heuristic-systematic model (HSM; Eagly & Chaiken, 1993), which all refer to information needs as tied to uncertainty. In general, these theories assume that people pursue a satisfying amount of certainty about topics in their lives. When this certainty decreases (or uncertainty increases), the need for information grows. According to Atkin (1973), the need for information is "a function of extrinsic uncertainty produced by a perceived discrepancy between the individual's current level of certainty about important environmental objects and a criterion state he seeks to achieve" (p. 206). Belkin (1980) refers to an "anomalous state of knowledge" (ASK), which exists when a person recognizes that there is an anomaly (i.e., uncertainty) in their state of knowledge regarding an issue. Eagly and Chaiken (1993) explain that, according to their sufficiency principle, "people will exert whatever effort is required to attain a 'sufficient' degree of confidence that they have accomplished their processing goals" (p. 330). A perceived gap between one's current understanding and the level of understanding required (i.e., insufficiency), then, is associated with actively seeking additional information through the use of multiple information sources. A key motivator is to minimize effortful behavior. The balance between this minimal effort and one's desired level of judgmental confidence has been called the sufficiency principle. The basic assumption is that individuals will continue to actively engage in seeking or processing until they have reached the depth or breadth of understanding that they perceive to be necessary. In general, it is assumed that individuals attempt to address their cognitive information shortcoming by requesting or consulting information (Case, 2007) or, as Atkin (1973) put it:

> "Uncertainty is the key concept in this paradigm. For a given object, the individual's level of knowledge varies along a continuum from total uncertainty to total certainty. The basic building blocks contributing to increased certainty are cognitions. [..] A primitive cognitive uncertainty arises when the individual perceives an insufficient level of knowledge about an object after reprocessing stored cognitions from previous experience. Acquisition of external information from a message automatically reduces the individual's knowledge gap."

In contrast, a more subjective approach is taken by other authors, who state that information needs arise from feelings of e.g., unease (with the amount of knowledge held), or anxiety or worry, such as Kelly (1963), Dervin (1992), and Afifi & Weiner (2006). Kelly (1963) and Afifi & Weiner (2006) stress the affective sates of individuals in the process of gaining knowledge and constructing meaning. They state that uncertainty is often accompanied by feelings of anxiety. These feelings of anxiety, then, produce an information need and drive one to seek information. Dervin (1992) states that people have a tendency to "make sense" of the world and this sense-making tends to emphasize feelings rather than cognitions in information seeking.

In general, information need is seen as "a recognition that your knowledge is inadequate to satisfy a goal that you have" (Case, 2007, p. 5). The notion of information needs, then, could be approached as a concept comprising various phases, levels, and levels of specifity (Kuhlthau, 1991). Carol Kuhlthau's ISP theory is theoretically founded on the theories of Kelly, Taylor, and Belkin (see Table 1.1). According to Kuhlthau (1991), these theories "suggest a series of stages with changes in feelings, as shown in the phases of construction; changes in thoughts, as shown in levels of information need and levels of specificity; as well as changes in expression and mood" (p. 363).

Table 1.1. Phases, levels, and specifities in information needs (based on Kuhlthau, 1991)

Phases of Construction (cf. Kelly)	**Levels of Need (cf. Taylor)**	**Levels of Specifity (cf. Belkin)**
Confusion	Visceral	Anomalous State of Knowledge (ASK)
Doubt	Conscious	New problem New situation
Threat		Experiential needs
Hypothesis testing	Formal	
Assessing	Compromised	Defined problem Well understood
Reconstruing		Situation Informative needs Coherent state of knowledge

1.6. The Theories

Numerous general models of information-seeking behavior and the interacting variables have evolved over the years. These models, however, do not all attempt to describe the same set of activities (i.e., they represent different aspects of the same general outcome). In this sense, they are complementary rather than competing (Wilson, 1999). Some, for instance, stem primarily

from libraries and information retrieval sciences and therefore focus on the information search process itself. As such, they are concerned with behavioral patterns in the actual search activity (Ellis et al., 2002), or they conversely represent stages of activity within which the behavioral patterns may occur (Kuhlthau, 1991). Others are concerned with interpersonal communication, such as the uncertainty reduction theory (Berger and Calabrese, 1975). As a response, Wilson (1994, 2005) reflected the importance of "an integrative model of information need, information-seeking behavior and information use."

In a more general sense, former information-seeking models have more or less incorporated similar views on what motivates people to seek information. For example, Wilson's (1981) model of information seeking (Figure 1.3) proposes that this behavior is not triggered by primary human needs. Information seeking instead reflects more secondary needs, which arise from needs of a more fundamental form, such as environmental, social, and individual-related variables. According to Wilson's theory, it is the barriers that may arise out of the same set of contexts that impede the search for information (Wilson, 1999). He later described his model as a 'macro model' or a 'model of the gross information–seeking behavior.' As such, it suggests hypotheses about information context without making them explicit, and neglects to indicate the processes in which a person is affected by context and how the context subsequently affects his or her perception of information seeking barriers (Wilson, 1999; Godbold, 2006).

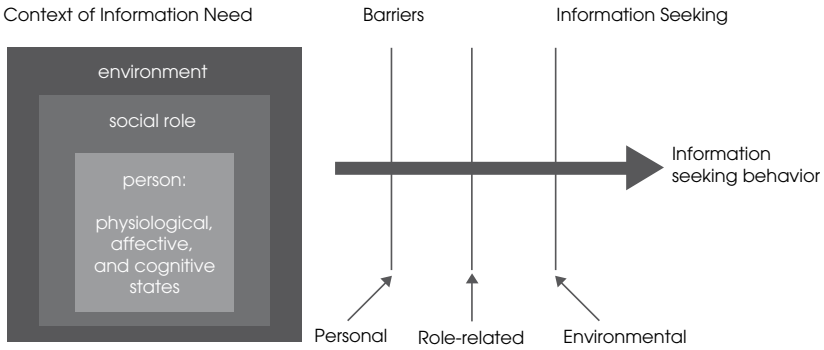

Figure 1.3. Wilson's (1981) model of information seeking behavior

Instead of focusing on barriers affecting the information seeking process, Dervin (1999) focused on the information gap. Her sense-making theory consists of four elements, including a situation in time and space, a perceived information gap, an outcome of the sense-making process, and a bridge as a way of closing the gap between situation and outcome. Inspired by the usefulness of ideas from many areas of information behavior research, Godbold (2006) proposed an extended model of information-seeking behavior by merging the frameworks of Wilson (1981) and Dervin (1999) (Figure 1.4). In Godbold's model, a person in a certain situation or context stands at the

gap, contemplating their gap and the need for sense making. Based on the decision derived from the conclusions, the person undertakes some course of action to make sense by employing one (or more) of a full range of options for handling the information.

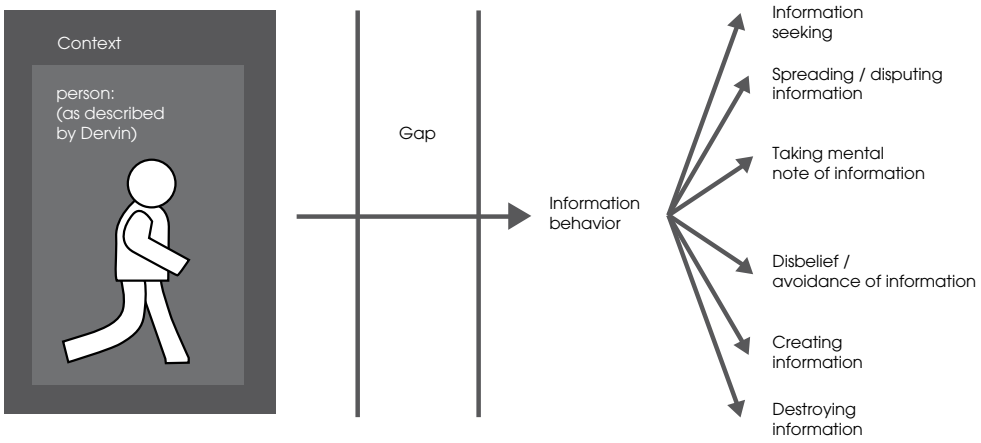

Figure 1.4. Godbold's extended model of information seeking behavior

In summary, many factors other than the existence of an information shortcoming or 'gap' will play a role in information seeking; these factors include the importance of satisfying the need for information (e.g., perceived involvement or personal relevance) and the availability of information sources. Many decisions are taken with incomplete information or on the basis of beliefs (Wilson, 2006). Information seeking may therefore not occur at all when the barriers in the process of information gathering overwhelm one's motivation to seek information.

Although the field of information science has produced numerous models of information seeking (Godbold, 2006), theories of risk information-seeking behavior remain scarce. One of the first attempts was made by Griffin and colleagues (1999), who recently developed the model of risk information seeking and processing (RISP). The model concedes to the recently changing views on public responses to risks and risk communication. It proposes a variety of variables that may predispose individuals to seek (and process) information in various risk settings (Griffin, Dunwoody, & Neuwirth, 1999). In doing so, RISP pulls together existing theoretical concepts from various fields of research based primarily on parts of the HSM (Eagly & Chaiken, 1993), the theory of planned behavior (Ajzen, 1991), and mass media research. The concept of information sufficiency is central to the model, representing an individual's sense of the presence or absence of a discrepancy between the amount of knowledge held and that needed to deal with a given risk. This is based on Eagly & Chaiken's (1993) sufficiency principle. The model suggests that each

individual has a different level of the amount of information they deem necessary in order to feel confident about judging a given risk. A sense of information insufficiency is therefore proposed to be a direct cognitive driver of risk information processing or seeking behavior.

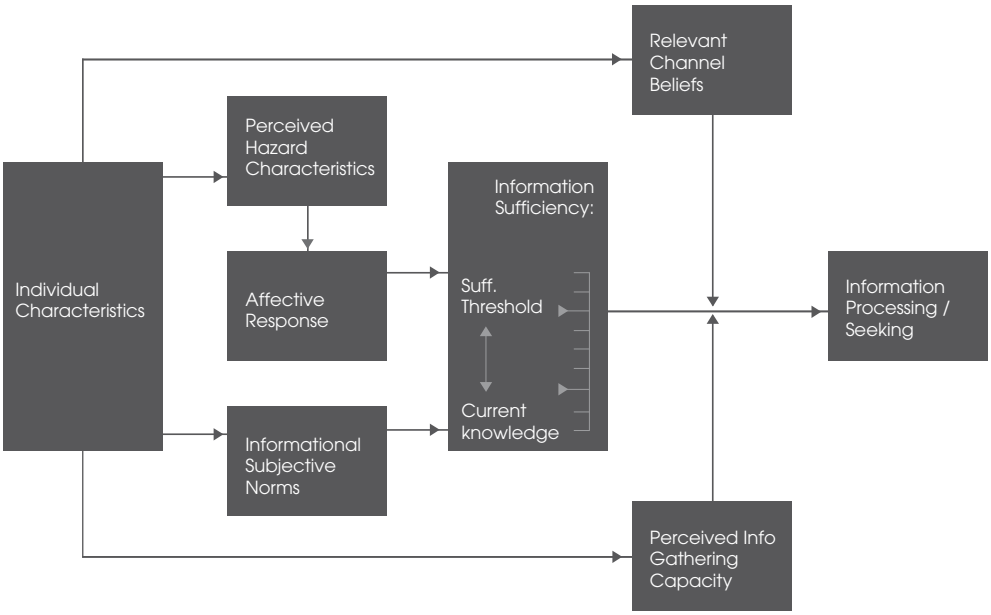

Figure 1.5. The Model of Risk Information Seeking and Processing

In general, the model suggests that three factors directly affect the risk information seeking strategy one would employ: (1) information sufficiency; (2) relevant channel beliefs (i.e., the beliefs about the information channels that supply risk information); and (3) capacity (i.e., the individual's perceived ability to perform the information seeking steps necessary for the outcome he or she desires). In addition, some indirect factors are stated to affect one's risk information processing or seeking behavior: affective responses (e.g., feelings such as worry or anger); informational subjective norms (i.e., the perceived pressure from relevant others to be knowledgeable about the topic); perceived hazard characteristics (e.g., risk perception and institutional trust); and individual characteristics (e.g., political philosophy, social status, and demographics). By integrating theories and concepts from theories in various research areas, the Griffin et al. framework addresses the multidimensional concepts of risk and risk communication. It aims to "help explain variation in how individuals respond to messages about health risks" (Griffin, Neuwirth, et al., 1999). As such, it tends to focus on information- and channel-related variables as direct predictors of information behavior (see Figure 1.5). The RISP model is a relatively young model, but empirical studies have been at least partially supportive of the relationships depicted in the model across various types of risks and settings (see for example Griffin et al., 2004; Griffin et al., 2008; Kahlor et al., 2006; Trumbo, 2002). This is promising for future research due to the applicability of such

receiver-oriented frameworks. Although the model has primarily been employed to study risk information processing behaviors, it could also add valuable insights for information seeking as a dependent variable. Research on modeling risk information-seeking behavior, however, is still in its infancy, and a complex, in-depth understanding of those behaviors is still lacking (Turner et al., 2006; Kahlor, 2007). More specific to the risk context, a sound framework that incorporates the specific factors in the risk field that motivates people to seek relevant information would be valuable in filling this gap in risk research.

1.7. The Destination

The aim of this research is to develop a framework that would help identify key aspects of an individual's responses to various aspects of external safety risks as well as the psychological processes that would help understand the individual's motivation to gather relevant risk information. The framework is new in its focus on (a) the individual as an active risk information seeker regarding external safety issues, and (b) the focus on the specific social-psychological risk-related variables aimed at understanding the risk information seeking process. It seeks to provide recommendations for more effective means of risk communication efforts by recognizing the importance of a receiver-oriented, bottom-up approach to risk information conditions. The need for a sound framework becomes especially relevant when risk communication outcomes are to be assessed (Rohrmann, 1998). The basic assumption of this project is that the success or failure of risk communication efforts regarding external safety issues lies in the interaction of the individual's risk-related information-seeking behavior and the development of risk communication efforts that consider the audience's concerns, needs, and information preferences. The central, fundamental research question of this thesis is:

What motivates an individual citizen to seek personally relevant risk information about external safety issues?

Inspired by the usefulness of ideas from many areas of research, including information science, social psychology, and risk perception studies, a theory-based framework will be developed and tested based on survey data called "Framework of Risk Information Seeking" (FRIS). In the previous sections we have characterized information behavior in general, and have specifically characterized risk information seeking as a very complex behavior, but also as a behavior that requires further exploration in order to gain an in-depth understanding of the individual and social-psychological processes that underlie the behavior of interest. Compared to risk information-seeking behavior, even less is known about how to stimulate the general audience in order to seek personally relevant information regarding hazardous industrial chemicals in their neighborhoods and how to best communicate these issues effectively to the audience.

1.8. The Route

Building this model involves five steps: (1) a theory-based content of relevant variables/factors; (2) propositions about the causal links between these elements in a tentative framework; (3) constructing a measurement instrument for relevant concepts; (4) data collection; and (5) model testing. In doing so, this thesis presents studies that were performed to eventually present a framework of risk information seeking and its implications for risk communication practice.

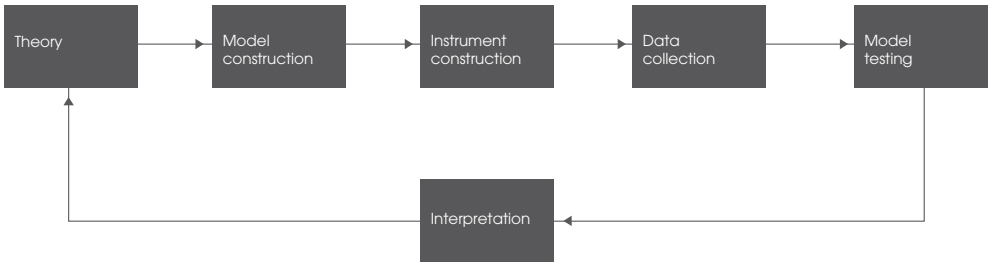

Figure 1.6. Stages in model development

1.8.1. The Methodology

In the process of developing FRIS, a variety of structural equation modeling (SEM) procedures will be employed for different analytical purposes. Structural equation modeling is now a regularly used method for testing dependency or causal relationships in behavioral and social sciences (McDonald & Ringo Ho, 2002; Byrne, 2001; Kline, 2005). According to Byrne (2001), the term "structural equation modeling" conveys two important aspects of the procedure: (1) the causal processes under study are represented by a series of structural (i.e., regression) equations, and (2) these structural relationships can be modeled pictorially to make a clearer conceptualization of the theory under study. The hypothesized model can then be tested statistically in a simultaneous analysis of variables to determine the extent of consistency within the data. Structural equation modeling therefore enables a researcher to test a set of regression equations simultaneously. Several statistics produced by a typical linear regression analysis (e.g., (un)standardized regression coefficients, standard errors for those coefficients, and squared multiple correlations) are similarly produced by SEM. This, however, generates statistics for multiple equations rather than one, as is the case in ordinary least-squares regression.

Structural equation modeling produces a variety of advantages compared to traditional statistical techniques (MacCallum & Austin, 2000). Some of these advantages, described by Byrne (2001), MacCallum and Austin (2000), and Stephenson and Holbert (2003) will be listed here. First, a notable feature of SEM is that it takes a confirmatory instead of an exploratory approach to the analysis of a structural theory. As such, SEM demands that the patterns of (causal) relationships are specified a

priori. Differing from most other multivariate procedures, which generally are descriptive in nature, SEM is well suited to analyze inferential data and hypothesis-testing. Second, SEM allows for the estimation of measurement error by providing explicit estimates of error variance parameters, whereas traditional multivariate methods are not only incapable of assessing or correcting for measurement error; they generally ignore it altogether. Third, SEM can incorporate both observed (i.e., manifest) and unobserved (i.e., latent) variables as opposed to more traditional procedures, which in essence can only incorporate observed variables. As such, a SEM is therefore a hypothesized pattern of (directional and nondirectional) linear relationships among a set of both observed and unobserved variables (MacCallum & Austin, 2000).

The general linear model is extended by SEM by offering a wide array of applications that go beyond the limitations of the older methods of multivariate procedures (Byrne, 2001). In general, SEM may be used as a more powerful alternative to procedures such as multiple regression, path analysis, factor analysis, time series analysis, and covariance analysis (Garson, 2008). Some special applications commonly used in practice are of particular interest for this thesis.

Construct Validation and Scale Refinement

The suitability of a measurement model is commonly assessed using a SEM procedure known as confirmatory factor analysis (Cheung & Rensvold, 2002). In measurement construction, confirmatory factor analysis is often applied to evaluate the validity of items proposed, capturing a higher-order latent factor. According to Cheung & Rensvold (2002), a measurement model is considered suitable if the covariance structure implied by the model is somewhat similar to the covariance structure of the sample data, as indicated by an acceptable goodness-of-fit. The factor analysis procedure in SEM allows for correlational (nondirectional) relationships among latent variables, but does not include directional influences as in general SEM (MacCallum & Austin, 2000). In confirmatory factor analysis procedures, SEM therefore tests the fit of theoretically grounded models to data, and thus is especially useful for construct validation and scale refinement purposes in theory-based research such as identifying social-psychological variables that influence risk-related information behavior. Measurement and confirmatory factor analysis can be used to detect errors, making estimated relationships among latent variables less contaminated by measurement error.

Multiple Sample Approach

In order to test for structural invariance (i.e., equivalence) across different samples, the multiple sample approach of SEM is often utilized. Multi-sample modeling refers to a procedure, wherein a model is fit simultaneously to sample data from different populations. A key aspect of this approach involves the testing of the invariance of critical parameters across groups (Byrne, 2001; MacCallum & Austin, 2000). To examine whether certain paths in a specified causal structure are invariant across populations, group differences in means of manifest variables is a common way to analyze multiple group invariance. Path analysis provides for the testing of models of relationships among manifest variables, and no latent variables are included in the model (MacCallum & Austin, 2000).

Full Structural Equation Modeling

Theory testing in the behavioral sciences is most commonly executed by full structural equation modeling. A full structural model captures both the measurement model as well as the path model (McDonald & Ringo Ho, 2002), with the measurement model depicting the links between the latent (unobserved) variables and their observed (manifest) measures and the structural model depicting the links among the latent variables themselves (Byrne, 2001). This approach is preferred over a regression or observed variable SEM approach, as it allows for the estimation of measurement error (Stephenson & Holbert, 2003).

1.8.2. Outline

The remainder of this thesis is organized as follows: The first study (Chapter 2) seeks to gain an overview of relevant constructs by reviewing the literature and proposing a tentative framework that includes the causal links between these elements. In addition, measurement instruments for relevant concepts are developed and validated based on survey data. Although it is generally acknowledged that poor measurement properties of instruments can lead to erroneous conclusions, only a handful of studies in the risk information seeking field have used instruments that meet the minimal standards of reliability and validity (Johnson, 2005; Beerepoot et al., 2004). Moreover, even fewer measurement instruments are validated for general use in the risk context. To overcome this limitation, the study presented in Chapter 2 aims to develop a sound measurement instrument for use in further model building studies, capturing the relevant concepts revealed from the literature.

Chapter 3 builds on the results of the previous chapter by employing the measurement instruments and the insights in causal relationships that have emerged among predictor variables. It describes a cross-cultural test of the risk information seeking and processing model among U.S. and Dutch resident samples. The intent of this study is to test the causal structure that involves the impact of different predictors of information seeking regarding risks from hazardous industrial substances in different countries. The insights emerging from the previous study regarding specific causal relationships will be tested and evaluated.

The study reported in Chapter 4 proposes and tests a framework of risk information seeking by integrating all variables and relationships that emerged from the previous studies. The resulting framework is tested based on survey data from a random sample of the adult Dutch population.

The purpose of Chapter 5 is to investigate the main and combined effects of trust on the most relevant direct predictors of risk information seeking presented in the framework of risk information seeking. Individuals are categorized into one of four trust-based groups according to their levels of self-efficacy and social trust and tested. This study also aims to gain insight into the public's information preferences based on their levels of self-trust and institutional trust.

Finally, a reflection of the major findings and conclusions of the studies reported in this thesis are discussed in Chapter 6. Theoretical implications as well as implications for risk communication practice and future research efforts are described.

References

Afifi, W.A. & Weiner, J.L. (2002). Information Seeking Across Contexts. *Human Communication Research,* 28 (2), pp. 207-212.

Afifi, W.A. & Weiner, J.L. (2006). Seeking Information About Sexual Health: Applying the Theory of Motivated Information Management. *Human Communication Research,* 32, pp. 35-57.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, 50, pp. 179-211.

Ale, B. J. M. (2002). Risk Assessment in the Netherlands. *Safety Science*, 40, pp. 105-126.

Atkin, C.K. (1973). Instrumental Utilities and Information Seeking. In P. Clarke (Ed.): *New Models for Mass Communication Research*, Volume 2. London: Sage.

Beck, U. (1986). *Die Risikogesellschaft*. Frankfurt am Main: Suhrkamp.

Beerepoot, W., Levi, R., Schreurs, K., Kuttschreuter, M., & Gutteling, J. (2004). De Burger en de Risicokaart: Gebruikerservaringen in Enschede Drie Jaar na de Vuurwerkramp. *Tijdschrift voor Communicatiewetenschap*, 32 (4), pp. 361-375.

Belkin, N. J. (1980). Anomalous State of Knowledge for Information Retrieval. *Canadian Journal of Information Science*, 5, pp. 133-143.

Belkin, N.J., Cool, C., Stein, A., & Thiel, U. (1995). Cases, Scripts, and Information-Seeking Strategies: On the Design of Interactive Information Retrieval Systems. *Expert Systems with Applications*, 9, pp. 379-395.

Bennett, P. (1999). Understanding Responses to Risk: Some Basic Findings. In P. Bennett and K. Calman (Eds.). *Risk Communication and Public Health*, pp. 3–19. Oxford: Oxford University Press.

Berger, C.R. & Calabrese, R.J. (1975). Some Explorations in Initial Interaction and Beyond: Toward a Developmental Theory of Interpersonal Communication. *Human Communication Research*, 1, pp. 99-112.

Bord, R.J. & O'Connor, R.E. (1992). Determinants of Risk Perceptions of a Hazardous Waste Site. *Risk Analysis*, 12 (3), pp. 411-416.

Bottelberghs, P.H. (2000). Risk analysis and safety policy developments in the Netherlands. *Journal of Hazardous Materials*, 71, pp. 59-84.

Botterill, L. & Mazur, N. (2004). *Risk & Risk Perception*. *A Literature Review*. Publication No. 04/043. Barton: Rural Industries and Development Corporation.

Brashers, D. E., Neidig, J. L., Haas, S. M., Dobbs, L. K., Cardillo, L. W., & Russel, J. A. (2000). Communication in the Management of Uncertainty: The Case of Persons Living with HIV or AIDS. *Communication Monographs*, 67, pp. 63–84.

Byrne, B.M. (2001). *Structural Equation Modeling with Amos: Basic Concepts, Applications, and Programming*. Mahwah, N.J.: Erlbaum.

Campbell, I. (2000). T*he Ostensive Model of Developing Information Needs*. Glasgow: University of Glasgow.

Case, D.O., Andrews, J.E., Johnson, D.E., & Allard, S.L. (2005). Avoiding versus Seeking: The Relationship of Information Seeking to Avoidance, Blunting, Coping, Dissonance, and Related Concepts. *Journal of the Medical Library Association*, 93 (3), pp. 353-362.

Case, D.O. (2007). *Looking for Information. A Survey of Research on Information Seeking, Needs, and Behavior*. San Diego, CA: Academic Press.

CBS. (2008). *ICT Gebruik van Huishoudens naar Persoonskenmerken*. Retrieved March 13, 2008 from http://statline.cbs.nl/StatWeb/publication.

Cheung, G.W. & Rensvold, R.B. (2002). Evaluating Goodness-of-Fit Indexes for Testing Measurement Invariance. *Structural Equation Modeling*, 9 (2), pp. 233-255.

Coles, D. (1999). The Identification and Management of Risk: Opening up the Process. In P. Bennett and K. Calman (Eds.). *Risk Communication and Public Health*, pp. 195–204. Oxford: Oxford University Press.

Covello, V.T., McCallum, D.B., and Pavlova, M.T. (1989). Principles and Guidelines for Improving Risk Communication. In Covello, V.T., McCallum, D.B., and Pavlova, M.T. (Eds.): *Effective Risk Communication. The Role and Responsibility of Government and Nongovernment Organizations*. New York: Plenum.

Covello, V. T., Von Winterfeldt, D., & Slovic, P. (1986). Risk Communication: A Review of the Literature. *Risk Abstracts* 3 (4), pp. 172–182.

Dervin, B. (1992). From the Mind's Eye of the User: The Sense-Making Qualitative-Quantitative Methodology. In J. D. Glazier & R. R. Powell (Eds.), *Qualitative Research in Information Management*. Englewood, CO: Libraries Unlimited Inc.

Dervin, B. (1999). On Studying Information Seeking Methodologically: The Implications of Connecting Metatheory to Method. *Information Processing & Management*, 35, pp. 727-750.

Eagly, A. H., and Chaiken, S. (1993). *The Psychology of Attitudes*. Harcourt Brace, San Diego.

Earle, T. C., & Cvetkovich, G. (1995). *Social Trust: Toward a Cosmopolitan Society*. Westport, CT: Praeger.

Ellis, D., Wilson, T.D., Ford, N., Foster, A., Lam, H.M., Burton, R., & Spink, A. (2002). Information Seeking and Mediated Searching. Part 5. User-Intermediary Interaction. *Journal of the American Society for Information Science and Technology*, 53 (11), pp. 883-893.

Ford, N. (2004). Modeling Cognitive Processes in Information Seeking: From Popper to Pask. *Journal of the American Society for Information Science and Technology,* 55 (9), pp. 769-782.

Fessenden-Raden, J., Fitchen, J.M., and Heath, J.S. (1987). Providing Risk Information in Communities: Factors Influencing what is Heard and Accepted. *Science, Technology, & Human Values*, 12, nos. 3/4, pp. 94-101.

Forsythe, D., Buchanan, B., Osheroff, J., & Miller, R. (1992). Expanding the Concept of Medical Information: An Observational Study of Physician's Information Needs. *Computers and Biomedical Research,* 25, pp. 181-200.

Franssen, E.A.M., Van Dongen, J.E.F., Ruysbroek, J.M.H., Vos, H., & Stellato, R.K. (2004). *Hinder door Milieufactoren en de Beoordeling van de Leefomgeving in Nederland.* RIVM Rapport 815120001.

Frewer, L., Miles, S., Brennan, M., Kuznesof, M.N., & Ritson, C. (2002). Public Preferences for Informed Choice under Conditions of Risk Uncertainty. *Public Understanding of Science,* 11, pp. 363-372.

Garson, G.D. (2008). Statnotes: T*opics in Multivariate Analysis.* North Carolina State University Raleigh, NC. Retrieved March 24, 2008 from http://www2.chass.ncsu.edu/ garson/pa765/structur.htm.

Godbold, N. (2006). Beyond Information Seeking: Towards a General Model of Information Behavior. *Information Research,* 11(4), paper 269. Available at http://InformationR.net/ir/11-4/paper269.html.

Gough, J. & Hooper, G. (2003). *Sharing the Future: Risk Communication in Practice.* Christchurch: CAE, University of Canterbury.

Gregory, J., & Miller, S. (1998). *Science in Public: Communication, Culture, and Credibility.* New York: Plenum.

Griffin, R.J., Dunwoody, S., & Neuwirth, K. (1999). Proposed Model of the Relationship of Information Seeking and Processing to the Development of Preventive Behaviors. *Environmental Research*, 80, pp. S230-245.

Griffin, R.J., Neuwirth, K., Giese, J., & Dunwoody, S. (1999). The Relationship of Risk Information Processing to Consideration of Behavioral Beliefs. *Proceedings of the Annual Meeting of the Association for Education in Journalism and Mass Communication*. New Orleans, Louisiana: August, 3-8.

Griffin, R.J., Neuwirth, K., Dunwoody, S., & Giese, J. (2004). Information Sufficiency and Risk Communication. *Media Psychology*, 6, pp. 23-61.

Griffin, R.J., Yang, J., Ter Huurne, E., Boerner, F., Ortiz, S. and Dunwoody, S. (2008). After the Flood: Anger, Attribution, and the Seeking of Information. *Science Communication*, 29 (3), pp. 285-315.

Groothuis, P.A. & Miller, G. (1997). The Role of Social Distrust in Risk Benefit Analysis: A Study of the Siting of a Hazardous Waste Disposal Facility. *Journal of Risk and Uncertainty,* 15, pp. 241-257.

Grunig, J. (1989). Publics, Audience and Market Segments: Segmentation Principles for Campaigns. In C. Salmon (Ed.), *Information Campaigns: Balancing Social Values and Social Change*, pp. 174- 197. London: Routledge.

Gurabardhi, Z. (2005). *A Journey into Risk Communication. Findings and Reflections on Organizations' Risk*

Communication with Stakeholders. Enschede, the Netherlands: Printpartners Ipskamp.

Gutteling, J.M. & Wiegman, O. (1996). *Exploring Risk Communication*. Dordrecht: Kluwer Academic Publishers.

Gutteling, J.M. (2002). Risicocommunicatie: Verleden, Heden, Toekomst? *Tijdschrift voor Wetenschap, Technologie en Samenleving*, 10 (3), pp. 72-76.

Gutteling, J.M. & Kuttschreuter, M. (2002). The Role of Expertise in Risk Communication: Laypeople's and Expert's Perception of the Millennium Bug Risk in the Netherlands. *Journal of Risk Research*, 5 (1), pp. 35-47.

Hadden, S.G. (1991). Public Perception of Hazardous Waste. *Risk Analysis*, 11 (1), pp. 47–57.

Hampel, J. (2006). Different Concepts of Risk – A Challenge for Risk Communication. *International Journal of Medical Microbiology*, 296 (S1), pp. 5-10.

Ingwersen, P. (1992). *Information Retrieval Interaction*. London: Taylor Graham.

Johnson, B.B. (2005). Testing and Expanding a Model of Cognitive Processing of Risk Information. *Risk Analysis*, 25, (3), pp. 631-650.

Johnson, J.D. (1997). *Cancer-Related Information Seeking*. Cresskill, NJ: Hampton Press.

Jonas, E., Schulz-Hardt, S., Frey, D., & Thelen, N. (2001). Confirmation Bias in Sequential Information Search after Preliminary Decisions: An Expansion of Dissonance Theoretical Research on Selective Exposure to Information. *Journal of Personality and Social Psychology,* 80 (4), pp. 557-571.

Kahlor, L.A., Dunwoody, S., Griffin, R.J., and Neuwirth, K. (2006). Seeking and Processing Information about Impersonal Risk. *Science Communication*, 28(2), pp. 163-194.

Kahlor, L.A. (2007). An Augmented Risk Information Seeking Model: The Case of Global Warming. *Media Psychology*, 10, pp. 414-435.

Kasperson, R.E. (1986). Hazardous Waste Facility Siting: Community, Firm, and Government Perspectives. In: *Hazards: Technology and Fairness.* Washington, DC: National Academy Press.

Kelly, G. A. (1963). A Theory of Personality: *The Psychology of Personal Constructs*. New York: Norton.

Kline, R.B. (2005). *Principles and Practice of Structural Equation Modeling*. 2nd Edition. New York: Guilford Press.

Kuhlthau, C.C. (1991). Inside the Search Process: Information Seeking from the User's Perspective. *Journal of the American Society for Information Science*, 42(5), pp. 361-371.

Lang, S., Fewtrell, L. & Bartram, J. (2001). Risk Communication. In L. Fewtrell & J. Bartram, J. (Eds.). *Water*

Quality: Guidelines, Standards and Health. London: IWA Publishing, pp. 317-332.

Leiss, W. (1996). Three Phases in the Evolution of Risk Communication Practice. *Annals AAPSS*, 545, pp. 85-94.

Lion, R., Meertens, R.M., & Bot, I. (2002). Priorities in Information Desire about Unknown Risks. Ris*k Analysis*, 22 (4), pp. 765-776.

MacCallum, R.C. & Austin, J.T. (2000). Applications of Structural Equation Modeling in Psychological Research. *Annual Review of Psychology*, 5, pp. 201-226.

Marchionini, G. (1995). *Information Seeking in Electronic Environments*. New York: Cambridge University Press.

McDonald, R.P. & Ringo Ho, M-H. (2002). Principles and Practice in Reporting Structural Equation Analyses. *Psychological Methods*, 7 (1), pp. 64-82.

Meijnders, A.L., Midden, C.J.H., Wilke, H.A.M. (2001). Role of Negative Emotion in Communication about CO2 Risks. *Risk Analysis*, 21, pp. 955-966.

Moen, J. E. T.& Ale, B. J. M. (1998). Risk Maps and Communication. *Journal of Hazardous Materials*, 61 (1-3), pp. 271-278.

Nathan, K., Heath, R.L., & Douglas, W. (1992). Tolerance for Potential Environmental Health Risks: The Influence of Knowledge, Benefits, Control, Involvement, and Uncertainty. *Journal of Public Relations Research*, 4 (4), pp. 235-258.

Ng, K.L. & Hamby, D.M. (1997). Fundamentals for Establishing a Risk Communication Program. *Health Physics*, 73 (3), pp. 473-482.

Otway, H. (1987). Experts, Risk Communication, and Democracy. *Risk Analysis*, 7, pp. 125-129.

Passchier-Vermeer, W., Kluizenaar, Y. de, Steenbekkers, J.H.M., Dongen. J.E.F. van, Wijlhuizen, G.J., & Miedema, H.M. E. (2001). *Milieu en Gezondheid 2001: Overzicht van risico's, Doelen en Beleid*. TNO-rapport PG/VGZ/2001.95.

Pettigrew, K.E., Durrance, J.C., & Unruh, K.T. (2002). Facilitating Community Information Seeking Using the Internet: Findings from Three Public Library-Community Network Systems. *Journal of the American Society for Information Science and Technology*, 53 (11), pp. 894-903.

Petts, J. & Leach, B. (2000). *Evaluating Methods for Public Participation*. R&D Technical Report E135. Bristol: Environment Agency.

Renn, O. & Levine, D. (1991) Credibility and Trust in Risk Communication. In R.E. Kasperson and P.J.M. Stallen (Eds.). *Communicating Risks to the Public*, pp. 175–214, Kluwer, Dordrecht.

Rohrmann, B. (1998). Assessing Hazard Information/Communication Programs. *Australian Psychologist,* 33, pp. 105-112.

Rohrmann, B. (2000). A Socio-Psychological Model for Analyzing Risk Communication Processes. *Australasian Journal of Disaster Studies*, 2000-2. Retrieved March 12, 2008 from http://www.massey.ac.nz/~trauma/issues/2000-2/rohrmann.htm

Rowan, K.E. (1994). The Technical and Democratic Approaches to Risk Situations: Their Appeal, Limitation, and Rhetorical Alternative. *Argumentation*, 8, pp. 391-409.

Rowan, F. (1996). The High Stakes of Risk Communication. *Preventive Medicine*, 25, pp. 26-29.

Sjöberg, L. (2002). Risk Communication Between Experts and the Public: Perceptions and Intentions. *Questions de Communication*, 2, pp. 19-35.

Slovic, P. (1999). Trust, Emotion, Sex, Politics, and Science: Surveying the Risk-Assessment Battlefield. *Risk Analysis*, 19 (4), pp. 689-701.

Stephenson, M.T., & Holbert, R.L. (2003). A Monte Carlo Simulation of Observable Versus Latent Variable Structural Equation Techniques. *Communication Research*, 30, pp. 332-354.

Trettin, L. & Musham, C. (2000). Is Trust a Realistic Goal of Environmental Risk Communication? E*nvironment and Behavior*, 32 (3), pp. 410-426.

Trumbo, C.W. (2002). Information Processing and Risk Perception: An Adaptation of the Heuristic- Systematic Model. *Journal of Communication*, 52 (2), pp. 367-382.

Turner, M., Rimal, R., Morrison, D., & Kim, H. (2006). The Role of Anxiety in Seeking and Retaining Risk Information: Testing the Risk Perception Attitude Framework in Two Studies. *Human Communication Research*, 32, pp. 130-156.

Wade, C.R., Molony, S.T., Durbin, M.E., Klein, S.H., & Wahl, L.E. (1992). Communicating with the Public about Risk. U.S. Department of Energy, Los Alamos.

Walker, G., Simmons, P., Irwin, A., & Wynne, B. (1999). Risk Communication, Public Participation and the Seveso II Directive. *Journal of Hazardous Materials*, 65, pp. 179-190.

Williams, B.L., Brown, S., & Greenberg, M. (1999). Determinants of Trust Perceptions among Residents Surrounding the Savannah River Nuclear Weapons. Environment and Behavior, 31 (3), pp. 354-371.

Wilson, T.D. & Walsh, C. (1996). *Information Behavior: An Interdisciplinary Perspective*. Sheffield: University of Sheffield, Department of Information Studies.

Wilson, T.D. (1999). Models in Information Behavior Research. *The Journal of Documentation*, 55 (3), pp. 249-270.

Wilson, T.D. (2000). Human Information Behavior. *Information Science,* 3 (2), pp. 49-55.

Wilson, T.D. (2005). Evolution in Information Behavior Modeling: Wilson's Model. In K. E. Fisher, S. Erdelez & L. McKechnie (Eds.), *Theories of Information Behavior*, pp. 31-36. Medford, N.J: Information Today, Inc.

Wilson, T.D. (2006). A Re-Examination of Information Seeking Behaviour in the Context of Activity Theory. *Information Research*, 11 (4), paper 260 [Available at http://Information R.net/ir/11-4/paper260.html].

Witte, K. (1992). Putting the Fear back in Fear Appeals: The Extended Parallel Process Model. *Communication Monographs*, 59, pp. 329–349.

Witte, K. (1994). Generating Effective Risk Messages: How Scary Should your Risk Communication be? In B. Burleson (Ed.). *Communication Yearbook*, 18. Thousand Oaks, CA: Sage, pp. 229-254.

Woudenberg, F. (1997). Risicocommunicatie in Vogelvlucht. Er is altijd Gevaar voor de Volksgezondheid. *Comma*, 11, pp. 2-5.

2

Information Needs and Risk Perception as Predictors of Risk Information Seeking

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2.1. Abstract

This chapter introduces a theoretical framework that describes the importance of the public's information needs, risk perception, and self-efficacy as predictors of intended risk information-seeking behavior. Based on theoretical assumptions, measurement instruments for relevant concepts were developed and validated using data from a mail questionnaire. Relationships among selected determinants of risk information-seeking behavior were analyzed. Results indicate that information needs, risk perception, and current knowledge are direct predictors of intention to seek information. Trust, engagement, social influence, and self-efficacy affect risk perception, and the need for information is prejudiced by engagement and social influence.

2.2. Introduction

The Internet offers the public the opportunity to access readily available relevant risk information. This requires that organizations and governments providing risk information to the public understand the public's risk information-seeking behavior. Information-seeking behavior is a relatively new area of research in the field of risk communication (see for example Griffin et al., 1999, 2006; Afifi & Weiner, 2006). Many questions, however, remain regarding the determinants of information seeking and the development of adequate measurement instruments (Johnson, 2005). This chapter describes a study in which a theoretical model for information seeking was developed and a multidimensional measurement instrument was validated.

2.2.1. Information Need as a Predictor of Information-seeking behavior

People seek information for different reasons. According to Moore (2002), people seldom need information for information's sake, but need it as a means of serving different goals, such as making choices or improving their well-being and supporting their role as members of society. Studies in the field of health risks confirmed that people will actively seek risk information when they are making important decisions (Alaszewski, 2005) or when people get involved (Johnson, 2005). Involvement increases when the perceived relevance of the risk increases and prompts the desire for information. In turn, involvement might bear a positive effect on information-seeking behavior (Johnson, 2005).

Knowledge and Uncertainty Reduction

The most basic drive for seeking information is to gain knowledge. The model of the Information Search Process (ISP; Kuhlthau, 1991) states that initiation to seek information occurs when a person becomes aware of a lack of knowledge or understanding regarding an area or topic. Concentrating on this cognitive aspect of information seeking processes, the Anomalous State of Knowledge model (ASK; Belkin, 1980) similarly states that the gap between information held and information wanted reflects an information need, motivating the individual to seek more. The model for Risk Information Seeking and Processing (RISP), developed by Griffin et al. (1999), describes this discrepancy between current knowledge levels and a criterion state as 'information sufficiency'. Initially, the construct of information sufficiency finds its roots in the Heuristic Systematic Model (Chaiken et al., 1989). A perceived gap between the amount of knowledge people possess regarding a topic and the amount of knowledge people need to adequately deal with that topic is called information insufficiency. Recently, scholars have begun to explore the concept of risk information sufficiency, as it may well predict how people seek and process risk information (see for example Griffin et al., 2004; Trumbo & McComas, 2003; Johnson, 2005).

The individual's social environment may increase the desire to gain knowledge by seeking information (Radecki & Jaccard, 1995). According to Atkin (1972), individuals are motivated to seek information when it is perceived as useful in their social relationships. The assumption that significant others (i.e., family and friends) are knowledgeable about an issue might stimulate the

individual to seek information. People compare their abilities with other people's abilities, desiring social approval and liking (see Eagly & Chaiken, 1993). The social context approach assumes that "relationships with other people affect the degree to which individuals attend to, understand and use information about risks" (Johnson, 1987, p. 103). They may identify and respond to the same risks in very different ways, highly influenced by their social situation (Alaszewski, 2005). Wilson (1999) proposes that the various social contexts people belong to (e.g., work, life, or political and economical environments) will predict to whether a person feels a need for subsequently seek information. Individuals faced with risky situations are inclined to base their decisions on which behavior to pursue by first considering the actions of others. Possible reactions of family, friends, and others are seen as great influencers of these decisions (Neuwirth & Frederick, 2004). This implies that those who are more influenced by others and perceive them as knowledgeable about an issue in their everyday lives might have a greater need for information and therefore be more motivated to seek risk information.

Finally, people seek information to reduce uncertainty. The Information Seeking Theory (Atkin, 1973) states that people pursue a satisfying amount of certainty about topics in their environment. When this certainty decreases (or uncertainty increases), the need for information grows and information-seeking behavior arises. According to Atkin (1973), the need for information is a function of extrinsic uncertainty produced by a perceived discrepancy between the individual's current level of certainty regarding important environmental objects and a criterion state he seeks to achieve. Berger and Calabrese's Uncertainty Reduction Theory (1975) posits a similar idea. Their third axiom states that "High levels of uncertainty cause increases of information-seeking behavior. As uncertainty levels decline, information-seeking behavior decreases." (p. 103). This suggests that when individuals experience uncertainty, they try to reduce that uncertainty by seeking information.

Risk Perception

The last decade saw changing approaches in risk perception studies. The public's judgments of risks were previously approached as the likelihood and probability of coming to harm combined with the severity of potential consequences. Modern theories state that there are two fundamental ways in which people respond to risks. In describing what Slovic and colleagues (2004) term the "affect heuristic", they explain that it's not only about what people know about risks ("analytical system"), but that they also base their judgments on what they feel about risks ("experiential system"). These affective responses refer to emotional reactions to risks, such as worry, anxiety, and fear. Higher risk perception is assumed to reflect higher uncertainty. Several studies have reported evidence for a positive relationship between risk perception and information needs, which in turn affect information-seeking behavior (Neuwirth et al., 2000; Strating et al., 2004).

Institutional Trust

Most people do not possess sufficient knowledge of science and technology to be capable of judging risks and benefits (Gregory & Miller, 1998). People therefore have to rely on information

that reflects experts' risk assessments and judgments (Earle & Cvetkovich, 1995). Institutional trust is the willingness to rely on those who are responsible for making decisions and taking actions that are related to the management of technology, the environment, or other realms of public health and safety (Siegrist et al., 2000). This trust is especially important when the risks are difficult for the public to control or understand. In the field of risk communication, it must be kept in mind that trust in government is linked to trust in industry and belief that the problem is amenable to control (Bord & O'Connor, 1992). Building and maintaining trust, however, depends heavily on the performance of the social institutions involved (Kasperson et al., 1992). Lack of trust can amplify the amount of risk a person perceives (Groothuis & Miller, 1997; Slovic, 1999).

Self-Efficacy

Self-efficacy refers to the notion that the individual expects to be able to cope with risks adequately with the newly acquired information (Bandura, 2000). The RISP model refers to "perceived information gathering capacity" as a form of self-efficacy (Griffin et al., 1999). Johnson (2005) describes this concept as "ability," whereas Ajzen (1991) describes it as "perceived behavioral control," postulating the concept as one of the key predictors of behavioral intentions within the Theory of Planned Behavior (Ajzen, 1991). People feeling more confident about their ability to perform certain behaviors are more likely to do so. Previous studies in the area of risk communication consider self-efficacy mainly in terms of a person's sense of their own ability to deal with the media and the information about the risks (see for example Trumbo, 1999; Griffin et al., 1999; Johnson, 2005). However, self-efficacy must also refer to the core of the risk-issue itself (i.e., the ability of the provided risk information to enable the person to deal adequately with the danger).

2.2.2. Research Focus

In this study, we focus on the determinants of intentions to actively search for information about risks from producing, using, storing, and transporting hazardous industrial substances. Based on the theoretical assumptions described above, our hypotheses represent the relationships among selected variables of intended risk information-seeking behavior (Figure 2.1).

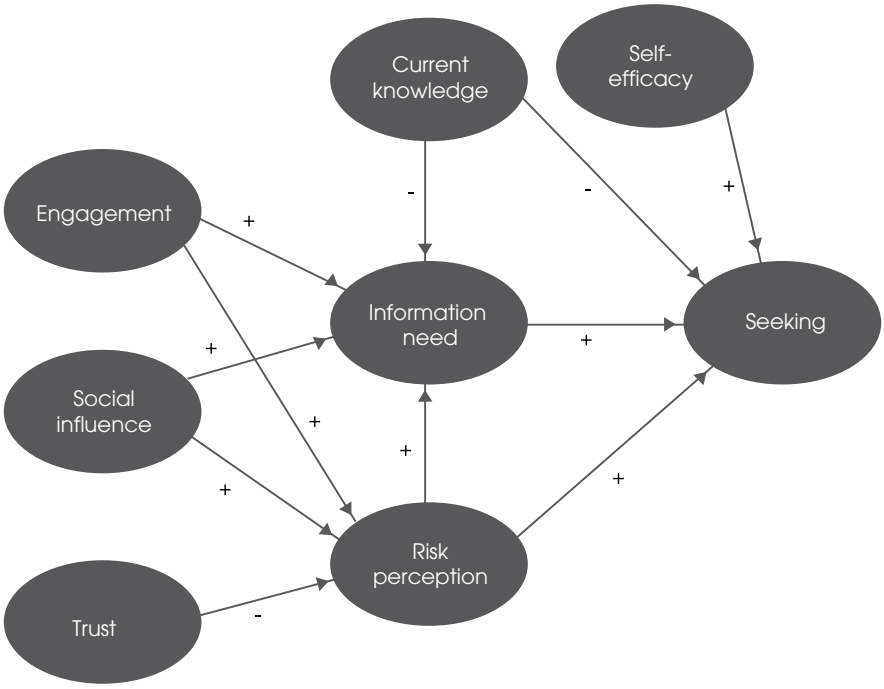

Figure 2.1. Hypothesized latent variables' relationships

2.3. Method

2.3.1. Design and Procedure

This study is part of a four-year project and is considered a pilot-project due to its developing and validating nature. A random sample of Dutch adults was asked to complete a written mail questionnaire. In the fall of 2005, selected respondents received the questionnaire together with an information sheet explaining the topic of the study and a postage-paid envelope to return the completed questionnaire. Two weeks after the first mailing, a reminder letter was sent out. The study was presented as a study regarding how Dutch residents feel and think about (information regarding) risks from hazardous industrial substances.

2.3.2. Sample and Participants

The sample (N=1042) was drawn from a professional marketing database containing all Dutch postal addresses of adult heads of households. In total, 28 addressees were unable or unwilling to cooperate. In total, 182 questionnaires were completed and returned (response rate 18%, number of questionnaires useful for analysis=171). More males (71%) than females (29%) participated in the study ($\chi^2(1) = 29.8$, $p<0.05$). Respondents ranged in age from 20 to 87 years

with a mean age of 54 years. Of the subjects, 43% indicated a higher level of formal education, 32% indicated an intermediate level, and 26% reported a lower level.

Approximately 25% of the respondents reported living near a place where dangerous substances are stored, 16% live near a place where dangerous substances are produced or used, and 32% live near transport routes of dangerous substances. A minor proportion of the respondents had experienced incidents with storage, production/use, and/or transportation of dangerous industrial substances in their neighborhood (18%, 17%, and 12%, respectively). Only 2% experienced personal harm or property loss due to storage, production/use of dangerous substances and 1% reported property loss or personal harm as a consequence of the transportation of these substances. Approximately one quarter of the respondents have actively searched for information regarding storage (24%), production/use (22%, or transportation (27%) of dangerous industrial substances previously.

2.3.3. Instrument Development and Operationalization of Concepts

Intended information-seeking behavior and its determinants (information sufficiency, risk perception, and self-efficacy) as well as their predictors (trust, current knowledge, engagement, and social influence) were conceptualized. Items intended to assess the constructs were generated by multiple methods. Some were based on measures of similar constructs from previous empirical research. Information seeking measures were based on previous studies conducted by Griffin et al. (2006) and Johnson (2005). The information sufficiency scale was partially inspired by Trumbo (1999) and partly newly developed. Risk perception measures were based on descriptions of different risk characteristics by Slovic (1987) and affective responses were adapted from Gutteling & Wiegman (1990). The engagement scale was partly based on that of Johnson (2005). Others were newly developed or adjusted from other risk related instruments. The exact formulation of the items is presented in Tables 2.1 and 2.2. Items were presented in a five-point Likert-type format with response scales ranging from completely disagree to completely agree, with exception of part of the risk perception scale in which respondents were asked to rate how dangerous they perceived different risks from hazardous substances on a five-point scale with extremes not dangerous at all (1) to extremely dangerous (5). Items were scored such that a higher score indicated a higher agreement with the statement.

2.3.4. Analysis

Both exploratory and confirmatory factor analyses were conducted for scale refinement purposes (using the Statistical Packages for Social Sciences (SPSS) and the Amos software for analyses, respectively). Prior to conducting the factor analysis, the inter-item and item-total correlations of the items were computed. Any item correlating less than 0.40 with all other items in the scale or with the scale-total score was deleted from further analysis.[1]

Since it is deemed necessary to use several independent samples in scale development processes (Hinkin, 1998), the sample was randomly split into halves. Internal consistency was assessed by

computing Cronbach's alpha after unidimensionality was established. The reliability coefficient was computed for each of the new scales.[2] To overcome the weakness of exploratory factor analysis, (i.e., the inability to compute goodness-of-fit statistics), confirmatory factor analyses were performed for each of the latent variables to test whether the postulated measurement model was appropriate. This was based on the second half of the sample. Confirmatory factor analysis is needed to evaluate and refine scales (Gerbing & Anderson, 1988).[3]

In addition to determining the factorial structure of the concepts and internal consistency computation of the measurement scales, our intent was to validate the theoretical assumptions regarding the underlying dimensions of risk information-seeking behavior.[4] To find out more about the direction and pattern of the relationships between the independent variables and risk perception, information need, and information-seeking behavior, a multiple regression analysis using SPSS was conducted to estimate the coefficients of the linear equation, involving one or more independent variables that best predict the value of the dependent variables.

2.4. Results

2.4.1. Scale Refinement and Reliability

Intended Information-seeking behavior

The three items in this scale showed high factor loadings in exploratory factor analysis (see also Table 2.1). No items were removed due to low item-total or inter-item correlations. Internal consistency of the scale was good (α=0.72). Model-fit statistics indicate that this measurement model was appropriate ($\chi^2(1)=0.01$, $p>0.05$, GFI=1.00, AGFI=0.99, CFI=1.00, RMSEA=0.00).

Information Sufficiency

Exploratory factor analysis resulted in two distinct factors of the information sufficiency scale. One item that was intended to assess information needs, however, showed low inter-item correlations with the other measures in the scale, and was consequently deleted. A new factor analysis resulted in two factors, together explaining 68% of the variance: current knowledge (three items; α=0.75) and the need for information (two items; $r=0.40$, $p<0.01$). Although inter-item correlation of the latter items was not very high, it was significant and the scale was maintained. The two-factor solution fits the data well ($\chi^2(4)=2.7$, $p>0.05$, GFI=0.99, AGFI=0.95, CFI=1.00, RMSEA=0.00).

Risk Perception

The risk perception scale comprised a set of subscales: affective responses, perceived danger, and risk characteristics. After item-total correlation and factor analyses, a clear four-factor structure appeared: affective responses (six items; α=0.92), perceived danger of hazardous substances in the city (three items; α=0.85), perceived danger of hazardous substances in the country side (three items; α=0.80), and severity of possible outcomes (two items; $r=0.68$, $p<0.01$), all together explaining 76% of the variance. Findings from CFA show that this four-factor solution fit the data reasonably well ($\chi^2(66)=69$, $p>0.05$, GFI=0.88, AGFI=0.82, CFI=0.99, RMSEA=0.03). Although

the goodness-of-fit and the adjusted goodness-of-fit statistics did not meet the minimum standards (i.e., > 0.90), the model-fit was positively evaluated due to the high comparative fit index and the low value of the root mean square error of approximation.

Table 2.1. Factor loadings and item statistics target variables

Measures	Factor loadings I	II	III	IV	Item statistics Mean[1]	SD
Intended information seeking behavior (α=.72)						
I search for as much information as possible about this topic.	**.75**				2.54	.84
I search for information about what I would have to do in case an accident happens in my surroundings.	**.83**				3.15	.90
If a chemical accident happens anywhere in the Netherlands, I am likely to search for information.	**.77**				3.04	.83
Variance explained:	*62%*					
Information sufficiency:						
Current knowledge (α=.75)						
I know a lot about this topic at the moment	**.80**	.00			2.36	.95
I know to which toxic chemical hazards I am exposed to.	**.84**	.04			2.70	1.05
When it comes to judging these risks, my knowledge fails.*	**.81**	.07			2.41	.95
*Information need (r=.40**)*						
I require a lot of information to judge the risks I am exposed to.	.02	**.84**			3.54	.91
I should know everything about changes or accidents regarding this topic in my surroundings.	.05	**.83**			3.53	.84
Variance explained	*40%*	*28%*				
Risk perception:						
Affective response (α=.92)						
Tense	**.77**	.13	.14	.18	2.46	1.12
Content*	**.84**	.15	.03	.13	3.30	1.06
Anxious	**.77**	.06	.21	.16	2.27	1.16
Comfortable*	**.86**	.06	.15	.10	2.79	1.15
Worried	**.80**	.13	.21	.14	2.93	1.27
At ease*	**.85**	.16	.13	.07	2.94	1.07
Perceived danger in the city (α=.85)						
Storage depots in the city.	.15	**.89**	.16	.07	4.26	1.02
Chemical plants in the city.	.06	**.93**	.00	.08	4.42	.95
Transportation of dangerous substances through the city.	.26	**.69**	.24	.19	4.21	.85
Perceived danger in the country side (α=.80)						
Storage depots in the country side.	.22	.11	**.85**	.12	2.48	1.08
Chemical plants in the country side.	.15	.29	**.74**	-.02	3.01	1.25
Transportation of dangerous substances in the country side.	.16	-.01	**.84**	.20	2.64	1.14
*Severity of consequences (r=.68**)*						
An accident with hazardous substances will extremely disrupt the victims' lives.	.16	.19	.16	**.87**	4.23	.67
An accident with hazardous substances will strike a large number of people in the neighborhood.	.29	.08	.09	**.86**	3.95	.75
Variance explained	*31%*	*17%*	*16%*	*12%*		

Note: Extraction Method: Principal Components Analysis, eigenvalues >1.0. Rotation Method: Varimax with Kaiser Normalization. Cronbach's alpha for scale reliability. Loadings in bold significant at p<.05. [1]Five-point scale, ranging from 1 to 5; higher scores indicate higher agreement. *Item reverse coded, **Significant at p<.01.

Self-Efficacy

The self-efficacy scale served four items. Item-total correlations did not lead to the deletion of poorly correlating items. Factor analysis resulted in one factor, as intended, explaining 55% of the variance. The reliability of this measure was good (α=0.73). Results from CFA supported the one-factor structure of the self-efficacy scale ($\chi^2(2)=1.0$, $p>0.05$, GFI=0.99, AGFI=0.97, CFI=1.00, RMSEA=0.00).

Engagement

The item-total correlations test led to the deletion of one item. Factor analysis resulted in two distinct dimensions: involvement (two items; $r=0.54$, $p<0.01$) and personal relevance (three items; α=0.61), together explaining 66% of the variance in engagement. Although internal consistency of the personal relevance scale did not meet the minimum standards, this was considered high enough to use the variable in the analysis. This two-factor solution was confirmed in CFA analysis based on the second half of the sample ($\chi^2(1)=1.1$, $p>0.05$, GFI=0.99, AGFI=0.93, CFI=1.00, RMSEA=0.04).

Social Influence

Exploratory factor analysis of the social influence scale resulted in two factors. Items in one factor did not have a clear structure and the internal consistency was low. These two items were therefore removed and the factor analysis procedure was repeated. The remaining three items load on a single factor representative of factor content, explaining 65% of the variance with good internal consistency (α=0.72). This is an acceptable solution ($\chi^2(1)=0.68$, $p>0.05$, GFI=0.99, AGFI=0.97, CFI=1.00, RMSEA=0.00).

Trust

The trust scale initially served 19 items. After item-total correlation and factor analyses several items were deleted resulting in a clear two-factor structure, each serving four items representative of factor content. The scale explains 63% of the variance and internal consistency was good (α=0.81 and α=0.79, respectively). The measurement model fit the data well ($\chi^2(19)=16$, $p>0.05$, GFI=0.96, AGFI=0.92, CFI=1.00, RMSEA=0.00).

Table 2.2. Factor loadings and item statistics predictor variables

Measures	Factor loadings		Item statistics	
	I	II	Mean[1]	SD
Self-efficacy (α=.73)				
I would be able to:				
Protect myself against the possible consequences of exposure.	**.67**		2.33	.94
Do what I have to do when I hear about a release in my surroundings.	**.76**		3.58	1.00
React in the right way if an accident happens.	**.83**		2.99	1.03
Get and make sense of information about these risks.	**.70**		3.67	.84
Variance explained	*55%*			
Engagement: *Involvement* (r=.68) and *Personal Relevance* (α=.61)**				
It is important to seek information about these risks in my life.	**.84**	.14	3.23	.95
I am interested in these risks in my surroundings.	**.86**	.07	3.70	.75
I do not feel connected with people exposed to these risks.*	.22	**.69**	3.46	.89
I feel different from people exposed to these risks.*	-.17	**.83**	3.07	.91
I feel matched with people exposed to these risks.	.37	**.68**	3.20	.82
Variance explained	*33%*	*33%*		
Social influence (α=.72)				
To me, it is important to know how people around me handle things.	**.81**		3.61	.72
I often wonder what others would do if they were in my position.	**.79**		3.22	.90
The opinion of people around me is very important to me.	**.81**		3.55	.79
Variance explained	*65%*			
Trust:				
Government (α=.81)				
The government is concerned about the safety and health of citizens.	**.78**	.14	3.04	.98
The government communicates openly about these risks.	**.69**	.25	2.58	.85
The government protects people like me from these risks	**.79**	.20	2.87	.89
When the government claims to do everything to minimize the risks for me as a citizen, I believe that.	**.84**	.20	2.93	.93
Companies (α=.79)				
Companies that use toxic chemicals take account of the health and safety of people like me.	.23	**.75**	3.16	.83
When companies that use toxic chemicals claim to have the risks under control, I believe them.	.21	**.70**	2.92	.85
Companies using toxic chemicals protect local residents from possible harm.	.17	**.78**	2.81	.89
Companies using toxic chemicals know how to handle the risks.	.15	**.79**	3.35	.78
Variance explained	*32%*	*31%*		

Note: Extraction Method: Principal Components Analysis, eigenvalues >1.0. Rotation Method: Varimax with Kaiser Normalization. Cronbach's alpha for scale reliability. Loadings in bold significant at p<.05.

[1]Five-point scale, ranging from 1 to 5; higher scores indicate higher agreement.

* item reverse coded, **significant at p<.01.

2.5. Information Seeking, Information Need, Risk Perception, and Determinants

Computation of the mean scores of the overall sample revealed that respondents have moderate intentions to seek risk information (M=2.91). Table 2.3 presents the mean scores of the focus predictors. Evaluating the need for information, the mean score is above moderate (M=3.49), which is rather high compared to the current knowledge people have (M=2.48). This implies that on average, respondents need more information than they currently possess. Respondents reported moderate levels of risk perception (M=3.19). However, closer examination of the different factors of risk perception revealed that people believe that dangerous substances may provoke serious consequences (M=4.01) and also perceive industrial chemicals within the urban area as rather dangerous (M=4.19). On the contrary, the use of industrial chemicals in the countryside is perceived as far less risky (M=2.72). Furthermore, the risks do not really evoke emotions, since the mean scores on affective responses are below average (M=2.67). Participants feel slightly above average engaged in the risks (M=3.25) and are influenced by their social environment at a somewhat similar level (M=3.47). The levels of trust people put into responsible institutions is moderate, with a mean score of 2.99. Finally, respondents perceive themselves to be above average in their capability to deal with (information about) risks from hazardous industrial chemicals (M=3.13).

Face validity of the scales was clearly high, since items were selected or developed specifically to represent the constructs of interest, and also because factor analyses indicate that the scales are distinct. The results of construct validity by means of regressing the main constructs in this study (i.e., risk perception, information need, and intended information-seeking behavior on possible predictors) are shown in Table 2.3.

Since the sample mainly consists of male participants (71%), results were controlled for gender by entering this variable as the first block into the hierarchical regression analysis. Furthermore, to assess information sufficiency, we used a regression approach consistent with difference scores previously conducted by studies on information sufficiency (see Griffin et al., 2006). This was done by entering the current knowledge prior to the block of information needs (Cohen & Cohen, 1983) so that the results would represent the information insufficiency (information needs controlled for the level of perceived current knowledge).

Risk Perception

As shown in Table 2.3, risk perception is significantly predicted by trust (β=-0.33, $p \leq 0.001$), engagement (β=0.23, $p \leq 0.01$), social influence (β=0.18, $p \leq 0.05$), and self-efficacy (β=-0.17, $p \leq 0.05$). This indicates that people who consider responsible institutions (government and industry) less trustworthy and have lower perceived self-efficacy report higher risk perceptions. Furthermore, those who are more engaged in the risks (i.e., higher personal relevance and feeling more involved) perceive industrial substances as more dangerous.

Table 2.3: Regression of risk perception, information need, and risk information seeking

Focus predictor:	Risk perception	Information need	Information Seeking	*Scale statistics:* Mean[1]	Variance
Control block:					
Gender	.05	-.09	.08		
ΔR^2	.01	.00	.01		
Trust	**-.33*** **			2.99	.80
ΔR^2	**.12*** **				
Engagement	**.23** **	**.22***		3.25	.87
ΔR^2	**.07*** **	**.11*** **			
Social influence	**18** **	**.40*** **		3.47	.71
ΔR^2	**.03** **	**.14*** **			
Self efficacy	**-.17***		.09	3.13	.93
ΔR^2	**.11*** **		.01		
Current knowledge		.03	**.37*** **	2.48	.84
ΔR^2		.002	**.15*** **		
Need for information			**.28*** **	3.49	.73
ΔR^2			**.11*** **		
Risk perception		.04	**.32*** **	3.19	1.16
ΔR^2		.01	**.03***		
Multiple R	.58	.51	.56		
ΔR^2	.34	.26	.31		
ANOVA: $F_{5,123}$	*12.61*** **	*8.48*** **	*10.95*** **		

Standardized regression coefficients (betas) except where indicated.
Significance Key: * p≤.05 **: p≤.01 *** p≤.001.
[1]Five-point scales, ranging from 1 to 5, higher scores indicate higher agreement

Information Need

Having a need for information about risks from industrial substances is associated with engagement (β=0.22, p≤0.05) and social influence (β=0.40, p≤0.001). Those who are more involved in the risks of dangerous industrial substances and consider these as more relevant to themselves appear to have a greater need for information. The relatively strong relationship between social influence and information need suggests that a person who tends to be influenced by people in his or her surroundings requires more information on the topic. It is noteworthy that both risk perception and current knowledge did not significantly relate to need for information (β=0.04 and β=0.03, respectively). The amount of knowledge people already possess does not in any way affect the amount of information they state to need. Furthermore, perceiving industrial risks as more dangerous does not lead to higher needs for risk information.

Intended Information-seeking behavior

Regressing the postulated concepts on intended information-seeking behavior shows that both information needs (β=0.28, p≤0.001) and risk perception (β=0.32, p≤0.001) are positively associated with information-seeking behavior. This is in support of our expectations. Those who

perceive industrial substances as more dangerous and report that a greater amount of information is needed are more likely to seek additional information. Interestingly, current knowledge tends to have a direct positive effect on information seeking as well (β=0.37, $p \leq 0.001$). Thus, people who are already more knowledgeable about the topic are more likely to search for additional information. This is an interesting finding, since the amount of knowledge held did not relate to information needs. Furthermore, perceived self-efficacy appeared to be a non-significant predictor of information-seeking behavior (β=0.09), which is in contrast with our expectations.

2.6. Discussion

The aim of this study was to gain insight into the determinants of intended risk information seeking. A tentative theoretical framework was developed by establishing the validity and reliability of a measurement instrument and exploring the directions and patterns of interrelationships with relevant variables. Findings from both exploratory and confirmatory factor analysis showed good empirical grounds for the conceptual distinction between the constructs, as the postulated factorial solutions were replicated in both samples and accounted for a substantial proportion of the variance in each case. We are not suggesting, however, that the (measurement) task is complete. Although the overall findings were positive, there is room for improvement.

As shown in previous studies and replicated here, the need for information plays a key role in predicting risk information-seeking behavior. The results indicate that both current knowledge and amount of information needed are significantly associated with the intentions to gather additional information. Our results, however, raise some question to the operationalization of the information sufficiency concept, primarily caused by the unexpected finding that current knowledge directly and independent of the amount of knowledge needed motivates people to search for information. One may therefore hypothesize that a need for risk information is not exclusively dependent on a perceived gap. Rather, it is likely that *feeling* dissatisfied with the information gap or amount of information held regarding the issue is more important (see Eagly & Chaiken, 1993, Trumbo, 1997). For example, engagement in the topic of interest and being more influenced by social surroundings seem to play a major role in predicting to both information needs and information-seeking behavior. Our data suggest that risks from dangerous industrial substances may be relevant for most people at some level. It could be expected that people feeling engaged in a topic always have a need for information apart from rating their gap between amount of knowledge held and needed. This implies that the operationalization of information sufficiency as a strictly cognitive phenomenon may not be sufficient in the context of this paper (i.e., risks from industrial substances), although it is in others (see for example Griffin et al., 2004; 2006). More emotional or indirect and unconscious factors are therefore also points of interest. Griffin et al. (2006) argued that *"…cognitions and affect interact in complex but, occasionally, predictable ways to influence information gathering…"* (p.27).

The current results, therefore, give rise to some questions with regard to approaching the sufficiency principle as two separate components (current knowledge and sufficiency threshold). This type of measurement captures some possible difficulties for both researchers and respondents. First, with the indirect assessment of information sufficiency, a researcher is somewhat restricted in analyzing and evaluating data, as the information threshold should always be controlled for by current knowledge in assessing the level of insufficiency. It remains somewhat unclear whether this approach to difference scores actually reflects a *sense* of information *in*sufficiency. Second, indirect assessment may give rise to difficulty for respondents. That is, explicitly estimating how much information regarding a risk issue is currently possessed or needed by the individual could be problematic for people, as no one could possibly know the exact amount of risk information that is out there. Furthermore, it is unclear whether the need for information exclusively arises as a consequence of a quantitative gap in knowledge. One could possess a large amount of knowledge without being satisfied with the information held, as the type or content of that information is, for example, irrelevant to the individual. As such, information insufficiency might also capture a qualitative component that is complementary to the quantity of information. A direct, overall measure of information sufficiency may overcome these limitations, for example by asking people to indicate how sufficient their knowledge at a certain point in time is for their personal purpose. A clarification of these issues in future research would be of value to researchers seeking to conceptualize and measure information sufficiency in the wake of similar analyses.

Furthermore, we demonstrated that perceived risk plays a major role that also requires attention. Although a few other studies have incorporated risk perception in frameworks of risk information seeking as part of other concepts (e.g., hazard characteristics), its effect seems to be underestimated and therefore requires more attention. People's judgments of risks are not exclusively based on numbers or statistics; they also incorporate affective responses. Therefore, risk perceptions can vary across times and contexts. People feeling more threatened or anxious by some changes in their everyday lives regarding risks may experience a higher need for information, possibly due to increased uncertainty. As described previously, different theories state that reducing this uncertainty motivates people to seek information (see for example Atkin, 1973; Berger & Calabrese, 1975).

Finally, the non-significant relationship between self-efficacy and subsequent intentions for seeking information requires further attention. According to the Theory of Planned Behavior (Ajzen, 1991), relevant behavioral beliefs have a significant effect on intentions (i.e., positive attitudes towards the outcome expectancies of the behavior to perform might provoke intentions). Subsequently, self-efficacy may relate to outcome expectancies of the target behavior, in turn affecting intentions to perform the particular behavior. We therefore propose to incorporate the concept of outcome expectancies related to risk information seeking in future studies.

We expected a relatively strong tendency for people to report intended information-seeking behavior associated with information insufficiency. This would be a result of the fact that active problem-focused coping behavior is more socially desirable compared to a more passive position. This is also supported by the finding of a positive relationship between information need and social influence. This implies that a behavioral measure of actual risk information-seeking behavior, next to intended behavior, is very important for future studies. The predictive value of intentions to seek information on actual risk information-seeking behavior can then be explored. However, this may require a research method different from a survey, as was used in this study.

A tentative model for intended risk information-seeking behavior is proposed and evaluated in this chapter. We therefore combined and adapted aspects from different theories and frameworks and applied these to the context of industrial risks. In doing so, we discovered some interesting relationships between different variables proposed in the model. Concepts such as personal relevance, involvement, and social influence seem to play key roles in this context, but are not (yet) part of other theories in the field. Risk perception seems to be a more important predictor of intended risk-related information seeking than has been stated by, for example, the Theory of Planned Behavior or the RISP-model. Although exploratory in nature, these findings could help to further develop relevant frameworks regarding risk information-seeking behavior.

This study may contribute to sustainable risk communication decisions by improving risk information supplies for the general public, forthcoming their risk perception, risk information needs and subsequent information-seeking behavior. The framework presented here better fits the critique on top-down risk communication. The new perspective is important because it may also provide a solution to earlier attempts to communicate risks effectively to a general public, starting with understanding public concerns and their need for risk information (Rowan, 1996).

Notes

[1] A key assumption is that all items belonging to a common domain should have similar item total correlations and have at least moderate correlations with the total scale (Nunnally, 1978; Gerbing & Anderson, 1988). Low correlations indicate that items are not drawn from the domain at the target and produce errors and unreliability (Churchill, 1979).

[2] No significant differences between the two sub-samples regarding age, gender, educational level, and relevant hazard experience were found. A coefficient alpha of 0.70 is considered acceptable in social sciences (Nunnally, 1978). Items that negatively affected reliability were eliminated, and factor analysis procedures were then repeated.

[3] The main purpose of exploratory factor analysis is to empirically determine the number of latent variables that underlie a set of items and reduce the initial set of items so that the variation can be accounted for with a smaller set (DeVellis, 2003). The goal was to develop scales with a clear factor structure that are reasonably independent of one another, so the principal components method with an orthogonal rotation was used. Only items that clearly loaded on a single appropriate factor were retained. There are no strict rules for factor loadings, but we used the heuristic of an appropriate loading of greater than 0.40 and a loading twice as strong on the appropriate factor than on any other factor, as described by Hinkin (1998). The Kaiser Criterion (eigenvalues greater than 1) and a screen test of the percentage of variance explained (minimum 60%) were used to justify the factor structures of the scales developed (Hinkin, 1998).

Model-data fit was evaluated based on multiple fit indexes. The use of chi-square statistics permits the assessment of fit of a specific model as well as comparison with a default model. A non-significant Chi-square is preferable (Hinkin, 1998). The goodness-of-fit index (GFI) is a measure of the relative amount of variance and covariance in S that is jointly explained by Σ; the Adjusted Goodness-of-fit Index (AGFI) adjusts for the number of degrees of freedom in the specified model (Byrne, 2001). Values close to 0.90 were originally considered as representative of a well-fitting model, but a revised cut-off value close to 0.95 has recently been advised (Hu & Bentler, 1999). The final goodness-of-fit statistic used in this study is the root mean square error of approximation (RMSEA). The RMSEA has recently been recognized as one of the most informative criteria in covariance structure modeling since it takes into account the error of approximation in the population and measures how well the model would fit the population covariance matrix if it were available. Values less than 0.05 indicates good fit and values as high as 0.08 represent reasonable errors of approximation in the population (Browne & Cudeck, 1993).

[4] Construct validity is concerned with the examination of the theoretical relationship of a variable with the constructs with which they could be hypothesized to relate to (Hinkin, 1998; DeVellis, 2003).

References

Afifi, W.A. & Weiner, J.L. (2006). Seeking Information About Sexual Health: Applying the Theory of Motivated Information Management. *Human Communication Research*, 32, pp. 35-57.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, 50, pp. 179-211.

Alaszewski, A. (2005). A Person-Centered Approach to Communicating Risk. *PLoS Medicine, 2*, (2), pp. 93-95.

Atkin, C.K. (1972). Anticipated Communication and Mass Media Information-Seeking. *The Public Opinion Quarterly*, 36 (2), pp. 188-199.

Atkin, C.K. (1973). Instrumental Utilities and Information Seeking. In: P. Clarke (Ed.): *New Models for Communication Research*, Vol. 2. London: Sage.

Bandura, A. (2000). Exercise of Human Agency Through Collective Efficacy. *Current Directions in Psychological Science*, 9, (3), pp. 75-78.

Belkin, N. J. (1980). Anomalous State of Knowledge for Information Retrieval. *Canadian Journal of Information Science*, 5, pp. 133-143.

Berger, C.R. & Calabrese, R.J. (1975). Some Explorations in Initial Interaction and Beyond: Toward a Developmental Theory of Interpersonal Communication. *Human Communication Researc*h, 1, pp. 99-112.

Bord, R.J. & Connor, R.E. (1992). Determinants of Risk Perceptions of a Hazardous Waste Site. *Risk Analysis*, 12, (3), pp. 411-416.

Browne, M.W., & Cudeck, R. (1993). Alternative Ways of Assessing Model Fit. In K.A. Bollen & J.S. Long (Eds.). *Testing Structural Equation Models* (pp.445-55). Newbury Park, CA: Sage.

Byrne, B.M. (2001). *Structural Equation Modeling with Amos: Basic Concepts, Applications, and Programming*. Mahwah, N.J.: Erlbaum.

Chaiken, S., Liberman, A., & Eagly, A.H. (1989). Heuristic and Systematic Information Processing Within and Beyond the Persuasion Context. In J.S. Uleman & J.A. Bargh (Eds.), *Unintended Thought* (pp. 212-52). New York: Guilford Press.

Churchill, G.A. (1979). A Paradigm for Developing Better Measures of Marketing Constructs. J*ournal of Marketing Research*, 16, pp. 64-73.

Cohen, J., & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences, 2nd ed*. Hillsdale, NJ: Lawrence Erlbaum.

DeVellis, R.F. (2003). *Scale Development. Theory and Applications*. 2nd ed. Volume 26. London:Sage.

Eagly, A. H., & Chaiken, S. (1993). *The Psychology of Attitudes.* Harcourt Brace, San Diego.

Earle, T. C., & Cvetkovich, G. (1995). *Social Trust: Toward a Cosmopolitan Society*. Westport, CT: Praeger.

Gerbing, D.W. & Anderson, J.C.(1988). An Updated Paradigm for Scale Development Incorporating Unidimensionality and Its Assessment. *Journal of Marketing Research*, 25, pp. 186-192.

Gregory, J., & Miller, S. (1998). *Science in Public: Communication, Culture, and Credibility*. New York: Plenum.

Griffin, R. J., Dunwoody, S., & Neuwirth, K. (1999). Proposed Model of the Relationship of Information Seeking and Processing to the Development of Preventive Behaviors. *Environmental Research,* 80, pp. S230-245.

Griffin, R. J., Neuwirth, K., Dunwoody, S., & Giese, J. (2004). Information Sufficiency and Risk Communication. *Media Psychology*, 6, pp. 23-61.

Griffin, R.J., Yang, J., Ter Huurne, E., Boerner, F., Ortiz, S. & Dunwoody, S. (2006). After the Flood: Anger, Attribution, and the Seeking of Information. *Paper presented to the Association for Education in Journalism and Mass Communication annual convention*, San Francisco, CA.

Groothuis, P. A., & Miller, G. (1997). The Role of Social Distrust in Risk-Benefit Analysis: A Study of the Siting of a Hazardous Waste Disposal Facility. *Journal of Risk and Uncertainty*, 15, pp. 241-257.

Gutteling, J.M. & Wiegman, O. (1990). Reacties op Milieurisico's: Invloed van Sekse, Opleidingsniveau, Politieke Voorkeur en Woonafstand tot het Risico-Object. *Gedrag en Organisatie*, 3, (2), pp. 101-116.

Hinkin, T.R. (1998). A Brief Tutorial on the Development of Measures for Use in Survey Questionnaires. *Organizational Research Methods*, 1, (1), pp. 104-121.

Hu, L.-T., & Bentler, P.M. (1999). Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6, pp. 1-55.

Johnson, B.B. (1987). Accounting for the Social Context of Risk Communication. *Science & Technology Studies*, 5 (3/4), pp. 103-111.

Johnson, B.B. (2005). Testing and Expanding a Model of Cognitive Processing of Risk Information. *Risk Analysis*, 25, (3), pp. 631-650.

Kasperson, R.E., Golding, D. & Tuler, S.T. (1992). Social Distrust as a Factor in Siting Hazardous Facilities and Communicating Risks. *Journal of Social Issues,* 48, (4), pp.161-187.

Kuhlthau, C.C. (1991). Inside the Search Process: Information Seeking from the User's Perspective. *Journal of the American Society for Information Science*, 42, (5), pp. 361-371.

Moore, N. (2002). A Model of Social Information Need. *Journal of Information Science*, 28, (4), pp. 297-303.

Neuwirth, K. & Frederick, E. (2004). Peer and Social Influence on Opinion Expression: Combining the Theories of Planned Behavior and the Spiral of Silence. *Communication Research*, 31, (6), pp. 669-703.

Neuwirth, K., Dunwoody, S. & Griffin, R.J. (2000). Protection Motivation and Risk Communication. *Risk Analysis*, 20, (5), pp. 721-734.

Nunnally, J. C. (1978). *Psychometric Theory* (2nd ed.). New York: McGraw-Hill.

Radecki, J.M., & Jaccard, C. (1995). Perceptions of Knowledge, Actual Knowledge and Information Search Behavior. *Journal of Experimental Social Psychology*, 31, pp. 107-138.

Rowan, F. (1996). The High Stakes of Risk Communication. *Preventive Medicine*, 25, pp. 26-29.

Siegrist, M., Cvetkovich, G., & Roth, C. (2000). Salient Value Similarity, Social Trust, and Risk/Benefit Perception. *Risk Analysis*, 20 (3), pp. 353-362.

Slovic, P. (1987). Perception of Risk. *Science*, 236, (4799), pp. 280-285.

Slovic, P. (1999). Trust, Emotion, Sex, Politics, and Science: Surveying the Risk-Assessment Battlefield. *Risk Analysis*, 19, (4), pp. 689-701.

Slovic, P., Finucane, M.L., Peters, E., & MacGregor, D. (2004). Risk as Analysis and Risk as Feelings: Some Thoughts about Affect, Reason, Risk, and Rationality. *Risk Analysis*, 24 (2), pp. 311-322.

Strating, M., Van Beuningen, G., Kuttschreuter, M. & Gutteling, J.M. (2004). De Risicokaart in Ontwikkeling: een Eerste Evaluatie. *Tijdschrift voor Veiligheid en Veiligheidszorg*, 3 (1), pp. 4-17.

Trumbo, C.W. (1997). Heuristic-Systematic Processing and Risk. *Paper presented to the Association for Education in Journalism and Mass Communication annual convention*, Chicago, Ill.

Trumbo, C.W. (1999). Heuristic-Systematic Information Processing and Risk Judgment. Risk Analysis, 19, (3), pp. 391-400.

Trumbo, C.W. & McComas, K.A. (2003). The Function of Credibility in Information Processing for Risk Perception. Risk Analysis, 23, (2), pp. 343-353.

Wilson, T.D. (1999). Models in Information Behavior Research. *The Journal of Documentation*, 55, (3), pp. 249-270.

3

Risk information seeking among U.S. and Dutch residents: An application of the risk information seeking and processing model

(submitted)

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3.1. Abstract

The model of Risk Information Seeking and Processing (RISP) proposes characteristics of individuals that might predispose them to seek risk information. The intent of this study was (a) to test the causal structure involving the impact of different predictors of seeking information about risks from hazardous industrial substances and (b) to cross-validate the RISP model across U.S. and Dutch samples by performing multiple group analyses in structural equation modeling. Results indicate that the RISP model is applicable to the context of industrial risks in both samples. Structural invariance across samples by constraining regression weights was not achieved.

3.2. Introduction

Following the trend in communication research (McComas, 2006), risk scholars have recognized the importance of receiver-oriented explanations of how and why people seek and use information, or even actively avoid such information. Insight into what predicts to information seeking regarding industrial risks is important for future development of communication and public information efforts. Results might indicate how to stimulate people to actually search for information about this topic and use relevant channels (Huurne, ter & Gutteling, in press).

The Model of Risk Information Seeking and Processing (RISP; see Figure 3.1), developed by Griffin et al. (1999), develops this audience-based perspective and proposes different characteristics of individuals that might predispose them to seek and process information about risks in different ways. Based primarily on parts of the Heuristic Systematic Model (HSM; Eagly & Chaiken, 1993) and the Theory of Planned Behavior (Ajzen, 1991), RISP states that information insufficiency, relevant channel beliefs, and perceived information gathering capacity, together with indirect predictors such as perceived hazard characteristics, informational subjective norms, affective responses, and various individual characteristics, will affect the extent to which people are motivated to seek (or avoid) and process risk information.

The RISP model has been applied to various environmental and health risks (Griffin et al., 1999; Griffin et al., 2004a; Griffin et al., 2006; Johnson, 2005; Kahlor et al., 2006). To date, no studies are known in which the RISP model is tested internationally (here as applied to risks from hazardous industrial substances) to see how well results replicate across countries. By performing multiple group analyses in structural equation modeling, this study will test the causal structure of parts of the RISP model as applied to individuals' seeking of information about industrial risks in the Netherlands and Milwaukee County in the United States. Although the RISP model is also designed to predict how people process risk information, this analysis will limit itself to risk information seeking.

3.2.1. External (off-site) Safety

Various industrial activities, especially the use, storage, and transportation of industrial chemicals and other hazardous substances, could threaten surrounding areas and potentially lead to major accidents. A large scale explosion in a fireworks storage depot in the Netherlands in 2000 (which killed 23 people, injured a thousand, and produced enormous material and psychological damage) has led to major governmental attention in the Netherlands to the safety of people and property in the areas surrounding industrial facilities and their transportation corridors. The ignorance of both citizens and governmental institutions regarding the presence of the fireworks facility in that neighborhood has been postulated as one of the main reasons for the amount of human and material damage inflicted by the explosion.

Increased knowledge and awareness of external (or "off-site") safety issues among the general public could enhance the likelihood that people would perform adequate preventive behaviors in the event of an accident. Modern communication media, such as the Internet, offer risk communication practitioners the opportunity to have relevant risk information permanently available and accessible to the public. Similarly, opportunities are created for the general public to obtain and seek personally relevant risk information. In the United States, for example, people can use online sources such as the U.S. Environmental Protection Agency's Toxics Release Inventory and the EPA Enviromapper to find out about hazardous substances stored, released, and transported in their communities and neighborhoods. In the Netherlands, similar sources of information are available for the public to learn more about potential risks from hazardous industrial substances, for example, by means of digital risk maps, which are publicly accessible online. However, insight into what motivates people to actually use these information sources remains scarce. Application of the RISP model could add insight into the determinants of individuals' risk information seeking regarding external safety issues.

3.2.2. RISP Model Variables

Information insufficiency

Central to the RISP model is the concept of information insufficiency, representing an individual's sense of a discrepancy between the amount of knowledge held and that needed to deal with a given risk (i.e., "sufficiency threshold"). The model suggests that different people have different levels of the amount of information they believe they need to feel capable of coping with a given risk in their lives. A sense of information insufficiency, then, is proposed as a direct cognitive drive to seek information. The concept of information sufficiency finds its roots in the HSM (Eagly & Chaiken, 1993) and, according to Griffin et al. (1999), more effortful information seeking will be motivated when the sufficiency threshold is higher than the knowledge base a person feels he or she currently has. In other words, people are induced to put more effort into reaching information sufficiency (e.g., by seeking information across different channels) when they sense a greater amount of insufficiency (e.g., when they perceive that the amount of information they currently have is not enough for them to deal with the risk).-

Perceived information gathering capacity

One's sense of self-efficacy (Bandura, 1986; 2000) or perceived behavioral control (Ajzen, 1991) in performing the necessary information seeking is an important predictor of that behavior. Self-efficacy reflects the perceived ease or difficulty of performing the behavior (Ajzen, 1991). The RISP model refers to "perceived information gathering capacity" as a form of self-efficacy or perceived behavioral control (Griffin et al., 2006).

Relevant channel beliefs

Another factor that might impact the information seeking strategies an individual employs is a person's beliefs about communication channels that might provide him or her with information about the risk (Griffin et al., 1999; Kahlor et al., 2006). Channel beliefs can include factors such

as trustworthiness and usefulness. Individuals holding more positive beliefs regarding possible information channels are expected to use these channels more actively. The RISP model (Griffin et al., 1999) suggests that information insufficiency, perceived information gathering capacity, and relevant channel beliefs may also interact with one another to affect information seeking and processing.[1]

Informational subjective norms

The RISP model proposes that informational subjective norms might affect information insufficiency. Subjective norms refer to the perceived social pressure to perform or not perform a certain behavior (Ajzen, 1991). An individual's social environment might increase his or her desire to gain knowledge by seeking information (Radecki & Jaccard, 1995); especially when significant others (e.g., family and friends) are knowledgeable about an issue. People tend to compare their abilities with other people's abilities and desire social approval and liking (Eagly & Chaiken, 1993). Possible reactions of family, friends, and others are seen as great influencers of these decisions (Neuwirth & Frederick, 2004). So, this felt pressure from relevant others to keep on top of risk information might elevate the amount of information a person feels he or she needs, thus widening the gap with current knowledge.

Affective Responses

A growing body of research indicates that emotional reactions and moods influence the way people cope with information. Previous studies on coping styles (Miller, 1987; Ben-Zur, 2002) point out that negative emotions, like fear and worry, can have different effects on coping with information than might positive feelings like hope or joy. Thus, the RISP model proposes that affective responses such as worry or anxiety, or even positive responses such as hope, could also influence a person's sense of information insufficiency about the risk and, ultimately, his or her seeking of risk information.

Perceived Hazard Characteristics: Risk Perception, Trust, and Self-Efficacy

Perceptions of risk play a prominent role in developing risk communication. In particular, differences in risk perception often lie at the heart of disagreements between technical experts and members of the general public about the best courses of action to take to deal with a risk (Slovic, 1987). Risk perception is not just a matter of objective risk evaluation (based on the demonstrable probability of coming to harm, together with the severity of possible outcomes). Subjective risk perception plays a key role in how people respond to risks as well. Whereas experts are often seen as purveying risk assessments, characterized as objective and rational, as the basis for developing policies to manage various hazards, the public is often viewed as relying, instead, more on their own, varied, subjective perceptions of risks.

According to Slovic (1999), the limited effectiveness of risk communication efforts can be attributed to the public's lack of trust in responsible institutions. Institutional trust is the willingness to rely on those who have the responsibility for making decisions and taking actions related to

the management of technology, the environment, or other realms of public health and safety (Siegrist, Cvetkovich & Roth, 2000). Trust has two principal components: reliance and risk (Curall & Epstein, 2003). Most people do not have enough knowledge of science and technology to be truly able to judge risks and benefits (Gregory & Miller, 1998). People therefore have to rely heavily on information provided by experts (Earle & Cvetkovich, 1995), which makes most laypeople subject to experts' assessments and judgments. Public trust in experts and government agencies to protect people from risks is especially important with regard to hazards, such as risks from industrial chemicals that are difficult for the general public to understand or control. This lack of control could lead people to perceptions of low self-efficacy (an individual's own sense of power in dealing with a risk). It could make one feel more helpless and therefore more dependent on management institutions. The RISP model proposes that trust in managing agencies, self-efficacy, and perceived risk influence an individual's affective response to risk information.

Individual Characteristics

Although not illustrated in Figure 3.1, the RISP model also proposes that various individual characteristics (e.g., demographic, experiential) can ultimately affect risk information seeking and processing through various predictors (e.g., perceived hazard characteristics, informational subjective norms, current knowledge, perceived information gathering capacity).

3.2.3. Previous Findings on the RISP Model

Previous studies have been at least partially supportive of the relationships depicted in the RISP model across various types of risks and settings (see e.g., Griffin et al., 2004a; Griffin et al., 2006; Johnson, 2005; Kahlor et al., 2006; Trumbo, 2002). These results are promising for future use of the RISP model. However, over the course of time, some progress has been made on the relationships among variables proposed in the original RISP model which we would like to address in this paper (see Figure 3.1). First, researchers have found positive direct relationships between self-reported current knowledge and perceived information gathering capacity (Griffin et al., 2006; Kahlor et al., 2006). Although not overtly specified in the original model, the amount of knowledge people hold about a risk could affect their capacity to gain new information about it. As Tichenor et al. (1970) explain in their Knowledge Gap Theory, higher states of existing knowledge enhance capacities to understand and gain additional knowledge. Thus, succeeding in understanding information in the past should give individuals more faith in their abilities to gather information in the future. Ajzen (1991) similarly argues that perceived behavioral control is "assumed to reflect past experience as well as anticipated impediments and obstacles" (p. 188). In this study we therefore hypothesize a positive association between current knowledge and perceived information gathering capacity. Furthermore, we suppose that a higher (perceived) knowledge base on a topic might lead to more active information seeking regarding that issue directly (Kahlor et al., 2006; Huurne, ter & Gutteling, 2006).

Second, the RISP model states that informational subjective norms and affective responses will affect information insufficiency. However, recent research indicates that both informational

subjective norms and affective responses might relate more directly to information seeking as well (Griffin et al., 2006; Kahlor et al., 2006; Loewenstein et al., 2001). These findings for informational subjective norms are in line with the Theory of Planned Behavior, which suggests that subjective norms are directly related to behavioral intentions (Ajzen, 1991). Based on these results, an adjustment has been proposed by Griffin et al. (2006) to accommodate the role of informational subjective norms as a more direct motivator of information seeking behavior, independent of the cognitively based information insufficiency component of the model.

Previous research also found that affective responses to a risk could directly relate to a person's information seeking behavior, not just indirectly via the information sufficiency component proposed by the model (Griffin et al., 2006; Kahlor et al., 2006). These findings are in accordance with the risk-as-feelings hypothesis (Loewenstein, 2001), which suggests that people could respond to risks based on direct emotional influences. Reliance on feelings has been called the "affect heuristic" by Slovic and colleagues (2004). They explain that individuals' risk judgments are based not only on what they know about risks ("analytical system") but also on what they feel about risks ("experiential system") and their subsequent emotional reactions. Responding to risks based on feelings (e.g., worry or anxiety) might directly motivate an individual to actively seek additional information.

Thus, informational subjective norms and affective responses may drive the seeking and processing of risk information in indirect ways (by increasing the need for more information, as proposed by the RISP model), but they might also operate independently of information sufficiency as direct predictors of information seeking as well (Griffin et al., 2006). Therefore, we include direct associations between both affective responses and informational subjective norms and information seeking behavior.

3.2.4. Research Questions

This study draws on the theoretical assumptions described above and, therefore, our research questions and hypotheses reflect the relationships between the intention to seek risk information regarding hazardous industrial chemicals and its antecedents, as presented in Figure 3.1. We focus on selected paths proposed in the original RISP model as well as the newly added paths based on previous studies as described above. The analysis focuses particularly on those parts of the RISP model that are involved in the chain of RISP elements found to be robust across contexts and settings in previous studies. Studies on the effects of channel beliefs still remain exploratory and have produced rather inconsistent results so far and, consequently, have not been found to be among the most consistent predictors of risk information seeking behavior (see Griffin et al., 2004b). As Griffin et al. (2006) report the need to change some conceptual or measurement strategies for the channel belief component, we therefore omitted this component from this study.

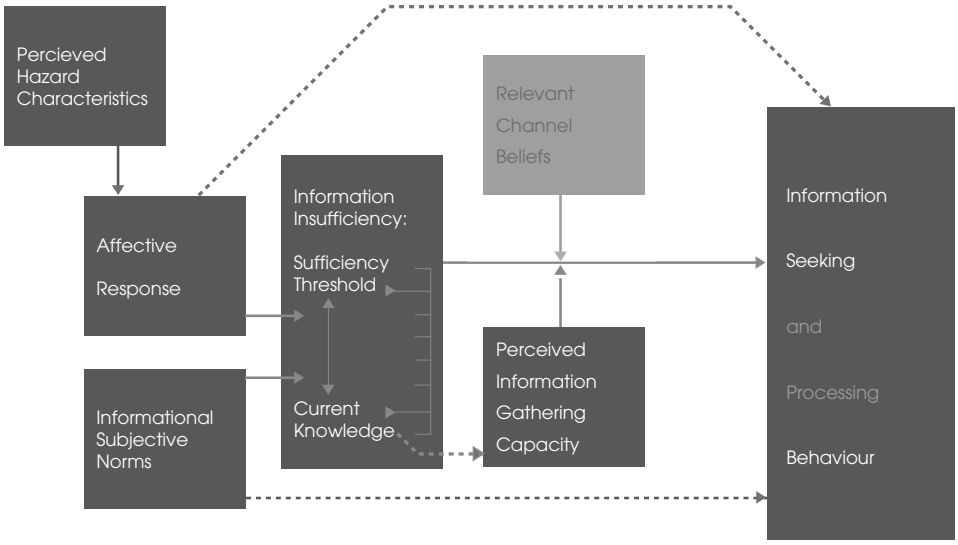

Figure 3.1: Excerpt from Model of Risk Information Seeking and Processing

Note: Dashed lines are proposed alternatives to the original RISP model. The RISP model's block of "individual characteristics" variables is not shown above. Relevant channel beliefs and risk information processing will not be investigated in this analysis.

The analysis thus addresses two research questions: (1) what are the relationships between individual risk information seeking behavior and select predictors from the RISP model in the context of industrial risks and (2) how well does the RISP model apply in different national settings?

3.3. Method

3.3.1. Design and Procedure

Data were gathered by conducting a mail questionnaire survey among a random sample of adult residents in both the Netherlands and in Milwaukee County, Wisconsin, in the United States. These samples were chosen because they both have fairly diverse populations and a manufacturing base that uses and transports hazardous substances. Thus, residents from both study populations have a reasonably comparable likelihood of exposure to industrial hazardous substances, given the potential for local accidents. This analysis is intended primarily to study the RISP model's theoretical robustness across two independent samples in different nations (i.e., compare the relationships among key variables) rather than to describe differences between samples on the variables themselves, although we will, of course, report the latter.

Participants were asked to respond to a printed mail questionnaire. Dutch participants were contacted in fall 2005, Milwaukee County residents in spring 2006. Selected people received the questionnaire together with a cover letter explaining the topic of the study and a postage paid envelope to return the completed questionnaire. The research project was presented to potential respondents as a study about how citizens feel and think about risks from hazardous industrial substances, being conducted in order to provide people with better information about this topic. A number of follow-up letters and reminders were sent after the first mailing to increase response rates.[2]

3.3.2. Sample and Participants

In the Netherlands, the sample (N=1042) was drawn from a professional marketing database containing all Dutch postal addresses of adult heads of households. 182 questionnaires were completed and returned (response rate 18%, number of questionnaires useful for analysis 171). Significantly more males (71%) than females (29%) participated in the study ($\chi^2(1) = 29.8$, $p < .05$). Respondents ranged in age from 20 to 87 years with a mean of 54 years. Of the subjects, 43% indicated a higher level of formal education (i.e., college graduate, post grad or professional degree), 32% intermediate (i.e., some technical school or vocational training, technical school graduate, some college or associate degree), and 26% reported a lower educational level (i.e., eighth grade or less, some high school, high school grad or GED certificate). About 32% of the respondents reported they live near a place where dangerous substances are stored, used, or transported. Eighteen percent had experienced an incident with dangerous industrial substances and 2% suffered property loss or health damage due to the release of hazardous industrial substances. About a quarter of the respondents had actively searched for information about dangerous industrial substances previously.

In Milwaukee County, the University of Wisconsin Survey Center, a professional research organization associated with the University of Wisconsin-Madison, sent out 600 questionnaires to randomly selected adult residents, of which 300 were completed and returned (response rate 50%, number of questionnaires useful for analysis 296). The portion of male participants was significantly larger than the portion of female respondents (57.5% and 42.5% respectively; $\chi^2(1) = 6.6$, $p < .05$). Respondents ranged in age from 20 to 91 years with a mean of 56 years. Of the respondents, 29% had a higher level of formal education, 45% intermediate, and 25% a lower educational level. About 18% of the respondents reported they live near a place where dangerous substances are stored, used, or transported. Seven percent had been involved in an accident with hazardous substances, and 3% suffered property loss or health damage due to the release of hazardous substances. About 12% of the respondents had actively tried to get information about hazardous industrial chemicals previously.

No significant differences between samples were found with respect to age ($F(1,451) = 1.5$, n.s.) and educational level ($F(1,462) = 2.0$, n.s.). Distribution of gender, however, differed between samples ($\chi^2(1) = 8.4$, $p < 0.01$) and therefore will be controlled for in the analyses.

3.3.3. Measures

A pilot study that preceded the survey in the Netherlands (Huurne, ter & Gutteling, in press) guided the construction of the measures to be used. Some measures were based on existing scales and some were newly developed. Native speakers from both the Netherlands and the U.S. collaborated on developing the instrument. Measures were translated from English into Dutch and then translated back into English to ensure adequate translation. Item wordings and reliability assessments (Cronbach's alpha) for both samples are shown in Table I. The questionnaire consisted of statements to which respondents could indicate their agreement on a 5-point Likert-type scale ranging from "strongly disagree" to "strongly agree."

Information Seeking

Respondents were asked via three items to indicate the extent to which they were likely to search for additional information whenever they ran across information about industrial chemicals.

Informational Subjective Norms

A two-item scale was used to assess the perceived social pressure on respondents to stay on top of information about industrial chemicals.

Perceived Information Gathering Capacity

Perceived information gathering capacity was assessed by asking respondents the degree to which they would be able to get and make sense of information on this topic.

Information Sufficiency

Two subscales were used to assess both current knowledge and the sufficiency threshold. The sufficiency threshold was assessed by two items. Three items assessed the amount of perceived current knowledge.

Affective Responses

Respondents were asked, via six items, to indicate how they felt when thinking about the possibility of being exposed to risks from industrial hazards in their everyday lives (tense, anxious, content, comfortable, worried, at ease). Three positive emotions were reverse coded, so higher scores on the scale indicated higher negative affect.

Perceived Hazard Characteristics

Risk perception was assessed by asking respondents to indicate the extent to which they felt certain activities involving industrial substances would be dangerous and how severe possible outcomes of these activities would be. Individuals' mean scores from both summated scales were multiplied to form a measure of risk perception. An 8-item scale was developed to assess *institutional trust*. Relevant aspects of trust, such as concern, expertise, openness, and credibility (see Poortinga & Pidgeon, 2003), were included. *Self-efficacy* was measured by asking respondents the degree to which they expected themselves to be able to protect themselves from possible consequences

and react in the right way if an accident with hazardous chemicals would occur.

Although some of the scales (i.e., sufficiency threshold in both samples and informational subjective norms in the MC sample) had relatively low reliability, we decided to maintain those items, since inter-item correlations were significant at the 0.01 level.

3.3.4. Analysis

Analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 12 and Amos version 5. A t test of independent samples by groups was conducted to explore differences in scores. To test whether the RISP model applies across different samples, path analysis was conducted in two ways. First, the model was tested separately for both samples. Second, the fitting model was tested with all regression weights constrained. In this approach, path analysis is conducted on both samples simultaneously, with and without the constraint that the regression weights be equal across groups.[3]

Table 3.1. Questionnaire Item Wordings and Internal Consistencies

Information seeking (MC: α=.74; NL α=.69)[1]
When I see, hear, or read something about this topic…
I search for as much information as possible
I look for information about what I would have to do in case an accident happens in my surroundings
If a chemical accident happens in [the Netherlands / Wisconsin], I am likely to search for information

Affective responses (MC: α=.88; NL α=.92)
How do you feel when you think about the possibility of being exposed to hazards regarding industrial chemicals in your everyday life? I feel…
[Tense / Anxious / Content / Comfortable / Worried / At ease]

Informational subjective norms (MC: α=.68; NL α=.71)
Most people who are important to me think I should stay on top of information about the topic
I am expected to be knowledgeable about this topic

Current knowledge (MC: α=.71; NL α=.70)
I know a lot about this topic at the moment
I know which industrial chemicals I am exposed to

Sufficiency threshold (MC: α=.63; NL α=.56)
I require a lot of information to judge the risks I am exposed to
I need to know everything I can about any accidents or other changes in risks from industrial chemicals in my neighborhood

Risk perception (MC: α=.87; NL α=.80)
In your estimation, how dangerous are the following activities with industrial chemicals?
[use, production, storage, transportation] of industrial chemicals [in the country side/ city] [2]
An accident with these industrial chemicals would probably affect a large number of people who are nearby
An accident with these industrial chemicals would seriously disrupt the victims' lives

Institutional trust (MC: α=.84; NL α=.83)
Companies using industrial chemicals know how to handle the risks
Companies using industrial chemicals protect local residents from possible harm
When companies using industrial chemicals claim to have the risks under control, I believe them
Companies that use industrial chemicals ignore the health and safety of people like me[3]
The government is concerned about the safety and health of citizens
Governments communicate openly about these risks with citizens
The government protects people like me from these risks
When the government claims to do everything to minimize the risks for me, I believe that

Self-efficacy (MC: α=.82; NL α=.70)
How much could you deal personally with hazards from industrial chemicals if you had to?
I would be able to…
Protect myself against the possible consequences
React in the right way if an accident happens
Do what I have to do if I hear that industrial chemicals have been released in my surroundings

Scales ranging from *strongly disagree* (1) *to strongly agree* (5); [1]MC=Milwaukee County sample; NL = Dutch sample;
[2] Scale ranging from *not dangerous* at all (1) to *extremely dangerous* (5); [3] Reverse coded

3.4. Results

3.4.1. Descriptive Statistics

Table 3.2 presents the mean differences between Milwaukee County (MC) and Dutch residents on constructs assessed in this study. Milwaukee County residents are more likely to seek risk information (M=3.34) than Dutch people (M=2.90). Milwaukee County respondents report lower current knowledge (M=2.28) than do the Dutch (M=2.48). The sufficiency threshold is higher among Milwaukee County respondents (M=3.76) than among the Dutch (M=3.49). Both populations report fair to good perceived capacities of gathering relevant information (MC: M=3.18; NL: M=3.53) with the difference (the Dutch reporting higher capacity) being significant. Samples differ on affective responses as well: Milwaukee County residents have more negative feelings towards the risks (M=3.43) than do the Dutch (M=2.67). The amount of trust put in responsible agencies is moderate in both samples (MC: M=2.79; NL: M=2.99), with the Dutch showing a bit more trust than the Milwaukeeans. Respondents from Milwaukee (M=3.37) perceive themselves more efficacious compared to the Dutch (3.00) in dealing with the risks and possible outcomes. Risk perception and informational subjective norms, however, did not differ significantly across samples and scored moderately.

Table 3.2. Homogeneity of the variables across the two samples surveyed

	Dutch sample[1]: Mean (SD)	Milwaukee County[2] sample: Mean (SD)	t-value	Df
Information seeking	2.90 (0.67)	3.34 (0.70)	6.42***	447
Current knowledge	2.48 (0.72)	2.28 (0.77)	2.75**	448
Information need (sufficiency threshold)	3.49 (0.71)	3.76 (0.75)	3.65***	448
Perceived information gathering capacity	3.53 (0.93)	3.18 (1.05)	3.60***	461
Informational subjective norms	2.99 (0.68)	3.01 (0.78)	0.23[ns]	452
Affective responses	2.67 (0.95)	3.43 (0.76)	9.23***	434
Risk perception[3]	14.10 (4.72)	14.45 (5.25)	0.71 [ns]	443
Institutional trust	2.99 (0.61)	2.79 (0.65)	3.19**	449
Self-efficacy	3.00 (0.77)	3.37 (0.94)	4.44***	456

Significance levels: *p≤ 0.05; **p≤0.01; ***p≤0.001.
Scales ranging from 1 to 5, higher scores indicate higher agreement.

[1]N=171; [2]N=296; [3]Multiplied scores on perceived severity and perceived danger (extremes from 1 to 25).

3.4.2. Path Analysis

The first research question focused on the relationship between risk information seeking behavior and proposed predictors. By performing path analysis in Amos[4], regression coefficients are obtained for both samples, reported in Table 3.3. [5]

Information Seeking

Some interesting patterns emerge among the set of predictor variables of information seeking. For both MC and Dutch samples, two out of three original RISP model variables, i.e., sufficiency threshold and perceived information gathering capacity, are positively associated with information seeking (respectively β=0.29, $p<0.001$; β=0.17, $p<0.05$ for the Dutch sample and β=0.19, $p<0.001$; β=0.14, $p<0.05$ for the MC sample). This result implies that those who have higher sufficiency thresholds and perceive being better able to gather relevant information are more motivated to seek additional information. The amount of information held relates to information seeking in the Netherlands (β=0.31, $p<0.001$) but not in the Milwaukee County sample (β=-0.01, n.s.).

Evaluating the newly proposed direct motivators of information seeking (informational subjective norms and affective responses), we see that informational subjective norms are positively associated with information seeking behavior among Milwaukeeans (β=0.38, $p<0.001$) but not among the Dutch (β=0.10, n.s.). This suggests that, at least among Milwaukee County residents, those perceiving higher social pressure to be knowledgeable about the risk are more likely to seek information, quite apart from whether they feel any cognitive motivation to learn more (i.e., their information insufficiency). Affective responses, on the other hand, do relate positively to information seeking in both samples (NL: β=0.37, $p<0.001$; MC: β=0.19, $p<0.001$). This implies that being more emotionally negative about the risks may prompt one to seek information about them. These results seem generally consistent with the proposal that affective motivators can more directly lead to information seeking behavior, in addition to the more cognitively based sufficiency motivations originally hypothesized in the RISP model.

Sufficiency Threshold

In both samples, there is no significant relationship between the amount of current knowledge and the sufficiency threshold (NL: β=-0.04, n.s.; MC: β=-0.11, n.s.). Affective responses and informational subjective norms are positively associated with the sufficiency threshold (NL: β=0.16, $p<0.05$ and β=0.32, $p<0.001$ respectively; MC: β=0.27, $p<0.001$ and β=0.16, $p<0.01$ respectively), which is in line with the hypothesized relationships in the RISP model.

Current Knowledge

Results show that the more negatively respondents in both samples feel (negative affective response) toward the industrial risks, the less knowledge they feel they possess about the risks (NL: β=-0.30, $p<0.001$; MC: β=-0.30, $p<0.001$). Among Dutch residents, the felt pressure to be informed about the issue (i.e., informational subjective norms) does not affect their perceived current knowledge base (β=0.09, n.s.). Milwaukee County respondents, however, feel that when relevant others think they should stay on top of information about industrial risks, they report themselves to be more knowledgeable (β=0.30, $p<0.001$).

Affective Responses

Institutional trust and risk perception appear to influence affective responses in both samples. Holding less trust in managing agencies appears to lead people in both samples to have stronger negative feelings towards the industrial risks (NL: β=-0.24, p<0.001; MC: β=-0.18, p<0.01). Furthermore, higher perceived risk seems to strengthen negative affect (NL: β=0.44, p<0.001; MC: β=0.39, p<0.001). These findings are in line with the RISP model.

Perceived Information Gathering Capacity

In this study, we proposed adding to the original RISP model a direct link between current knowledge and perceived information gathering capacity. As table 3.3 shows, this link appears to be quite present in both samples (NL: β=0.27, p<0.001; MC: β=0.46, p<0.001). Thus, it seems that past experience with relevant information and the subsequent higher knowledge base might enhance one's perceived ability to get and make sense of risk information in the future. Of course, it is possible that the relationship may work in reverse: higher capacity may have already allowed individuals to have gained their current knowledge about the risk.

Table 3.3. Path weights for Figure 1

Dependent variable:	*Predictor variable:*	Netherlands (N=171)	Milwaukee County (N=296)
Information seeking[a]	Current knowledge	0.31***	-0.01 n.s.
	Sufficiency threshold	0.29***	0.19***
	Information gathering capacity	0.17*	0.14*
	Informational subjective norms	0.10 n.s.	0.38***
	Affective responses	0.37***	0.19***
Sufficiency threshold	Current knowledge	-0.04 n.s.	-0.11 n.s.
	Affective responses	0.16*	0.27***
	Informational subjective norms	0.32***	0.16**
Current knowledge	Informational subjective norms	0.09 n.s.	0.30***
	Affective responses	-0.30***	-0.30***
Affective responses	Risk perception	0.44***	0.39***
	Institutional trust	-0.24***	-0.18**
Info gathering capacity	Current knowledge	0.27***	0.46***
	R^2 Information seeking	*0.38*	*0.29*

Note: Standardized regression coefficients (β).
Significance levels: *p≤ 0.05; **p≤0.01; ***p≤0.001.
[a] Since gender differences were significant across samples, a separate regression analysis was performed in which was controlled for gender. Gender did not predict to information seeking in both samples (NL: β=.05, n.s., ΔR^2=.007, n.s.; MC: β=.08, n.s., ΔR^2=.006, n.s.).

3.4.3. Model Fit

Independent Samples Comparison

The second research question focused on the cross-validation of the hypothesized model across the Milwaukee County and Dutch samples. The path model was tested using maximum likelihood estimation. The results are shown in Table 3.4. First, model-fit statistics were evaluated for each sample separately to assure adequate model fit preceding cross-sample comparison. The results, shown in the upper half of Table IV, indicate a reasonable-to-good fit for both populations[6], which means that the model parameters could be tested simultaneously across the two samples (with corresponding increase in the number of moment estimates and degrees of freedom). A fit assessment is provided for the full model, which indicated good fit as well (χ^2 (24) =48.6, p<0.05; CFI=0.96; RMSEA=0.047).

Table 3.4. Model-fit statistics

	χ^2	Df	p	CFI	RMSEA	90% CI RMSEA
Independent samples:						
Netherlands	11.8.	12	n.s.	1.00	0.00	0.00-0.08
Milwaukee County	36.8	12	<0.05	0.94	0.08	0.05-0.11
Both samples:						
Unconstrained	48.6	24	<0.05	0.96	0.05	0.03-0.07
Equal loadings	94.5	37	<0.05	0.91	0.06	0.04-0.07
Model comparison:						
Equal loadings[a]	45.9	13	<0.05			

[a] Assuming unrestricted model to be correct.

Nested Model Comparisons

Amos examines every pair of models in which one model of the pair can be obtained by constraining the parameters of the other. For this pair of "nested" models, several statistics for comparing the two models are displayed at the bottom of Table 3.4. These statistics are useful in testing the null hypothesis that the more constrained model is correct under the assumption that the less constrained model is correct.[7]

The output shows that the equal loadings model can be obtained by constraining the unconstrained model. Under the hypothesis that the unconstrained model is correct, a test of the additional constraints of the equal loadings model can be based on the chi-square statistic change. A comparison of the two models gave $\Delta\chi^2$ (13) = 45.9, p<0.05, suggesting that the regression weights are not invariant across Dutch and Milwaukee County samples and structural equivalence has not been established.

3.5. Discussion

This study set out with the objective of providing empirical evidence that the RISP model is applicable to the context of industrial risks. To this end, we presented confirmative findings for both Milwaukee County and Dutch samples. The proposed model fit both datasets well, implying that the RISP model could be used in the context of industrial risks across different populations. Although channel beliefs were not included in this study, the overall amount of variance explained in risk information seeking behavior in this analysis was comparable to previous studies on the RISP model (see Griffin et al., 2004b).

Furthermore, we cross-validated the RISP model across two independent samples by performing multiple group analyses in structural equation modeling. This approach tested whether the groups met the assumption that they are equal by examining whether the path coefficients hypothesized in the model are invariant. Structural invariance across samples by constraining regression weights was not achieved, implying that the model, although fitting both datasets, is not absolutely robust across populations.

Although the overall patterns seem comparable, some differences appeared between samples. Milwaukeeans are more likely to seek risk information, report higher sufficiency thresholds and possess stronger negative emotions regarding industrial risks than the Dutch, while Dutch people, comparatively, put more trust in responsible agencies, think they know more about industrial risks and perceive being better capable of gathering and using risk information. Whereas current knowledge, information insufficiency (i.e., sufficiency threshold controlled for current knowledge), and affective responses are the main predictors of risk information seeking behavior in the Netherlands, information insufficiency, informational subjective norms, and affective responses are key in predicting directly to information seeking behavior in the Milwaukee County sample. Perceived information gathering capacity plays a lesser but nonetheless facilitative role in both samples. The role of informational subjective norms, in particular, seems to differ between samples. In the Netherlands, this felt social pressure to stay on top of information about industrial risks is indirectly related to information seeking through affecting the sufficiency threshold. For the Milwaukeeans, informational subjective norms appear to play a more key role by affecting current knowledge, sufficiency threshold, and information seeking.

Testing the RISP model internationally means testing across different cultures. Although not explored in this study, cultural backgrounds could be responsible for differences in how people think and feel about, and cope with, risks. In his overview of studies on cultural differences in people's work-related values, Hofstede (1983) found that the Netherlands and the United States are generally comparable on dimensions like individualism, power distance, and uncertainty avoidance. The countries differed on the masculinity index, i.e., the United States society is more masculine-oriented than the Dutch society. Masculinity refers to maximization of sex role divisions.

Furthermore, Inglehart et al. (2004) found that Americans put more faith and higher value on (confidence in) religion than do the Dutch people. These and other value differences might play a role in coping with industrial risks and could be valuable in future studies.

In the current study, we proposed some additional relationships to the original RISP model. Our data suggest that these modifications are plausible. First, current knowledge was directly associated with perceived information gathering capacity, as hypothesized. Second, as found previously, informational subjective norms were linked to information seeking behavior, although mainly as an indirect relationship in the Dutch sample. Finally, we found that emotional reactions are among the set of strongest predictors of individuals' risk information seeking behavior. As Griffin et al. (2006) state: "As with other potentially strong emotions, such as fear and worry, higher levels of anger, then, appear to produce more determined, more effortful information gathering on the part of individuals. But that effort does not take place in the absence of cognitive drivers. These and previous analyses using the RISP model indicate that cognitions and affect interact in complex but, occasionally, predictable ways to influence information gathering and processing" (p.27). Overall, the proposed modifications are justified in the context of this paper and are in line with previous findings on the RISP model.

Some limitations of the current study should be addressed. First, there were some differences in measurement strategies compared to past studies on the RISP model. Current knowledge and sufficiency threshold were captured by multiple Likert-type items, whereas in previous research these variables were typically assessed by self-reported ratings of current knowledge and amount of knowledge needed on scales from zero to hundred. Furthermore, perceived information gathering capacity was captured by one item, which is not ideal, rather than the six currently used in most other recent tests of the RISP model. This measurement difference might affect responses and in turn result in biased overall conclusions. Second, sample sizes were not equal across countries. In multiple group analyses, it has been suggested that sample sizes should be approximately equal. Although different in size, both samples could be qualified as "medium to large" (Kline, 2005). With larger sample sizes, even small differences or path coefficients have a tendency to be significant.

In general, the Model of Risk Information Seeking and Processing seems to be applicable to the context of industrial risks in different populations. We demonstrated that the proposed modifications to the original RISP model seem justified, at least as far as information seeking is concerned, and that risk information seeking behavior consists of both cognitively and emotionally based drivers. Future studies should focus on (1) whether the model should be similarly modified when predicting to information processing behaviors and (2) the role of possible additional variables in an effort to better understand what motivates people to seek and process information about industrial and other risks.

One upshot of the current study is that governmental and other purveyors of information

about community risks from industrial chemicals should (1) attend to what kinds of information people say they need in order to deal with the potential of these risks in their lives (information insufficiency), (2) make useful, understandable information is readily available to them, and (3) help the public feel confident about getting and using that information on their own (perceived information gathering capacity). Although the mechanisms might differ from population to population, informational subjective norms also seem to play a part in motivating information seeking. If individuals sense some social pressure to learn how to deal with these potential hazards (e.g., if they are reminded that they should be knowledgeable for the sake of helping family in case of emergency), or otherwise feel that being knowledgeable about a risk is part of their social role, they may be more likely to seek the risk information they need. This motivation seems to prompt information seeking, directly or indirectly, quite apart from any negative emotional response (e.g., worry or anger) people might have toward the potential hazard. Although more research is needed, this result suggests that there may be ways of encouraging people to get information about risks without unnecessarily raising their fears.

Notes

[1] Tests of the RISP model to date, however, have examined direct relationships, not any interactions, between these three predictors and individuals' seeking and processing of information about risk.

[2] Keeping the United States sample local instead of national was also intended to help response rate.

[3] Testing invariance is important because the path structure of a model may have a similar pattern when tested within each of two or more groups, but there is no guarantee that the model operates equivalently across these groups (Byrne, 2001). If the unconstrained model fits significantly better than does the constrained model, the hypothesis of invariance is rejected (Kline, 2005).

[4] Previous analyses on the RISP model are typically conducted by hierarchical regression analysis. In this study, model-fit was analyzed by structural equation modeling, which enables us to cross-validate the RISP model across two independent samples and testing whether path coefficients are invariant. A common approach in estimating information insufficiency is regressing the sufficiency threshold scores on current knowledge scores (Griffin et al., 2006). The regression approach to difference scores therefore requires using current knowledge as a covariate in any analysis in which sufficiency is correlated with other variables.

[5]Although self-efficacy is among the set of perceived hazard characteristics in the RISP model, this study focuses on risk perception and trust as the hazard characteristics of interest. However, self-efficacy was part of our survey, but inclusion of the variable in the model resulted in a significant

decrease in model fit (χ^2=130.7; CFI=.87), due to some non-included relationships between self-efficacy and some other variables in the model (information sufficiency and perceived information gathering capacity). These associations are not proposed by RISP. Therefore, self-efficacy was excluded from the analysis. Although not all studies on the RISP model include self-efficacy (see e.g., Kahlor, 2007; Kahlor et al., 2006), it has been found to be associated with affective responses in previous studies on the RISP model (see e.g., Griffin et al., 2006). Future research is therefore warranted to explore the explicit relationship between self-efficacy and information sufficiency. One could hypothesize that a sense of being able to control the situation makes a person feel that the amount of knowledge held is sufficient for daily life purposes, which in turn, decreases the need for additional information.

[6]Model-data fit was evaluated based on multiple fit indexes. The use of chi-square statistics permits the assessment of fit of a specific model as well as comparison with a default model. It assesses discrepancy between the estimated model-implied population covariance matrix and the sample data covariance matrix (Kelloway, 1998; Bollen, 1989; Joreskog, 1993). Although a non-significant χ^2 is preferable (Hinkin, 1998), the significance level of the χ^2 is affected by sample size and non-significant test statistics with large samples are unlikely (Kline, 2005; Byrne, 2001). We use the Comparative Fit Index (CFI) to evaluate model fit, since Bentler (1990) suggests this to be the fit index of choice, as it takes into account sample sizes. Typically, for this fit index, values greater than 0.90 and 0.95 are taken to reflect acceptable and excellent fit to the data respectively. Hu and Bentler (1999) recommend a cut-off-value close to 0.95 for these fit indices. Finally, the Root Mean Square Error of Approximation (RMSEA) is evaluated. The RMSEA has recently been recognized as one of the most informative criteria in covariance structure modeling since it takes into account the error of approximation in the population and measures how well the model would fit the population covariance matrix if it were available. It is based on the analysis of residuals and compensates for the effects of model complexity. Values less than 0.05 indicate good fit and values as high as 0.08 represent reasonable errors of approximation in the population (Browne & Cudeck, 1993).

[7]Although only coefficients for the direct effects were constrained in this study; it is theoretically possible to impose additional constraints on other parameters, like disturbance variances and the variances of exogenous variables (Kline, 2005). Unless specific hypotheses demand otherwise, it is usually only the coefficients for the direct effects that are constrained to be equal across the groups in multiple-sample path analysis.

References

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, 50, pp. 179-211.

Bandura, A. (1986). Social Foundations of Thought and Action: A Social Cognitive Theory. *Englewood Cliffs, NJ: Prentice-Hall.*

Bandura, A. (2000). Exercise of Human Agency Through Collective Efficacy. *Current Directions in Psychological Science*, 9(3), pp. 75-78.

Bentler, P.M. (1990). Comparative Fit Indexes in Structural Models. *Psychological Bulletin*, 107, pp. 238-246.

Ben-Zur, H. (2002). Monitoring/Blunting and Social Support: Associations with Coping and Affect. *International Journal of Stress Management*, 9(4), pp. 357-373.

Browne, M.W. & Cudeck, R. (1993). Alternative Ways of Assessing Model Fit. In K.A. Bollen & J.S. Long (Eds.). T*esting Structural Equation Models* (pp.445-55). Newbury Park, CA: Sage.

Bollen, K.A. (1989). Structural equations with latent variables. *New York, Chichester: Wiley.*

Byrne, B.M. (2001). Structural Equation Modeling with Amos: Basic Concepts, Applications, and Programming. *Mahwah, N.J.: Erlbaum.*

Currall, S.C. & Epstein, M.J. (2003). The Fragility of Organizational Trust: Lessons from the Rise and Fall of Enron. *Organizational Dynamics*, 32, pp.193-206.

Eagly, A. H., & Chaiken, S. (1993). *The Psychology of Attitudes.* Harcourt Brace, San Diego.

Earle, T. C., & Cvetkovich, G. (1995). *Social Trust: Toward a Cosmopolitan Society.* Westport, CT: Praeger.

Gregory, J., & Miller, S. (1998). *Science in Public: Communication, Culture, and Credibility.* New York: Plenum.

Griffin, R. J., Dunwoody, S., & Neuwirth, K. (1999). Proposed Model of the Relationship of Information Seeking and Processing to the Development of Preventive Behaviors. *Environmental Research,* 80, pp. S230-45.

Griffin, R.J., Neuwirth, K., Dunwoody, S., & Giese, J. (2004a). Information Sufficiency and Risk Communication. *Media Psychology,* 6, pp. 23-61.

Griffin, R. J., Powell, M., Dunwoody, S., Neuwirth, K., Clark, D., & Novotny V. (2004b). Testing the robustness of a risk information processing model. Paper presented to the 2004 Annual Convention of the *Association for Education in Journalism and MassCommunication,* Toronto, Ontario.

Griffin, R. J., Yang, Z., Boerner, F., Bourassa, S., Darrah, T., Knurek, S., Ortiz, S., & Dunwoody, S. (2005, August). Applying an Information Seeking and Processing Model to a Study of Communication about Energy. *Paper presented to the Association for Education in Journalism and Mass Communication annual convention, San Antonio, TX.*

Griffin, R.J., Yang, J., Huurne, E. ter, Boerner, F., Ortiz, S. & Dunwoody, S. (2006). After the Flood: Anger,

Attribution, and the Seeking of Information. *Paper presented to the Association for Education in Journalism and Mass Communication annual convention,* San Francisco, CA.

Hinkin, T.R. (1998). A Brief Tutorial on the Development of Measures for Use in Survey Questionnaires. *Organizational Research Methods,* 1(1), pp. 104-21.

Hofstede, G. (1983). The Cultural Relativity of Organizational Practices and Theories. *Journal of International Business Studies,* 14(2), pp. 75-89.

Hu, L.-T. & Bentler, P.M. (1999). Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria versus New Alternatives. *Structural Equation Modeling: A Multidisciplinary Journal,* 6, pp. 1-55.

Huurne, E.F.J. ter & Gutteling, J.M. (in press). Information Needs and Risk Perception as Predictors of Risk Information Seeking. *Journal of Risk Research.*

Huurne, E.F.J. ter & Gutteling, J.M. (2006, September). Risks from Hazardous Industrial Substances: What Motivates People to Seek Information? A Pilot Study in the Netherlands. Paper presented at the Society for Risk Analysis – Europe Annual Conference, Ljubljana, Slovenia.

Inglehart, R., Basanez, M., Diez-Medrano, J., Halman, L., & Luijkx, R. (2004). *Human Beliefs and Values. A Cross-Cultural Sourcebook on the 1999-2002 values survey.* Siglo XXI Editores, S.A. de C.V.

Johnson, B.B. (2005). Testing and Expanding a Model of Cognitive Processing of Risk Information. *Risk Analysis,* 25(3), pp. 631-650.

Joreskog, K. G. (1993). Testing Structural Equation Models. In K. A. Bollen & J. S. Long (Eds.), Testing Structural Equation Models. *Newbury Park,* CA: Sage.

Kahlor, L.A. (2007). An Augmented Risk Information Seeking Model: The Case of Global Warming. *Media Psychology,* 10, pp. 414-435.

Kahlor, L.A., Dunwoody, S., Griffin, R.J., and Neuwirth, K. (2006). Seeking and Processing Information about Impersonal Risk. *Science Communication,* 28(2), pp. 163-194.

Kelloway, E.K. (1998). Using LISREL for Structural Equation Modeling: A Researcher's Guide. *Newbury Park, CA: Sage.*

Kline, R.B. (2005). Principles and Practice of Structural Equation Modeling. Second edition. G*uilford Press: New York.*

Loewenstein, G.F., Weber, E.U., Hsee, C.K., & Welch, N. (2001). Risk as Feelings. *Psychological Bulletin, 127(2), pp. 267-286.*

McComas, K.A. (2006). Defining Moments in Risk Communication Research: 1996-2005. *Journal of Health Communication,* 11, pp. 75-91.

Miller, S.M. (1987). Monitoring and Blunting: Validation of a Questionnaire to Assess Styles of Information Seeking under Threat. *Journal of Personality and Social Psychology,* 52(2), pp. 345-353.

Neuwirth, K. & Frederick, E. (2004). Peer and Social Influence on Opinion Expression: Combining the Theories

of Planned Behavior and the Spiral of Silence. *Communication Research,* 31(6), pp. 669-703.

Poortinga, W. & Pidgeon, N. (2003). Exploring the Dimensionality of Trust in Risk Regulation. *Risk Analysis*, 23(5), pp. 961-972.

Radecki, J.M., & Jaccard, C. (1995). Perceptions of Knowledge, Actual Knowledge and Information Search Behavior. *Journal of Experimental Social Psychology,* 31, pp. 107-38.

Siegrist, M., Cvetkovich, G., & Roth, C. (2000). Salient Value Similarity, Social Trust, and Risk/Benefit Perception. *Risk Analysis,* 20(3), pp. 353-62.

Slovic, P. (1987). Perception of Risk. *Science,* 236(4799), pp. 280-85.

Slovic, P. (1999). Trust, Emotion, Sex, Politics, and Science: Surveying the Risk-Assessment Battlefield. *Risk Analysis,* 19(4), pp. 689-701.

Slovic, P., Finucane, M.L., Peters, E., & MacGregor, D.G. (2004). Risk as Analysis and Risk as Feelings: Some Thoughts about Affect, Reason, Risk, and Rationality. *Risk Analysis,* 24(2), pp. 311-322.

Tichenor, P.J., Donohue, G.A., & Olien, C.N. (1970). Mass Media Flow and Differential Growth in Knowledge. T*he Public Opinion Quarterly,* 34(2), pp. 159-170.

Trumbo, C.W. (2002). Information Processing and Risk Perception: An Adaptation of the Heuristic-Systematic Model. *Journal of Communication,* 52(2), pp. 367-382.

4

To know or not to know? A framework of risk information seeking in the sphere of industrial risks

(submitted)

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4.1. Abstract

This study looks at predictors of the information-seeking or avoidance strategies people employ regarding risks from hazardous industrial substances. Specifically, this article proposes and tests a framework of risk information seeking by integrating additional variables and relationships to the risk information seeking and processing model (RISP). The resulting framework is tested based on survey data (N=466). Results indicate that, next to cognitive information needs, affective and social factors are just as important predictors of the risk information seeking strategy that people employ. Of equal importance, a certain level of interest or involvement in the topic is found to play a key role in public responses to risk information.

4.2. Introduction

Mass-media campaigns regarding external (off-site) safety risks (i.e., the risks that come with the use, storage, and transportation of hazardous industrial substances) frequently combine messages highlighting possible threats or potential outcomes with the promotion of recommended protective action or preventive behaviors. The way people respond to risk messages in the mass media and other information channels contribute to the adoption of risk-related behaviors in the long run (Kahlor et al., 2003; Kahlor, 2007). For example, a risk campaign aimed at motivating the audience to seek relevant risk information (e.g., regarding external safety hazards in their neighborhood) is more likely to establish long-term effects which continue beyond the campaign itself (Turner et al., 2006).

Given the complexity of most external safety issues and competing risks, it may be advantageous for people to seek additional information in order to gain an in-depth understanding of the topic, by utilizing, for example, the Internet. Such modern communication media create opportunities for both risk communication practitioners and the public. Governments and other purveyors of risk information could make risk information permanently available and accessible to the public on the Internet. Similarly, the public could obtain and seek personally relevant risk information whenever perceived necessary or desired. A mass-media campaign aimed at stimulating people to actually go out of their way to seek and use the information provided could be an effective effort to promote self-protective behavior in regards to external safety risks. As risk information seeking has not been seen as important self-protective risk behavior until recently, little is known about the effects of such communication efforts and how the audience could be stimulated to actually use various information channels such as the Internet to gain personally relevant risk information. Moreover, little is known about what makes people avoid or reject such information. This study therefore focuses on examining the antecedents of risk information seeking and avoidance regarding external safety issues.

4.2.1. Seeking and Avoiding Risk Information

Individuals facing a threatening situation or a situation of risk could differ in how they respond to information regarding it. One person might feel he or she needs more information and will go out of his or her way to actively seek additional information through different sources, whereas others try to avoid such information and distract themselves from the risk (information) at stake (see for example Miller, 1987; Myers & Derakshan, 2000). Many studies on information behavior, however, assume that individuals are motivated to seek, or at least pay attention to, various sources of information. Consequently, most communication researchers simply do not consider the possibility that people do not want information (Case et al., 2005), which makes information avoidance a relatively understudied phenomenon in communication research in general, as well as specifically within the risk communication literature (Kahlor et al., 2006).

People seek information for different reasons. Information could reduce feelings of uncertainty towards the issue at stake (Case et al., 2005; Atkin, 1973; Berger & Calabrese, 1975), help people perform in their daily (social) lives (Radecki & Jaccard, 1995; Atkin, 1972; Johnson, 1987; Wilson, 1999; Neuwirth & Frederick, 2004), or satisfy a need for information (i.e., fill a perceived gap between the amount of knowledge held and that which is needed) (Belkin, 1980; Kuhlthau, 1991; Chaiken et al., 1989; Griffin et al., 1999).

According to some scholars, information avoidance is conceptually distinct from information seeking (Case et al., 2005; Kahlor et al., 2006). Research indicates that people may avoid information when the topic is distressing (Brashers et al., 2000). Lion, Meertens, & Bot (2002) found that avoidance was triggered by self-protection. Not knowing about the risks enables people to retain the idea of the world around them being a safe place to live. Feeling incapable of making adequate decisions and the fear of getting more confused by additional information are other reasons for not wanting risk information. The extended parallel process model (EPPM; Witte 1992, 1994) describes that high levels of fear can produce risk information avoidance if coupled with a sense of inefficacy when dealing with the hazard. Whereas information obtainment is primarily been thought of as reducing uncertainty, it could also increase uncertainty (Case et al., 2005). In such a case, people may be scared of the possible content or outcomes of (risk) information, like learning that a topic is far more threatening or difficult to control than a person already suspects, and therefore decides to reject such information.

4.2.2. The Risk Information Seeking and Processing Model

The last decade saw changing views on public responses to risks, which have triggered a new era with risk communication research that have focused on a broader understanding of the psychological and social influences on risk communication, moving beyond the narrow perspective of risk communication as persuasion (Leiss, 1996). As a consequence, a number of scholars have begun to explore potential social and psychological processes that have an effect on the audience's risk information seeking strategy and have attempted to model these processes.

One of the resulting frameworks is the model of risk information seeking and processing (RISP; Griffin et al., 1999), which proposes various characteristics of individuals that might predispose them to seek and process information in various risk settings. Based primarily on parts of the heuristic systematic model (HSM; Eagly & Chaiken, 1993) and the theory of planned behavior (TPB; Ajzen, 1991), RISP states that information sufficiency, relevant channel beliefs[1], and perceived information gathering capacity together with indirect predictors such as affective responses, informational subjective norms, and perceived hazard characteristics will affect the extent to which people are motivated to seek or avoid risk information (see Figure 4.1).

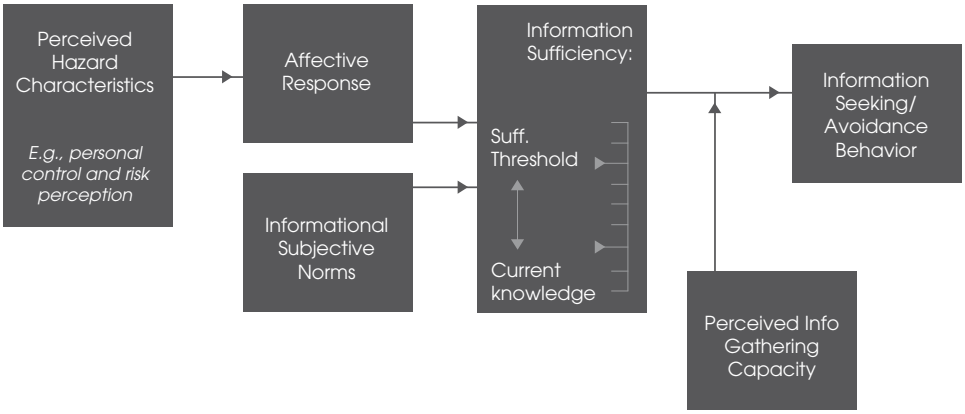

Figure 4.1. Excerpt from the Model of Risk Information Seeking and Processing

The model has been applied to various risk settings, including environmental and health risks (see for example Griffin et al., 2004; Griffin et al., 2006; Kahlor et al., 2006; Kahlor, 2007; Johnson, 2005; Kahlor et al., 2003). Empirical studies found promising results for the future use of RISP. Over the course of time, however, some variations and additional relationships have been proposed in an effort to better account for the variance in the audience's risk information behavior. As a result, scholars have tested expanded and augmented versions of the original RISP and the underlying HSM in an effort to further develop the Griffin et al. framework. For example, Johnson (2005) and Trumbo (1999) have tested alternative models integrating a motivational concept in terms of the perceived importance of the situation to the self, adapted from the HSM and the elaboration likelihood model (ELM; Petty & Cacioppo, 1981, 1986). Furthermore, in a recent study, Kahlor (2007) has employed all of the TPB's concepts alongside concepts originally depicted in the RISP model. Other progress has been made by Huurne, ter & Griffin (2007), who included more recent theories such as the affect heuristic (Slovic et al., 2004) and the risk-as-feelings hypothesis (Loewenstein et al., 2001). This includes a direct association between affective responses and the seeking of risk information. To date, no study has combined all of these past efforts on variations of the original model of risk information seeking and processing. This study, therefore, proposes a framework of risk information seeking (and avoidance) by merging the recent progress made regarding risk-related information behavior applied to risks from hazardous industrial substances.

4.2.3. Cognitive, Affective, and Social Antecedents of Risk Information Seeking and Avoidance

Information Sufficiency

Central to the RISP model is the concept of information (in)sufficiency, representing an individual's sense of a discrepancy between the amount of knowledge held and that needed to deal with a given risk (Griffin et al., 1999). The model suggests that individuals have differing levels of the amount of information they believe they need in order to feel confident in coping with a given risk in their lives. A sense of information insufficiency is therefore proposed as a direct cognitive drive to seek information. The sufficiency principle finds its roots in the HSM (Eagly & Chaiken, 1993) and, according to Griffin et al. (1999), more effortful seeking will be motivated when the sufficiency threshold is higher than the knowledge base a person feels he or she currently possesses. In other words, people are persuaded into putting more effort into reaching information sufficiency (e.g., by seeking information across different channels) when they sense a greater amount of insufficiency (e.g., when they perceive that the amount of information they currently have is not enough for them to deal with the risk).

Perceived Information Gathering Capacity

The decision to seek or avoid additional information is viewed as being dependent on one's ability to learn more about the risk, based on the HSM's concept of capacity. Griffin et al. (2006) explain that as information seeking and avoidance are essentially communication behaviors, one's sense of self-efficacy (Bandura, 1986) in performing them are important to incorporate. This concept, originally rooted in the TPB as a perceived behavioral control (Ajzen, 1991), captures the perceived controllability of the behavior. This variable is referred to as perceived information gathering capacity in RISP, which reflects one's perceived ability to perform the information seeking steps necessary for the desired outcome, especially in cases of active non-routine gathering of information through various information channels (Griffin et al., 2006).

Affective Responses

The RISP model proposes that affective responses such as worry, anxiety, or anger could influence a person's sense of information sufficiency about the risk and subsequently his or her decision to seek (or avoid) additional risk information. The impact of affective dimensions along with cognitive evaluations is among the most distinctive features of modern risk research (McComas, 2006). It is now widely acknowledged that people respond to the prospect of risk at two levels: they evaluate the risk cognitively and react to it emotionally (Loewenstein et al., 2001). For example, in their risk-as-feelings hypothesis, Loewenstein and colleagues (2001) state that people could respond to risks based on direct emotional responses, even without any intervening cognitive evaluations of the risk. Slovic and colleagues (2004) have termed this reliance on feelings the "affect heuristic". They posit a similar idea by explaining that individuals' risk judgments are not only based on what they know about risks ('analytical system'), but also on what they feel about risks ('experiential system').

Whereas RISP assumes that affective responses toward risks indirectly affect the information seeking strategy people apply by influencing the perceived amount of information sufficiency, the findings of various studies indicate that, next to cognition, affect directly predicts to a person's information seeking and avoiding behavior. Researchers have found indications that cognition and affect could operate in a parallel when predicting risk information seeking, therefore supporting the aforementioned new perspectives on risk responses and risk-related behavior. For example, in a study on external safety risks, Huurne, ter & Griffin (2007) found that emotional responses, such as worry and anxiety, were among the strongest predictors of the intentions to seek additional information. Turner et al. (2006) studied the effect of anxiety and its relation to information seeking and found that when people experience more anxiety, they were more motivated to seek additional information. Griffin et al. (2006) described similar findings regarding feelings of anger, which also were found to drive the seeking of information in a direct way. In other words, emotional responses are not just the triggers for the cognitive evaluation of information shortcomings (information insufficiency); they could also operate independently and directly affect risk information behavior, which is consistent with the risk-as-feelings hypothesis and the affect heuristic.

Informational Subjective Norms

Risk responses and risk-related information behavior are not purely individually based. As Kasperson (1986) states: "Learning about risk occurs not in isolated individuals but in a social dynamic, with multiple sources of information, channels of information flow, confirmatory and challenging mechanisms, and linkage with other social issues" (p. 131). Individuals faced with risky situations are inclined to base their decisions on which behavior to pursue by first considering what other people do. Possible reactions of family, friends, and others are seen as great influencers of these decisions (Neuwirth & Frederick, 2004). The individual's social environment may increase the desire to gain knowledge by seeking information (Radecki & Jaccard, 1995), as people are motivated to seek information when it is perceived as useful in their social relationships. People compare their abilities with other's abilities and desire social approval and liking (Eagly & Chaiken, 1993). The theory of planned behavior (Ajzen, 1991) holds that an individual's decision about what behavior to pursue is, among others, dependent on the perceived subjective norms (i.e., their beliefs about how significant others will view the behavior at stake). The RISP model incorporates this social pressure, calling this variable 'informational subjective norms', referring to one's perception of whether relevant others would expect us to be knowledgeable about the topic.

In its original conceptualization, RISP proposes that informational subjective norms might affect information sufficiency and therefore indirectly predict one's motivation to seek or reject additional information. The TPB, however, would imply that subjective norms resulting from one's normative beliefs directly affect a person's behavioral intentions (Ajzen, 2002). Support for this direct relationship between informational subjective norms and information seeking has been strong, especially in cases in which risks that do not pose direct personal threats to most people,

such as global warming and external safety risks (Kahlor et al., 2006; Huurne, ter & Griffin, 2007; Kahlor, 2007; Griffin et al., 2006). These results indicate that, especially in cases where it concerns more impersonal risks, the social environment and perceived social norms are likely to be direct motivators of gaining additional information. In such cases, how informed others expect us to be might be a powerful motivator for people to gather additional risk information.

4.2.4. Indirect Predictors: Perceived Hazard Characteristics

The RISP model also features a block of perceived hazard characteristics as precursors of risk information seeking and avoidance. According to Griffin et al. (1999), affective responses result from perceived hazard characteristics, such as risk perceptions and perceived personal control over the risk. Here we also investigated whether issue-involvement plays a role in how people respond to risk. Furthermore, the current model tests whether the perceived hazard characteristics under study merit their own place within the model (see Huurne, ter & Gutteling, forthcoming), as opposed to approaching them as a block of characteristics, as originally proposed by RISP.

Risk Perception

Perceptions of risk play a prominent role in developing risk communication in the sense that differences in risk perception lie at the heart of disagreements between technical experts and members of the general public regarding the best course of action (Slovic, 1987). Information about risks could affect how people judge and respond to risks (Gutteling & Wiegman, 1992). People tend to judge risks according to their perception of the hazard based on an availability heuristic (Slovic et al., 1981), mostly in absence of objective statistics. Therefore, risk perception includes subjective judgments of likelihood of harm to self, others, or the environment based on a given hazard, and is combined with the perception of the severity of possible outcomes (Griffin et al., 2006).

Self-Efficacy

Personal control has been referred to as self-efficacy (Bandura, 2000) or perceived behavioral control (Ajzen, 1991), and is an important predictor of behavioral intentions in the theory of planned behavior (Ajzen, 1991) and social cognitive theory (Bandura, 1986). According to RISP, perceived personal control concerns one's own sense of power in dealing with the risk and protecting the self, others, or the environment from possible harm. A lack of personal control or not knowing what behavior to pursue in order to deal adequately with the risk could lead people to perceptions of low self-efficacy, making them feel helpless or anxious and therefore influence one's affective responses toward the issue. In addition, feelings of lacking personal control could lead to widening the gap between the amount of information held and that which is needed. The latter was found by Huurne, ter & Griffin (2007). Although not proposed by RISP, one could hypothesize that senses of not being able to control the situation makes a person feel that the amount of knowledge held is insufficient for daily life purposes, and vice versa. In other words, lower levels of perceived personal control could lead to stronger affective responses (e.g., more anxiety) and higher needs for additional information (i.e., lower levels of information sufficiency).

Involvement

Although the RISP model does not incorporate variables such as involvement or personal importance, these could be valuable in this context as well. Most studies on information use employ some measure of involvement or issue salience. Involvement is a key variable in the elaboration likelihood model (Petty & Cacioppo, 1981; 1986) and situational theory (Grunig, 1989), and refers to the extent to which an individual is willing and able to 'think' about the position advocated and its supporting materials, thus representing the personal importance, interest, and significance of the risk topic to the individual (Johnson, 2005). When individuals face a situation of uncertainty (risk) they evaluate whether their self or altruistic interests are affected, which leads to problem recognition (Heath, Liao, & Douglas, 1995). Without this problem awareness, people do not experience sufficient involvement or motivation to seek information (Heath, Liao, & Douglas, 1995; Petty & Cacioppo, 1981; 1984; Ajzen & Sexton, 1999).

Although research has shown that involvement is positively associated with individuals' willingness to gather information (Nathan, Heath, & Douglas, 1992 Johnson, 2005; Kahlor et al., 2003; Huurne, ter & Gutteling, forthcoming), the relationship between involvement and subsequent information-seeking behavior is still rather exploratory. Nathan, Heath, & Douglas (1992) suggest that people try to reduce feelings of anxiety when they are involved in uncertain or risky situations. A certain degree of involvement or interest in the topic (e.g., when a risk becomes personally relevant to the individual) could therefore motivate people to actively seek additional information, mediated by feelings of, for example, anxiety. These ideas are supported by Huurne, ter & Gutteling (forthcoming), who found that higher levels of involvement increased the need for additional information (i.e., information insufficiency) as well as affective responses (i.e., feelings of worry and anxiety, for example), and therefore indirectly motivate people to seek or avoid additional information.

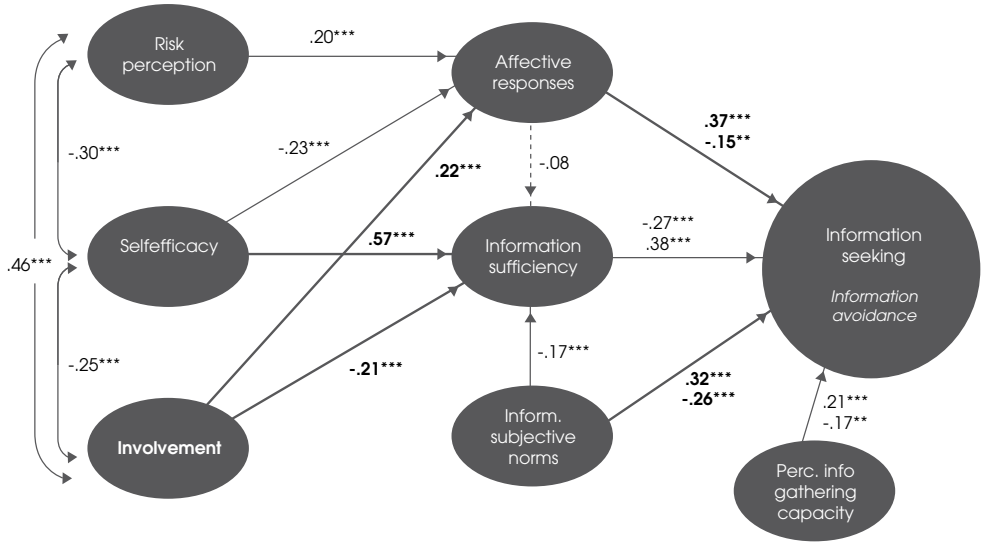

Figure 4.2. Path weights of the framework of risk information seeking (and avoidance)

Notes: N=466. Standardized regression coefficients (β) are on single-headed arrows; correlations are on double-headed arrows. Significance levels: $**p<0.01$; $***p<0.001$. Concept, arrows and regression coefficients in bold represent additions to original RISP model. Dashed lines are non-significant paths. Regression coefficients in italics predict to information avoidance.

4.3. The proposed Framework of Risk Information Seeking

Merging the findings of the above described studies and theories may extend our understanding of cognitive, affective, and social information needs and their impact on the risk-related information strategy that people employ. This study draws on the theoretical assumptions described above, and therefore proposes a number of variables that may predict the individual's risk information seeking and avoidance strategies. Proposed relationships and corresponding hypotheses are depicted in Figure 4.2. More specifically, our research questions and hypotheses are:

RQ1: What are the relationships between risk information seeking and avoidance and the direct predictors from the model?

Following the relationships proposed in the original RISP model, it is expected that:

- Information sufficiency will be negatively associated with information seeking (H1a) and positively associated with information avoidance (H1b).
- Perceived information-gathering capacity will be positively associated with information seeking (H2a) and negatively associated with information avoidance (H2b).

In addition, the following relationships are hypothesized:

- Affective responses will be positively associated with information seeking (H3a) and negatively associated with information avoidance (H3b).

- Informational subjective norms will be positively associated with information seeking (H4a) and negatively associated with information avoidance (H4b).

RQ2: What are the relationships between the precursor variables in the model?

Following the relationships proposed in the original RISP model, it is expected that:

- Risk perception will be positively associated with affective responses (H5).
- Self-efficacy will be negatively associated with affective responses (H6).
- Affective responses will be negatively associated with information sufficiency (H7).
- Informational subjective norms will be negatively associated with information sufficiency (H8).

In addition, the following relationships are hypothesized:

- Self-efficacy will be positively associated with information sufficiency (H9).
- Involvement will be positively associated with affective responses (H10a) and negatively associated with information sufficiency (H10b).

4.4. Method

4.4.1. Design and Procedure

Data were collected through a nation-wide survey in the Netherlands in spring 2007. A random sample of the adult Dutch population (N=1960) administered by a profit database company was asked by mail to participate in the study. Selected people received a letter explaining the topic of the study and the link to the study's website on which the questionnaire was located. Those unwilling or unable to participate online could return a postage-paid reply card and received a paper-and-pencil questionnaire.

4.4.2. Sample and Respondents

In total, 466 people responded to the questionnaire (response rate=24%). More males (58%) than females (42%) participated in the study ($\chi^2(1)=10.32$, $p<0.05$). Respondents ranged in age from 18 to 93 years with a mean age of 49 years (SD=17.64). Of the subjects, 25% reported a lower educational level, 32% an intermediate, and 43% indicated being highly educated. A minor portion of the participants had experienced an incident with dangerous goods in their environment (20%), personal harm or property loss (7%), or knew someone who had suffered personal harm or property loss (16%) due to dangerous substances.

4.4.3. Measures

Measures used to assess the relevant concepts in this study were based on several previous studies (see for example Huurne, ter & Gutteling, forthcoming; Huurne, ter & Griffin, 2007). The items were tested for legibility and internal consistency (Cronbach's α). Respondents were asked to indicate their level of agreement to statements assessed by Likert-type scales ranging from 1 (*not at all*) to 5 (*completely or very much*).

Risk Information Behavior

Respondents were asked to indicate the extent to which they agreed with eight statements about their responses to risk information regarding external safety hazards in their neighborhood (Table 4.1). To help validate the conceptual distinction between information seeking and avoidance, items were subjected to a factor analysis. Results confirmed the two distinct attentional styles reflecting information seeking (α=0.81) versus those that involve avoidance (α=0.81).

Table 4.1. Risk Information Behavior Factor Analysis

I search for as much information as possible.	**.77**	-.35
I look for information about what I would have to do in case an accident happens in my surroundings.	**.83**	-.26
I will keep an eye on the hazards in my surroundings, to see whether something happens that could be dangerous.	**.75**	-.13
If a chemical accident happens in the Netherlands, I am likely to search for information.	**.73**	-.17
I try to think of something else.	.01	**.84**
I barely pay attention and continue with what I was doing.	-.36	**.74**
I will do something else.	-.33	**.78**
I say to myself: "These risks are not that serious."	-.29	**.72**
Variance Explained	*34%*	*31%*

N=466. Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Information Sufficiency

Information sufficiency is held to the original conceptualization of Eagly & Chaiken's (1993), i.e., that the extent to which the individual feels that the information of the risk topic is needed has been satisfied. The result is a four-item scale in which respondents were asked to indicate their extent of satisfaction with the amount of knowledge held, how sufficient they felt their current knowledge level was, how content they were with the information base, and whether they felt that they knew enough about the topic to deal with the risks in their daily lives. These items formed a reliable scale (α=0.92).

Perceived Information Gathering Capacity

Perceived information gathering capacity was assessed by a reliable four-item scale (Σ=0.84) previously used in studies on the RISP model, which asked respondents to indicate whether they would know where to go for more information, how to separate fact from fiction, whether they could easily get information about the topic, and whether they perceived themselves as being able to make sense of and use information on the topic.

Affective Responses

Affective responses were measured by asking respondents to what extent they felt tense, anxious,

nervous, or angry while thinking of the possibility of being exposed to the risks of dangerous industrial chemicals in everyday life. The scale was highly reliable (α=0.93).

Social Norms

Social norms were assessed by two items (r=0.72, corresponding with an alpha coefficient of 0.83). The wordings for the items were: "People close to me think I should stay on top of information about the risks of hazardous substances in my neighborhood" and "I am expected to be knowledgeable about this topic".

Personal Control

To assess personal control, respondents were asked to indicate to what extent they thought they would be able to protect themselves against the possible consequences, react in the right way if an accident happened, and would be able to judge the risks they were exposed to regarding hazardous substances α=0.87).

Risk Perception

Risk perception was measured by three items (α=0.85). Respondents indicated how much risk they perceived was involved with the use, storage, and transportation of hazardous substances, how dangerous these activities are for people and the environment, and how likely an accident occurring with these substances would be.

Involvement

Level of involvement with the topic was measured by a reliable four-item scale (α=0.91), including statements about how interested respondents were in possible risks from hazardous substances in the neighborhood where they lived or worked, how important they felt it was to be knowledgeable about these risks in their neighborhood, how committed they felt with to the topic, and how important it was for them to have information regarding these risks in their neighborhood.

4.4.4. Analysis

Data were analyzed using AMOS 7. Latent variable structural equation modeling (SEM) with maximum likelihood estimation (Kline, 2005) was performed to test the hypothesized models of explaining risk-related information behavior.[2] Overall model fit was assessed by examining two absolute fit indices (χ^2 with its degrees of freedom and RMSEA) and two relative fit indices (TLI and CFI).[3]

4.5. Results

4.5.1. Descriptive Statistics

Table 4.2 presents the mean scores (M), standard deviations (SD), and Pearson correlation coefficients on the variables assessed in this study. All correlations between the variables assessed in this study were highly significant and in the predicted direction. All variables could therefore be included in further analyses. As shown in Table 4.2, information seeking and avoidance were negatively correlated (r=-0.57, p<0.001), implying that those with stronger intentions to seek additional information are less likely to avoid such information, and vice versa. As expected, the correlation signs between the predictor variables and information seeking are opposite those between the predictor variables and information avoidance.

4.5.2. Risk Information Seeking and Avoidance

The results from testing the validity of a causal structure of the hypothesized model depicted in Figure 4.2 show that the model fits the data well for explaining both risk information seeking ($\chi^2(332)=752$; CFI=0.95; TLI=0.94; RMSEA=0.05) and risk information avoidance ($\chi^2(332)=738$; CFI=0.95; TLI=0.94; RMSEA=0.05). Squared multiple correlations provide information about the variance accounted for by the complete set of predictor variables, showing that risk information-seeking behavior was explained for 40% and risk information avoidance was explained for 26%. The first research question concerned the association between the direct predictors of our model and the intentions to seek risk or avoid additional information regarding risks from hazardous industrial substances.

Table 4.2. Means, Standard Deviations, and Correlations

	1	2	3	4	5	6	7	8	9
1 Information seeking	1.00								
2 Information avoidance	-.57***	1.00							
3 Involvement	.57***	-.51***	1.00						
4 Risk perception		.32***	-.33***	.46***	1.00				
5 Affective responses	.46***	-.31***	.38***	.43***	1.00				
6 Information sufficiency	-.21***	.26***	-.19***	-.24***	-.36***	1.00			
7 Personal control		-.14**	.13**	-.12*	-.33***	-.34***	.64***	1.00	
8 Inform. Subj. norms	.33***	-.21***	.36***	.11*	.12*	-.18***	.19***	1.00	
9 Perc. info gath. capacity	.16***	-.10**	.16***	-.14**	-.16***	.35***	.45***	.32***	1.00
M1	3.17	2.41	3.40	3.32	2.67	2.86	2.51	2.55	2.96
SD	87	.82	.93	.74	1.02	.96	.86	.92	.83

N=466. Pairwise deletion of missing data. Significance levels: *p 0.05; **p0.01; ***p0.001.
1Scales ranging from 1 to 5; higher scores indicate stronger agreement with the scales' items.

Risk Information Seeking

Risk information seeking is predicted by information sufficiency (β=-0.27, p<0.001, in support of H1a) and perceived information gathering capacity (β=0.21, p<0.001, in support of H2a). Thus, lower levels of information sufficiency and perceptions of being capable of getting and using information on the topic motivate people to search for additional information. This is in accordance with the RISP model. In addition, the newly added direct predictors (affective responses and informational subjective norms) were significant as well (β=0.37, p<0.001, in support of H3a, and β=0.32, p<0.001, in support of H4a, respectively). That is, those with stronger negative feelings towards the risk, and perceiving more social pressure to be knowledgeable about the risks are also more likely to actively try to gather information about risks from hazardous industrial substances.

Risk Information Avoidance

Standardized regression weights show that risk information avoidance was predicted by information sufficiency (β=0.38, p<0.001, in support of H1b) and perceived information gathering capacity (β=-0.17, p<0.01, in support of H2b) as originally depicted by the model. People who perceive themselves as less capable of getting and using information on the topic and feel more satisfied with the amount of information held are therefore more likely to avoid information regarding hazardous substances. Furthermore, affective responses (β=-0.15, p<0.01, in support of H3b) and informational subjective norms (β=-0.26, p<0.001, in support of H4b) predict to the rejection of risk information as well, implying that those having less negative feelings towards the topic and also lack senses of social pressure to be knowledgeable about the topic tend to avoid additional risk information.

4.5.3. Relationships Between Predictor Variables

The second research question concerned the relationships among predictor variables in the model. These variables accounted for 48% of the variance in information sufficiency and 23% of the variance in affective responses.

Information Sufficiency

Information sufficiency was predicted by informational subjective norms (β=-0.17, p<0.001, in support of H8), implying that those perceiving less pressure from relevant others to stay abreast of information regarding risks from hazardous industrial substances are more satisfied with the amount of information held. Affective responses, however, did not significantly affect information sufficiency. The newly added predictors of information sufficiency, personal control and involvement, were significantly associated with information sufficiency (β=0.57, p<0.001, in support of H9 and β=-0.21, p<0.001, in support of H10b). Thus, feeling more involved in the topic and feeling less capable of dealing with the risks lead to a stronger cognitive need for information (i.e., lower senses of information sufficiency).

Affective Responses

Affective responses were influenced by risk perception (β=0.20, p<0.001, in support of H5), self-efficacy (β=-0.23, p<0.001, in support of H6) and the newly added concept of involvement (β=0.20, p<0.001, in support of H10a). Thus, higher risk perceptions, lower senses of self-efficacy, and feeling more involved in the topic lead to stronger negative feelings towards risks from hazardous industrial substances.

4.6. Discussion

This study proposed and tested a framework of risk information seeking in an effort to understand what motivates people to actively engage in risk information seeking or alternatively, shunt away and avoid such information. In doing so, additional concepts and relationships from relevant theories were integrated into the original RISP model. Results confirm the validity of the proposed relationships. However, the study results must be viewed in the wake of certain limitations. First, the study is based on cross-sectional data, meaning that no firm conclusions regarding the causal effects can be made. Second, the ultimate dependent variable of the model reflects intended risk-related information behavior. As such, no hard conclusions can be drawn regarding actual behavior. Future research efforts should therefore focus on investigating whether actual behavior corresponds to the self-reported intentions assessed in this study.

The major finding of this study is that risk information behavior is not primarily dependent upon the perception of cognitive information needs (information insufficiency) and the individual's perceptions of being capable of gathering and using relevant risk information, as originally proposed by RISP. Affective responses as well as subjective norms are important factors as well, and tend to be even stronger predictors of individuals' risk-related information behavior. These relationships surfaced as highly significant and occurred in the predicted direction. Affective responses, however, were not significantly associated with information sufficiency, as proposed by RISP. It seems, at least in the context of external safety issues, that affective responses do not lead people to cognitively evaluate their knowledge gaps. Rather, they surfaced as a strong direct predictor of risk-related information behavior. This finding confirms the more recent perspectives on risk responses, such as the affect heuristic (Slovic et al., 2004) and the risk-as-feelings hypothesis (Loewenstein et al., 2001), which argue that people's responses to risks could arise directly from emotions.

Thus, stronger negative feelings towards the risk topic and the individual's perception of others' expectations regarding their knowledge of risks directly enhance one's motivation to seek additional information. Conversely, weaker emotions and lower perceived social pressure evoke avoidance of risk information. The latter implies that the lack of perceived salience or urgency of gaining additional knowledge makes people less interested and therefore leads them to reject risk information. It appears that people are less motivated to gather information unless they feel

that relevant others expect them to be knowledgeable or get more emotional (but not extremely scared) regarding the topic, or strongly feel that the amount of information held is insufficient for daily life purposes.

Another interesting outcome of this study is the relative importance of issue involvement. The findings suggest that level of involvement or interest in the topic is a valuable factor in the framework. In this study, involvement is posited among the set of perceived hazard characteristics and predicted to affective responses and information sufficiency. As shown in previous studies (see for example Kahlor et al., 2003; Johnson, 2005) and replicated in this study, level of involvement bears a positive influence on one's intentions to seek additional risk information. A topic could become more salient or urgent because of changes in one's life, such as an accident with hazardous substances nearby, media attention, or elevated levels of personal relevance through personal experience.

As the aforementioned studies have found direct relationships between involvement and subsequent seeking of risk information as well, we also tested a model that included this direct link. Results of this model indicate that involvement is by far the strongest predictor of both information seeking (β=0.45, p<0.001) and information avoidance (β=-0.43, p<0.001), resulting in significantly larger proportions of variance explained in both information seeking (R^2=0.50) and information avoidance (R^2=0.36). The addition of this direct link, however, undermined the effect of some of the other antecedents of information avoidance (affective responses and subjective norms). One explanation could be that other factors not yet included in the model result in higher levels of perceived salience or relevance of the topic to the individual. It is of utmost importance to investigate the underlying factors that make individuals sense that a risk is relevant to them and that risk-related information is needed. A better understanding of the antecedents of involvement requires research efforts in the future.

Some unique patterns in risk information attentional styles emerged. Although highly significant in both cases, affective responses were more associated with information seeking than with avoidance. The cognitive component (risk information sufficiency), on the other hand, was a stronger predictor of risk information avoidance when compared to risk information seeking. This implies that information seeking is strongly triggered by senses of negative feelings (e.g., worry or anxiety). These feelings, however, have a lesser impact on deciding to refuse information. A possible explanation for this finding could lie in the magnitude of negative feelings. People do not get extremely anxious, scared, or worried while thinking about external safety hazards in their lives, nor do they believe that these hazards pose immediate (life) threatening outcomes to them personally. Affective responses in this study do not reflect fear, which could lead to total message rejection (Witte, 1992; 1994). In fact, a certain degree of emotional response seems needed for people to go out of their way to learn more about the topic.

Information sufficiency and affective responses were triggered by self-efficacy, perceived risk, and involvement. The association between personal control and information sufficiency appeared to be quite strong, in the sense that those convinced were more capable of dealing with the risk (outcomes) in everyday life and do not sense the need for additional information. Consequently, such people are likely to avoid or reject information. Conversely, the absence of perceived control leads to a stronger sense of information insufficiency and stronger feelings of, for example, worry and anxiety, which drives people to seek information. A strong sense of self-efficacy is therefore an important indirect factor in the decision to seek or avoid risk information. As both self-efficacy and information sufficiency captures some form of confidence judgment, the question is raised as to whether this could be partly due to personality traits. Some people, by nature, have a tendency to be intolerant for uncertainty or risks (see for example Buhr & Dugas, 2002; Lions & Meertens, 2005). As a consequence, they are likely to hold higher risk perceptions, which in turn negatively correlate with self-efficacy. A lack of personal control might therefore lead to senses of information insufficiency.

This study contributes to a small body of literature on the receiver-oriented perspective on risk communication. The resulting framework of risk information seeking might apply to a wide range of risks. It recognizes the importance of cognitive, as well as affective and social risk information needs and defines the antecedent factors of risk information behavior as a starting point in developing more effective receiver-oriented risk communication. Risk communication practitioners might profit from first putting effort into building interest in risks from hazardous industrial substances among the general public, as individuals who are more interested or involved in the topic will be more motivated to seek personally relevant risk information. For example, governments and other purveyors of risk information should attend to the kinds of information various populations think they need to adequately cope with these risks in daily life. Of equal importance, investigating the social context in which risks exist and the subsequent effects of this context on the public's responses to risks (as opposed to, or complementary to, influencing individual risk perception) would be valuable in the development of risk communication and information provision efforts before focusing on influencing knowledge levels or risk-related behaviors.

Communicating risks would therefore not be simply a matter of providing the public with the (amount of) factual information they need, but should originate from a broader context including affective and societal influences. As a consequence, risk information supplies should not exclusively be based upon communicating what the experts believe the public needs to know, but should also take into account the public's perceptions, feelings, capacities, and beliefs. The recognition of the impact of three major predictors (cognitive, affective, and social) of risk-related information behavior adds valuable insights to risk psychology and risk communication. The contributions of this study will hopefully stimulate further inquiry into these processes and continue development of these ideas.

Notes

[1] Studies on the effects of the channel beliefs component still remain exploratory and have produced rather inconsistent results thus far and, consequently, have not been found to be among the strongest predictors of risk information seeking and avoidance behavior (see Griffin et al., 2004 for an overview). As Griffin et al. (2006) report the need to change some conceptual or measurement strategies for the channel beliefs component, recent applications of the RISP model excluded this variable from the analysis (c.f. Huurne, ter & Griffin, 2007; Kahlor, 2007). We therefore omitted it from this study.

[2] This approach is preferred over a regression approach or observed variable SEM approach, as it allows for the estimation of measurement error (Stephenson & Holbert, 2003).

[3] Absolute fit indices evaluate the degree to which the specified model reproduces the sample data (see Hu & Bentler, 1999). We report the χ^2 statistic together with its degrees of freedom, as this combination is still observed as the most proper way of comparing across different models (Hoyle & Panter, 1995) and the Root Mean Square Error of Approximation (Browne & Cudeck, 1993). Incremental fit indices assess the improvement of fit when a target model would be compared with a nested model in which all observed variables are uncorrelated (Hu & Bentler, 1998). We report the Tucker Lewis index (TLI; Tucker & Lewis, 1973) and the Comparative Fit Index (CFI; Bentler, 1990).

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes,* 50, pp. 179-211.

Ajzen, I. (2002). Perceived Behavioral Control, Self-Efficacy, Locus of Control, and the Theory of Planned Behavior. J*ournal of Applied Social Psychology*, 32, pp. 665-683.

Ajzen, I. & Sexton, J. (1999). Depth of Processing, Belief Congruence and Attitude-Behavior Correspondence. In S. Chaiken & Y. Trope (Eds.). *Dual Process Theories in Social Psychology.* New York: Guilford, pp. 117-138..

Atkin, C.K. (1972). Anticipated Communication and Mass Media Information-Seeking. *The Public Opinion Quarterly*, 36 (2), pp. 188-99.

Atkin, C.K. (1973). Instrumental Utilities and Information Seeking. In: P. Clarke (Ed.): *New Models for Communication Research*, Vol. 2. London: Sage.

Bandura, A. (1986). *Social Foundations of Thought and Action: A Social Cognitive Theory.* Prentice Hall, Englewood Cliffs, NJ.

Bandura, A. (2000). Exercise of Human Agency Through Collective Efficacy. *Current Directions in Psychological Science*, 9 (3), pp. 75-78.

Belkin, N. J. (1980). Anomalous State of Knowledge for Information Retrieval. *Canadian Journal of Information Science*, 5, pp. 133-43.

Bentler, P.M. (1990). Comparative Fit Indexes in Structural Models. *Psychological Bulletin*, 107, pp. 238-246.

Berger, C.R. & Calabrese, R.J. (1975). Some Explorations in Initial Interaction and Beyond: Toward a Developmental Theory of Interpersonal Communication. *Human Communication Research*, 1, pp. 99-112.

Brashers, D. E., Neidig, J. L., Haas, S. M., Dobbs, L. K., Cardillo, L. W., & Russel, J. A. (2000). Communication in the Management of Uncertainty: The Case of Persons Living with HIV or AIDS. *Communication Monographs*, 67, pp. 63–84.

Browne, M.W. & Cudeck, R. Alternative Ways of Assessing Model Fit. In K.A. Bollen & J.S. Long (Eds.). *Testing Structural Equation Models.* Thousand Oaks, CA: Sage, pp. 136-162.

Buhr, K. & Dugas, M.J. (2002). The Intolerance of Uncertainty Scale: Psychometric Properties of the English Version. *Behavior Research and Therapy,* 40, pp. 931-945.

Case, D.O., Andrews, J.E., Johnson, D.E., & Allard, S.L. (2005). Avoiding versus Seeking: The Relationship of Information Seeking to Avoidance, Blunting, Coping, Dissonance, and Related Concepts. *Journal of the Medical Library Association,* 93 (3), pp. 353-362.

Chaiken, S., Liberman, A., & Eagly, A.H. (1989). Heuristic and Systematic Information Processing Within and Beyond the Persuasion Context. In J.S. Uleman & J.A. Bargh (Eds.). *Unintended Thought.* New York: Guilford Press, pp. 212-252.

Cvetkovich, G., Vlek, C.A.J., & Earle, T.C. (1989). Designing Technological Hazard Information Programs:

Towards a Model of Risk-Adaptive Decision Making. In: C.A.J. Vlek & G. Cvetkovich (Eds.). *Social Decision Methodology for Technological Projects.* Dordrecht, the Netherlands: Kluwer Academic Publishers, pp. 253-276.

Eagly, A. H. & Chaiken, S. (1993). *The Psychology of Attitudes*. Harcourt Brace, San Diego.

Griffin, R. J., Dunwoody, S., & Neuwirth, K. (1999). Proposed Model of the Relationship of Information Seeking and Processing to the Development of Preventive Behaviors. Environmental Research, 80, pp. S230-245.

Griffin, R. J., Powell, M., Dunwoody, S., Neuwirth, K., Clark, D., & Novotny V. (2004). Testing the Robustness of a Risk Information Processing Model. Paper presented to the Annual Convention of the *Association for Education in Journalism and Mass Communication*, Toronto, Ontario.

Griffin, R.J., Yang, J., Ter Huurne, E., Boerner, F., Ortiz, S. & Dunwoody, S. (2006). After the Flood: Anger, Attribution, and the Seeking of Information. Paper presented to the Annual Convention of the *Association for Education in Journalism and Mass Communication,* San Francisco, CA.

Grunig, J.E. (1989). Sierra Club Study Shows Who Become Activists. *Public Relations Review,* 15 (3), pp. 3-24.

Gutteling, J.M. & Wiegman, O. (1992). Beoordeling en Beleving van Milieurisico's: Overzicht van Onderzoek naar Ruimtelijke, Socio-Demografische, Culturele en Informationele Determinanten. *Nederlands Tijdschrift voor de Psychologie,* 47, pp. 97-114.

Heath, R.L., Liao, S.H., & Douglas, W. (1995). Effects of Perceived Economic Harms and Benefits on Issue Involvement, Use of Information Sources, and Actions: A Study in Risk Communication. *Journal of Public Relations Research,* 7 (2), pp. 87-109.

Hoyle, R. H., and Panter, A. T. (1995). Writing about Structural Equation Models, in R. H. Hoyle (Ed.). S*tructural Equation Modeling, Concepts, Issues, and Applications.* Thousand Oaks, CA: Sage Publications, pp. 158-176.

Hu, L.-T. and Bentler, P. M. (1998). Fit Indices in Covariance Structure Modeling: Sensitivity to Underparameterized Model Misspecification. *Psychological Methods,* 3 (4), pp. 424-453.

Hu, L.-T. and Bentler, P. M. (1999). Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives. *Structural Equation Modeling: A Multidisciplinary Journal,* 6, pp.1–55.

Huurne, E.F.J. ter & Gutteling, J.M. (forthcoming). Information Needs and Risk Perception as Predictors of Risk Information Seeking. *Journal of Risk Research.*

Huurne, E.F.J. ter, & Griffin, R.J. (2007). Seeking Information About Industrial Risks: A Cross-Cultural Test of the Model of Risk Information Seeking and Processing. Paper presented at the *Society for Risk Analysis – Europe Annual Conference,* The Hague, The Netherlands.

Jadad, A.R. & Gagliari, A. (1998). Rating Health Information on the Internet: Navigating to Knowledge or to Babel? *Journal of the American Medical Association,* 279, pp. 611-614.

Johnson, B.B. (1987). Accounting for the Social Context of Risk Communication. *Science & Technology Studies,* 5 (3/4), pp. 103-11.

Johnson, B.B. (2005). Testing and Expanding a Model of Cognitive Processing of Risk Information. *Risk Analysis,* 25 (3), pp. 631-650.

Kahlor, L.A., Dunwoody, S., Griffin, R.J., Neuwirth, K., & Giese, J. (2003). Studying Heuristic-Systematic Processing of Risk Communication. Risk Analysis, 23 (2), pp. 355-368.

Kahlor, L.A., Dunwoody, S., Griffin, R.J., & Neuwirth, K. (2006). Seeking and Processing Information about Impersonal Risk. *Science Communication,* 28 (2), pp. 163-194.

Kahlor, L.A. (2007). An Augmented Risk Information Seeking Model: The Case of Global Warming. *Media Psychology,* 10, pp. 414-435.

Kasperson, R.E. (1986). Hazardous Waste Facility Siting: Community, Firm, and Government Perspectives. In: *Hazards: Technology and Fairness.* Washington, DC: National Academy Press.

Kline, R.B. (2005). Principles and Practice of Structural Equation Modeling. Second edition. *Guilford Press: New York.*

Kuhlthau, C.C. (1991). Inside the Search Process: Information Seeking from the User's Perspective. *Journal of the American Society for Information Science,* 42, (5), pp. 361-371.

Kuttschreuter, M. (2006). Psychological Determinants of Reactions to Food Risk Messages. *Risk Analysis,* 26 (4), pp. 1045-1057.

Leiss, W. (1996). Three phases in the evolution of risk communication practice. *Annals AAPSS,* 545, pp. 85-94.

Lion, R. & Meertens, R.M. (2005). Security or Opportunity: The Influence of Risk-Taking Tendency on Risk Information Preference. *Journal of Risk Research,* 8 (4), pp. 283-294.

Lion, R., Meertens, R.M., & Bot, I. (2002). Priorities in Information Desire about Unknown Risks. *Risk Analysis*, 22 (4), pp. 765-776.

Loewenstein, G.F., Weber, E.U., Hsee, C.K., & Welch, N. (2001). Risk as Feelings. *Psychological Bulletin,* 127 (2), pp. 267-286.

McComas, K.A. (2006). Defining Moments in Risk Communication Research: 1996-2005. *Journal of Health Communication,* 11, pp. 75-91.

Miller, S.M. (1987). Monitoring and Blunting: Validation of a Questionnaire to assess Styles of Information Seeking under Threat. *Journal of Personality and Social Psychology,* 52 (2), pp. 345-353.

Myers, L.B. & Derakshan, N. (2000). Monitoring and Blunting and an Assessment of Different Coping Styles. *Personality and Individual Differences,* 28, pp. 111-121.

Nathan, K., Heath, R.L., & Douglas, W. (1992). Tolerance for Potential Environmental Health Risks: The Influence of Knowledge, Benefits, Control, Involvement, and Uncertainty. *Journal of Public Relations Research,* 4 (4), pp. 235-258.

Neuwirth, K. & Frederick, E. (2004). Peer and Social Influence on Opinion Expression: Combining the Theories

of Planned Behavior and the Spiral of Silence. *Communication Research,* 31, (6), pp. 669-703.

Petty, R.E., & Cacioppo, J.T. (1981). Issue Involvement as a Moderator of the Effects on Attitude of Advertising Content and Context. In K.B. Monroe (Ed.). *Advances in Consumer Research,* 8. Urbana, IL: Association for Consumer Research, pp. 20-24.

Petty, R.E., & Cacioppo, J.T. (1984). The Effects of Involvement on Responses to Argument Quantity and Quality: Central and Peripheral Routes to Persuasion. *Journal of Personality and Social Psychology,* 46, pp. 69-81.

Petty, R.E., & Cacioppo, J.T. (1986). Communication and Persuasion: *Central and Peripheral Routes to Attitude Change.* New York: Springer-Verlag.

Radecki, J.M., & Jaccard, C. (1995). Perceptions of Knowledge, Actual Knowledge and Information Search Behavior. *Journal of Experimental Social Psychology,* 31, pp. 107-38.

Rimal, R.N. (2001). Perceived Risk and Self-Efficacy as Motivators: Understanding Individuals' Long-Term Use of Health Information. *Journal of Communication,* 51 (4), pp. 633-654

Rimal, R.N. & Real, K. (2003). Perceived Risk and Efficacy Beliefs as Motivators of Change. Use of the Risk Perception Attitude (RPA) Framework to Understand Health Behaviors. *Human Communication Research,* 29 (3), pp. 370-399.

Slovic, P., Fischhoff, B., & Lichtenstein, S. (1981). Perceived Risk: Psychological Factors and Social Implications. *Proceedings of the Royal Society of London. Series A, Mathematical and Physical Sciences,* 374 (1764), pp. 17-34.

Slovic, P. (1987). Perception of Risk. *Science,* 236 (4799), pp. 280-285.

Slovic, P., Finucane, M.L., Peters, E., & MacGregor, D.G. (2004). Risk as Analysis and Risk as Feelings: Some Thoughts about Affect, Reason, Risk, and Rationality. *Risk Analysis,* 24 (2), pp. 311-322.

Stephenson, M.T., & Holbert, R.L. (2003). A Monte Carlo Simulation of Observable Versus Latent Variable Structural Equation Techniques. *Communication Research,* 30, pp. 332-354.

Trumbo, C.W. (1999). Heuristic-Systematic Information Processing and Risk Judgment. *Risk Analysis,* 19 (3), pp. 391-400.

Tucker, L.R. & Lewis, C. (1973). A Reliability Coefficient for Maximum Likelihood Factor Analysis. *Psychometrika,* 38, pp. 1-10.

Turner, M., Rimal, R., Morrison, D., & Kim, H. (2006). The Role of Anxiety in Seeking and Retaining Risk Information: Testing the Risk Perception Attitude Framework in Two Studies. *Human Communication Research,* 32, pp. 130-156.

Weinstein, N.D. (1993). Testing Four Competing Theories of Health-Protective Behavior. *Health Psychology,* 12(4), pp. 324-333.

Wilson, T.D. (1999). Models in Information Behavior Research. *The Journal of Documentation,* 55, (3), pp. 249-270.

Witte, K. (1992). Putting the fear back in fear appeals: The Extended Parallel Process Model. *Communication Monographs,* 59, pp. 329–349.

Witte, K. (1994). Generating Effective Risk Messages: How Scary Should your Risk Communication be? In B. Burleson (Ed.). *Communication Yearbook,* 18. Thousand Oaks, CA: Sage, pp. 229-254.

5

Who to trust? The importance of self-efficacy and social trust in public responses to risks

(submitted)

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5.1. Abstract

Although a great deal of research has linked both self-efficacy and social trust to risk responses, one overlooked question concerns the association between self-efficacy and institutional trust. The purpose of this study was to investigate the effect of self trust and trust in responsible agencies on affective responses and risk information sufficiency using a classification model. We also assessed the interaction of self trust and trust in agencies on these outcomes. Survey respondents in this study were placed into one of four categories based on their levels of self-efficacy (high/low) and social trust (high/low), including confident, independent, dependent, and insecure. Based on survey data (N=466), the accuracy of the four group classification was tested: emotional response and information sufficiency were queried to determine whether a similar classification could be yielded based in these data. Indeed, we found that our classification system correlated with responses. Both self-efficacy and institutional trust were found to contribute to emotional risk responses, risk information sufficiency and preferences for risk information, with self-efficacy being a stronger predictor of both affective responses and information sufficiency.

5.2. Introduction

Recent developments in risk communication research claim that social trust and self-efficacy affect the way the public responds to risks and risk communication. Studies have found negative associations between affective responses towards the risk, such as anxiety or worry, and positive associations with risk information sufficiency, such as the extent to which a person is satisfied with the amount of available information on the topic (Kuttschreuter, 2006; Huurne, ter & Gutteling, forthcoming; Griffin et al., 2006). Affective responses and information sufficiency, in turn, are direct predictors of how people respond to information about risks and the risk information-seeking strategy people employ (Griffin et al., 2004; Huurne, ter & Griffin, 2007; Huurne, ter & Gutteling, forthcoming). As a consequence, the potential value of self-efficacy and institutional trust as contributors to developing more effective risk communication, which includes being forthcoming regarding the public's concerns and information needs, should be a topic of interest in risk communication studies (Rowan, 1996). However, research emphasizing the compatibility between individual and institutional characteristics most often lacks investigation into how trust in self and trust in others are related (McComas, 2006); therefore, insight into the combined effect of the two types of trust is still lacking. A better understanding of the effects of self-efficacy and institutional trust on the response of the public to risk information could provide valuable insight for future risk communication efforts. Therefore, the aims of the current study were to explore (1) how various levels of self-efficacy and institutional trust influence the public's affective responses and information sufficiency, and (2) how the two types of trust affect the audience's preference for information about risks. Here, the risks relate to hazardous industrial substances.

5.3. Interaction Between the Individual and Responsible Institutions

The predominant belief in risk management and risk communication has been that the lay public is heavily dependent upon industries and institutions responsible for risk management in protecting area residents from possible harm. A general assumption is that most people do not possess sufficient knowledge of science and technology to be capable of judging risks and benefits (Gregory & Miller, 1998), so they must rely on information provided by experts (Earle & Cvetkovich, 1995), which makes them subject to the experts' assessments and judgments. As a consequence, most scholars in the field of risk management agree that the amount of trust put into responsible institutions by the public is among the most important factors in generating cooperative action (Cvetkovich & Löfstedt, 1999; Renn & Levine 1991; Slovic, 1993; Siegrist, Earle, & Gutscher, 2003) and effective risk communication (Slovic, 1999; Kasperson, Golding, & Tuler, 1992; Trettin & Musham, 2000). As a consequence, generating or maintaining trust often becomes a primary goal of risk communication (Renn & Levine, 1991; Trettin & Musham, 2000), e.g., it is employed to prevent public outrage instead of used a means to generate cooperative action.

Although it is now widely acknowledged that the public is not irrational and ignorant (Slovic, 1993; 1999), many risk communication efforts to date are still based on the assumption that the public needs to be educated and provided with the information experts feel they should know (Gough & Hooper, 2003). However, this top-down approach prevents interaction or actual communication with the public and generally neglects the role of the receiver (Fessenden-Raden, Fitchen, & Heath 1987). Such an educational approach could be accepted by the public to a certain extent, provided that the educational process is mutual and takes public concerns into account (Renn & Levine, 1991). If not, citizens will become frustrated and disappointed with the risk information provided by the government, for example, which (to them) seems disinterested in the public concerns. The audience will then feel that responsible agencies are reluctant or unwilling to allow them to participate in risk management (Covello, McCallum, & Pavlova 1989). However, recent perspectives on risk communication stress the importance of a bottom-up approach when communicating risks to the public. These views hold that risk communication is likely to fail unless the information provided meets the audience's perceptions, feelings, and information needs (Rowan, 1996; Slovic, 1999; Griffin, Dunwoody, & Neuwirth, 1999). A study on priorities in information desire by Lion, Meertens, & Bot (2002), for example, found that when confronted with a risk, most people first require information about the nature and consequences of the risk, followed directly by information about what they could personally do to prevent the consequence from occurring, methods of protection or how to influence the course of action of the risk if it were to occur. Only when the consequences were not considered to be personally controllable did people want to know what official agencies could do or had done about it. In sum, the amount of perceived self-efficacy seems quite important in how people respond to risks and information about risks.

Modern theories, such as the model of risk information seeking and processing (RISP; Griffin, Dunwoody, & Neuwirth, 1999), build on the receiver-oriented approach of risk communication. These theories highlight the importance of the individual's confidence in personal abilities, along with institutional trust, to adequately deal with risks and subsequent responses to risk communication (see Griffin et al., 2006, for example). According to these views, risk communicators should provide the public with tools and information on how to exert personal control over the risk (outcomes) and should make information easily accessible and understandable to the general public for daily life purposes. Providing the audience with personally relevant risk information that can be easily gained contributes to the adoption of risk-preventing behaviors in the long-term (Kahlor, 2007) and is more likely to establish long lasting effects (Turner et al., 2006). Therefore, people should be motivated to trust in themselves to adequately deal with specific risks. Thus, the construct of trust should still be considered as highly important in risk management, but approaching trust as reliance upon external parties exclusively might be somewhat limited in this context. As such, this trust could refer to trust in the self (i.e., perceived self-efficacy) to adequately cope with the risk as well (see Slovic, 1987, 1999; Kuttschreuter, 2006; Kasperson, Golding, & Tuler, 1992; Huurne, ter & Gutteling, forthcoming; Griffin et al., 2006).

5.3.1. Institutional Trust

The social (or institutional) trust approach (Kasperson, Golding & Tuler 1992; Siegrist, Cvetkovich, & Roth, 2000) proposes that public responses to risk communication depend heavily on the amount of trust put into managing agencies (Lundgren & McMakin, 2004; Löfstedt, 2005). Institutional trust is a general term in which government and industry are linked to each other (Bord & O'Connor, 1992). Although a specific definition of social trust in risk management remains somewhat elusive, in general it is a process whereby individuals are willing to rely on risk management institutions, and the often unknown individuals operating them, to protect them and their interests from risk (Cvetkovich & Löfstedt, 1999; Siegrist, et al., 2000). As such, social trust differs from what researchers term interpersonal trust, meaning trust that is placed in specific individuals based on the perceived presence or absence of certain traits (referred to as source credibility; Earle & Cvetkovich, 1995).

Another aspect of the institutional trust approach is called the asymmetry principle, which refers to the fragility of trust. Trust is hard to create or earn and can easily and rapidly be destroyed (Slovic, 1993; Walker et al., 1999). Research has found indications that the way trust and distrust are created and maintained differs (Slovic, 1993), and this difference matters for effective risk communication efforts and how these messages are received by the public. That is, negative information associated with a distrusted organization reinforces the public's distrust, while positive information is discounted. Fortunately, the converse is also true: If people trust an organization, positive information will reinforce that trust and negative information will be discounted (Cvetkovich et al., 2002). When people sense a lack of personal control over the risk, they prefer only those messages that come from sources they perceive as trustworthy (Cvetkovich & Winter, 2001). The determinants of trust have been investigated in a number of studies (for example, Peters, Covello, & McCallum, 1997), and the consensus seems to be that the main contributors to trust and credibility are the public's perception of the organization's ability to care, commitment to resolving risk, competence or expertise, and openness and honesty (for example, see Poortinga & Pidgeon, 2003; Kasperson et al., 1992; Renn & Levine, 1991). Institutional trust also captures an aspect of risk (Currall & Epstein, 2003). That is, when personal control or knowledge is lacking, trusting someone or an institution induces the risk that the person or institution will act unreliably.

5.3.2. Self-Efficacy

Self-efficacy is a construct of social cognitive theory (Bandura, 1986) that has been examined in numerous studies. Recent contributions to the risk communication and risk psychology literature have started to recognize the value of self-efficacy as it relates to risk responses (Rimal & Real, 2003; Neuwirth, Dunwoody, & Griffin, 2000; Turner et al., 2006; Rimal, 2001; Huurne, ter & Gutteling, forthcoming). Bandura (1997) explained that the control humans exercise over various situations and threats in their lives through agentive actions is powerfully influenced by the strength of their perceived efficacy, which Bandura defines as "beliefs in one's capabilities to organize and execute the courses of action required to produce to given attainments" (p. 3).

Perceptions of efficacy are important to individual behavior and behavioral intentions, and these perceptions regulate human functioning and emotional well-being. People with greater efficacy beliefs are able to translate knowledge into behavior (Rimal, 2000).

According to Bandura (1997), self-efficacy differs from confidence in the sense that confidence refers to strength of belief but does not necessarily specify what the certainty is in relation to. For example, a person can be supremely confident that he or she will fail at an endeavor. Perceived self-efficacy refers to belief in one's agentive capabilities that one can produce given levels of attainment. Therefore, self- efficacy is not a trait or generalized response. It is very specific to a given behavior. For example, one might feel very efficacious about exercising twice a day as recommended by a physician for losing weight, and have no confidence at all that one can follow a dietary change the physician also recommends as part of the plan to reach the weight-loss goal. Therefore, self-efficacy varies with tasks and behavioral challenges. In this way it is unlike constructs, such as self-esteem, that describe a general state of being.

5.3.3. Trust and Responses to Risk Information

Institutional trust and perception of personal efficacy are important in an individual's reaction to risk (Kuttschreuter, 2006). Many studies have investigated the association between institutional trust and public responses to risk, and these studies have generally found negative correlations between trust and perceived risk (Gaskell et al., 2004; Cvetkovich et al., 2002; Frewer, Scholderer, & Bredahl, 2003; McComas & Trumbo, 2001; Poortinga & Pidgeon, 2005; Siegrist, Gutscher, & Earle, 2005; Trumbo & McComas, 2003; Cvetkovich & Winter, 2001). Thus, a lack of institutional trust can amplify the amount of risk a person perceives (Groothuis & Miller, 1997; Slovic, 1999) and lead to feelings of worry and anxiety, for example (Huurne, ter & Gutteling, forthcoming; Griffin et al., 2006). In addition, when relevant parties are trusted, a certain level of risk information insufficiency seems acceptable to the individual, since trust has been found to be negatively associated with the need for additional information (Trumbo, 1999; Kuttschreuter, 2006; Griffin, Dunwoody, & Neuwirth, 2006).

Trusting experts and government is especially important in cases where this trust concerns risks that are difficult to understand or difficult for the general public to control. This lack of personal control corresponds with low perceptions of self-efficacy, which also is negatively correlated with perceived risk (Rimal & Real, 2003; Turner et al., 2006; Rimal, 2001). It could make one feel more (or less) helpless and therefore more (or less) dependent on managing institutions, implying that institutional trust is more important among those with a lack of perceived personal control. With respect to risks from hazardous industrial chemicals, self-efficacy refers to the notion that the individual expects to adequately cope with the risks that come with the use, production, storage, and transportation of hazardous chemicals. They cope by perceiving a capability of protecting oneself from possible harm, knowing what behavior to pursue in case of a chemical release, and being able to judge the risks one is exposed to in everyday living. For example, a lack of personal control or not knowing what behavior to pursue in order to deal adequately with a risk could

lead people to perceptions of low self-efficacy and make them feel helpless or anxious, which in turn amplifies one's affective responses toward the issue (Griffin, Dunwoody, & Neuwirth, 1999; Huurne, ter & Griffin, 2007; Huurne, ter & Gutteling, forthcoming). In contrast, individuals that perceive themselves as more self-efficacious, and therefore as capable of exerting personal control over the risk issue, express less feelings of worry and anxiety than self-efficacious people (for example, see Kuttschreuter, 2006; Kahlor et al., 2006). As a consequence, self-efficacy is positively correlated with perceived risk information sufficiency (Huurne, ter & Griffin, 2007; Kuttschreuter, 2006; Griffin et al., 2006). That is, a sense of lacking power or knowledge to control the situation widens the gap between the amount of information held and that needed to protect oneself from possible harm, and makes a person feel that he or she needs more information or knowledge to deal with the topic on a daily basis.

Despite the quite strong empirical evidence regarding the impact of both institutional trust and self-efficacy on affective responses and risk information sufficiency, the relative importance of both variables remains unclear (McComas, 2006).

5.3.4. Trust-Based Population Groups

Considering these perspectives as a main currency of risk communication research, we elaborate on the question of to what extent does believing that one is self-efficacious impact the role of social trust and successive responses to risk. In general, we propose that trust is related to affective responses toward the risk and perceived risk information sufficiency. Based on the literature described above, predictions about the combined role of institutional trust and self-efficacy on affective responses and information sufficiency results in a fourfold classification. Combining ratings of high vs. low for both self-efficacy and institutional trust results in a 2 x 2 design, in which four distinct groups of individuals are revealed, namely insecure, independent, dependent, and confident groups (Table 5.1).

Table 5.1. Fourfold classification based on self-efficacy and institutional trust

		Institutional trust	
		Low	*High*
Self-efficacy	*Low*	Insecure	Dependence
	High	Independence	Confidence

It can be assumed that people with lower trust and lower levels of self-efficacy (the insecure group) would feel more anxious, worried, or tense, and these people would feel a strong sense of information shortcoming since they do not know how to deal with the risks themselves and strongly feel they cannot rely on responsible agencies to protect them from possible harm. In those people with low self-efficacy but high trust in responsible agencies (the dependence group), affective responses decrease and levels of information sufficiency increase but not as much as

when self-efficacy is high and institutional trust is low (the independence group). The effects of personal control on risk responses are expected to be superior to those of institutional trust (cf. Lion, Meertens, & Bot, 2002). Both high institutional trust and self-efficacy result in a higher sense of information sufficiency and weaker affective responses (the confidence group).

Furthermore, levels of high versus low self-efficacy and institutional trust are expected to affect one's preference for information about risks from hazardous industrial chemicals. That is, individuals perceiving themselves as less self-efficacious could express stronger desires for information about what one could do to exert more personal control over the risk (outcome), therefore reducing information insufficiency and feelings of anxiety and worry. Those reporting lower institutional trust are expected to prefer information about what (local) governments and other responsible agencies (such as the industry) do to reduce or manage risks adequately. Our hypotheses regarding are as follows:

H1: The combined effect of self-efficacy and institutional trust affects information sufficiency in a sense that the confident group will express the highest level of information sufficiency, followed by the independent group, the dependent group, and the insecure group.

H2: The combined effect of self-efficacy and institutional trust modifies affective responses in a sense that the insecure group will express the strongest affective responses followed by the dependent group, the independent group, and the confident group.

H3: Both self-efficacy and institutional trust are positively associated with information sufficiency.

H4: Both self-efficacy and institutional trust are negatively associated with affective responses.

H5: Those with lower levels of self-efficacy would prefer information about what (s)he could do to reduce the possible negative effects of exposure to hazardous industrial chemicals.

H6: Those with lower levels of institutional trust prefer information about what responsible agencies (government and industry) do to reduce the possible negative effects of exposure to hazardous industrial chemicals.

5.4. Method

5.4.1. Design and Procedure

Data were collected through a nation-wide survey in the Netherlands in the spring of 2007. A random sample of the adult Dutch population (N=1960) administered by a profit database company was asked by mail to participate in the study. Selected people received a letter explaining the topic of the study and the link to the study's website on which the questionnaire was located. Those unwilling or unable to participate online could return a postage-paid reply card and received

a paper-and-pencil questionnaire.

5.4.2. Sample and Respondents

In total, 466 people responded to the questionnaire (response rate 24%). Significantly more males (58%) than females (42%) participated in the study ($\chi^2(1)=10.32$, $p<0.05$). Respondents ranged in age from 18 to 93 years with a mean of 49 years (SD=17.64). Of the subjects, 25% reported a lower educational level, 32% an intermediate, and 43% indicated they were highly educated. A minor proportion of the participants had experienced an incident with hazardous industrial substances in their neighborhood (20%), personal harm or property loss (7%), or knew someone who had suffered personal harm or property loss (16%) due to hazardous industrial chemicals.

5.4.3. Measures

Measures used to assess the relevant concepts in this study were tested on legibility and internal consistency (Cronbach's α). Respondents were asked to indicate their level of agreement with statements assessed by Likert-type scales, ranging from 1 (not at all) to 5 (completely or very much). Information sufficiency was held to its original conceptualization of Eagly and Chaiken (1993), defined as the extent to which the individual feels that the information needed of the risk topic has been satisfied. The response was a four-item scale in which respondents were asked to indicate their extent of satisfaction with the amount of knowledge held, how sufficient they felt their current knowledge level was, how content they were with the information base held, and whether they felt that they know enough about the topic to deal with the risks in their daily lives. These items formed a reliable scale (α=.92). Affective responses were measured by asking respondents to what extent they felt tense, anxious, nervous, or angry while thinking of the possibility of being exposed to the risks of dangerous industrial chemicals in everyday life. The scale was highly reliable (α=.93). To assess self-efficacy, respondents were asked to indicate to what extent they thought they would be able to protect themselves against the possible consequences, react appropriately if an accident happened, and would be able to judge the risks they are exposed to regarding hazardous industrial chemicals (α=.87). Institutional trust was measured by eight statements (α=.89), which captured the different components of trust, including openness, credibility, expertise, and concern in both industry and government agencies. Items were worded as "The [government/industry] protects local residents from possible harm", "When the [government/industry] claims to do everything to minimize the risks for me as a citizen, I believe that", "The government is concerned about the safety and health of citizens", "The government communicates openly about these risks", "Companies that use hazardous industrial chemicals take account of the health and safety of citizens", "Companies using hazardous industrial chemicals know how to handle the risks". The items were subjected to a factor analysis (Kaiser Normalization with Varimax Rotation) to assure the one-factor solution of institutional trust, which was confirmed.

5.5. Results

5.5.1. Descriptive Statistics

Table 5.2 presents mean scores, standard deviations and Pearson-correlation coefficients of the variables assessed in this study. All correlations were significant at p<.001 and in the expected direction. Respondents reported relatively low levels of affective responses and self-efficacy and medium-high levels of information sufficiency and institutional trust.

Table 5.2. Means, Standard Deviations, and Correlations

		1	2	3	4
1 Information sufficiency		1.00			
2 Affective responses		-.36***	1.00		
3 Institutional trust		.29***	-.29***	1.00	
4 Self-efficacy		.64***	-.34***	.27***	1.00
	M[1]	2.86	2.67	3.02	2.51
	SD	.96	1.02	.62	.86

N=466. Pairwise deletion of missing data. Significance levels: *p≤ 0.05; **p≤0.01; ***p≤0.001.
[1]Scales ranging from 1 to 5; higher scores indicate stronger agreement with the scales' items.

Trust-Based Population Groups

To evaluate the potential value of the proposed four-group distinction, two different analyses were conducted. First, we tested between-group differences by splitting variables at the median. After this categorization, analyses of covariance were conducted to examine the main effect of dependent variables (information sufficiency and affective responses) and interactions with these variables. Hypotheses 1 and 2 examined the four group classification of respondents based on their level of self-efficacy (high/low) and institutional trust (high/low). Table 5.3 shows the mean scores and standard deviations of the four groups regarding information sufficiency and affective responses. The overall analysis of variance was significant for both information sufficiency ($F(3,432)=55.94$, $p<.001$) and affective responses ($F(3,432)=14.88$, $p<.001$), indicating that the four group classification indeed results in four distinct groups based upon self-efficacy (high or low) and institutional trust (high or low).

Table 5.3. Means of information sufficiency and affective responses

		Mean[1] (SD)			
	N	Information sufficiency		Affective responses	
Insecure	139	2.20	(.81)	2.95	(1.11)
Dependence	85	2.63	(.83)	2.77	(.87)
Independence	107	3.17	(.84)	2.65	(.94)
Confidence	105	3.48	(.84)	2.14	(.82)
Total	436				
F	(3,432)	55.93***		14.89***	

[1] Scales ranging from 1 to 5; higher scores indicate higher agreement with the scales' items.

Significance level: ***p<0.001

As expected, the confident group reported the highest scores on information sufficiency (M=3.48), followed by the independent group (M=3.17), the dependent group (M=2.63), and the insecure group (M=2.20), and these findings support hypothesis 1. Post-hoc comparisons revealed that all differences were significant at p<.001 except for the difference between the dependent and independent groups, which was significant at p<.01.

With regard to affective responses, mean scores were as expected among the four different groups, with the insecure group expressing the strongest affective responses (M=2.95), followed by the dependent group (M=2.77), the independent group (M=2.65), and the confident group (M=2.14), and these findings support hypothesis 2. Post-hoc analyses revealed significant differences for all groups at p<.01, except for the difference between the dependent and independent group, which were non-significant. Figure 5.1 represents the pattern of the four groups based on their mean scores on information sufficiency and affective responses.

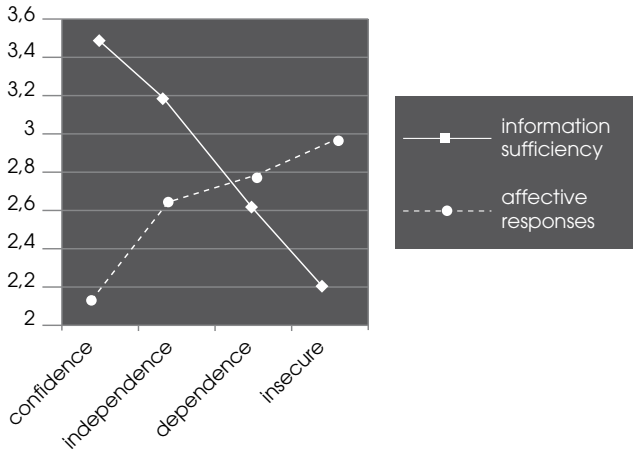


Figure 5.1. Mean scores of the four trust-based groups on information sufficiency and affective responses

We tested whether self-efficacy and institutional trust predict both information sufficiency and affective responses. Accordingly, hypotheses 3 and 4 proposed positive associations of the predictors with information sufficiency and negative associations with affective responses towards the risks of hazardous industrial chemicals. A univariate analysis of covariance was conducted (see Table 5.4) to test main effects and interactions with age, gender, and educational level as covariates.

Table 5.4. Main and combined effects on information sufficiency and affective responses

	Information sufficiency	Affective responses
	F (1,435)	F (1,435)
Institutional Trust	20.70***	11.14***
Self-Efficacy	132.98***	17.23***
Interaction IT*SE	.47	2.78#
F(6,429)	32.61***	17.77***
R^2	.31	.20

N=436. Significance levels: #p<.10, ***p<.001

5.5.2. Information Sufficiency

Hypothesis 3 concerned the direct effects of institutional trust and self-efficacy on risk information sufficiency. The overall analysis of covariance was significant ($F(6,429)=32.61$, $p<.001$, $R^2=.31$). Main effects were found for institutional trust ($F(1,435)=20.70$, $p<.001$) and self-efficacy

(F(1,435)=132.98, p<.001), with the latter being a very strong predictor of information sufficiency. Thus, higher levels of institutional trust and higher levels of self-efficacy lead to higher information sufficiency, thus supporting hypothesis 3. The interaction was non-significant.

5.5.3. Affective Responses

Hypothesis 4 regarded the effects of institutional trust and self-efficacy on affective responses. The overall analysis of covariance was significant (F(6,429)=17.77, p<.001, R^2=.20). Main effects were found for institutional trust (F(1,435)=11.14, p<.001) and self-efficacy (F(1,435)=17.23, p<.001). Thus, higher levels of institutional trust and higher levels of self-efficacy lead to weaker negative feelings in support of hypothesis 4. The interaction effect was marginally significant (F(1,435)=2.78, p<.10).

5.5.4. Risk Information Preferences

Hypotheses 5 and 6 proposed that different levels of self-efficacy and institutional trust would lead to different preferences for risk information. Table 5.5 presents the percentages of positive responses to different types of risk information. As expected, those with lower levels of self-efficacy reported a stronger need for information about what one could do himself to reduce possible harm (t=1.99, p<.05) and where to go for additional information (t=2.51, p<.05) compared to those with higher perceptions of self-efficacy.

High and low perceptions of self-efficacy did not affect preferences for information about what responsible agencies could do to reduce the risks or information about risk regulations and decisions. Significant differences between high and low levels of institutional trust were found for information about what government does to reduce the risks (t=2.04, p<.05), what industry does for a safe environment (t=1.98, p<.05), regulations regarding handling hazardous industrial chemicals (t=3.58, p<.001), and who decides which risks are acceptable (t=2.77, p<.01). Different levels of trust did not affect the preference for information about what one could for himself to reduce possible harm. Thus, hypotheses 5 and 6 were supported.

Table 5.5. Self-efficacy, institutional trust, and differences in information preference

	Self-Efficacy			Institutional Trust		
	Low	High	|t|	Low	High	|t|
What kind of information would you prefer? About…						
What the (local) government does to reduce the risks?	86%	83%	.90	87%	80%	2.04*
What industry does to assure a safe environment?	77%	74%	.90	80%	71%	1.98*
Regulations regarding handling hazardous industrial chemicals?	54%	47%	1.56	58%	41%	3.58***
Who decides which risks are acceptable?	69%	64%	1.28	72%	59%	2.77**
What you could do yourself to reduce possible harm?	90%	83%	1.99*	89%	84%	1.48
Where to go for additional information about the risks?	76%	65%	2.51*	76%	66%	2.25*

N=436. Percentages displayed represent positive responses.
Significance levels: *p<.05; **p<.01; ***p<.001

5.6. Discussion

The aim of the current study was to explore the relative importance of different types of trust on affective responses and perceived information sufficiency regarding risks from hazardous industrial chemicals. Affective responses and information sufficiency have been advanced as important predictors of an individual's motivation to gather additional information on a risk issue. In testing this relationship, trust was defined as a construct referring to trust in the capabilities of (a) the self (i.e., self-efficacy) and (b) others (i.e., institutional trust) to protect the individual from possible harm. We defined four different population groups based on level of personal efficacy (high or low) and institutional trust (high or low) related to risk information sufficiency and affective responses. Both personal efficacy and social trust were found to affect the audience's emotional response to risks and the need for additional information. The confident group (high efficacy/high institutional trust) was most satisfied with the amount of risk information held, followed by the independent group (high efficacy/low institutional trust), the dependent group (low efficacy/high institutional trust), and the insecure group (low efficacy/low institutional trust). The opposite pattern was found for affective responses. Specifically, the confident group expressed the weakest

negative feelings toward the risks, followed by the independent, dependent, and insecure group. The difference between the independent and dependent group, however, was not significant, indicating that with respect to affective responses, who is in control of managing the risks seems less important (i.e., whether that is the self or responsible institutions).

The results of this study indicate that institutional trust and perceived personal control are strongly correlated ($r=.64$, $p<0.001$). The proposition that self-efficacy and institutional trust are counterparts (Griffin et al., 2006) might be valid in this context since no interactions were found between personal efficacy and institutional trust in predicting to the dependent variables. Although both self-efficacy and institutional trust were significant predictors of risk information sufficiency and affective responses, self-efficacy was a significantly stronger predictor of both dependent variables. This finding might indicate that the perceived level of personal control plays a major role in how people respond to risks and information about risks. One could conclude that it is more important to the individual to be able to exert some control over the risk issue, or know what behavior to pursue, in order to adequately protect oneself from possible harm, as opposed to having to rely on others (such as government agencies and industry). Given these results, self-efficacy could be seen as a more important factor to be addressed in risk communication. This is in accordance with Peters, Covello, and McCallum (1997), who argued that a major institutional shift in societies has occurred in the sense that social trust is declining and people tend to put more trust in citizens, for example. Since both affective response and information sufficiency are key determinant of how people respond to information about risks (Huurne, ter & Griffin, 2007; Kahlor, 2007; Griffin et al., 2006), the influence of self-efficacy remains an important line of inquiry in this research area (McComas, 2006).

Our results provide valuable implications for future risk communication efforts. First, most people require information about what they could do themselves to reduce possible harm in the first place. Therefore, risk information provided to the general public should combine messages highlighting possible threats or potential outcomes with the promotion of recommended protective action or preventive behaviors. Second, the audience is interested in what policies responsible agencies of risk management (i.e., government and industry) enact to reduce the risks and ensure a safe environment. In other words, people are eager to learn about how trustworthy responsible agencies are in protecting the public from possible harm and how safe the world around them is in terms of industrial risks. Therefore, effective risk communication efforts should (a) provide the public with information about hazards and what one could do to protect the them self from possible harm, and (b) provide information about what governments and other purveyors of risk information are pursuing to minimize possible risks. Third, information about risks should be easily accessible to the general public. When perceived necessary, the audience wants to know where to go for relevant information about industrial chemicals issues. A risk communication effort will succeed only by making information personally relevant and appropriate and by conveying methods of controlling the risk (personal efficacy). Given the complexity of most industrial risk issues, it may be advantageous for people to seek additional information in order to gain an in-depth understanding of the topic.

However, the results of this study must be viewed in the light of limitations that need to be addressed. First, the measures used in this study are self-reported measures and not actual behavior. This method includes limitations because the participants were not in the actual situation. For example, some people could have difficulties indicating or predicting how they would respond emotionally to risks from industrial chemicals and what their level of information sufficiency is if the topic is not perceived as personally relevant at the time of study. Furthermore, evaluating one's own abilities of adequately dealing with the risks could be difficult in cases of low risk awareness or no past experience with the hazards. Future research efforts should therefore include actual responses to risks and risk information to validate the findings reported here. Second, risks from hazardous industrial chemicals might not be perceived as personally relevant at all times. In other words, some people are not aware of the risks that come with the use, storage, and transportation of hazardous chemicals and risk assessment is therefore imprecise. That being said, it is unclear how results could be replicated to include more personal risks or risks perceived as more personally controllable, such as dietary risks.

This study has focused on the need for a better understanding of responses to (information about) risks, which stems from the current shift in the risk communication literature towards a more bottom-up, receiver-oriented approach. A mass-media campaign aimed at stimulating people to actually go out of their way to seek and use the information provided could be an effective approach to promote self-protective behavior regarding external safety risks (Turner et al., 2006) and may enhance intentions to employ risk reduction behaviors in the long run (McComas, 2006).

References

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes* 50, pp. 179-211.

Allen, F.W. (1987). The Situation: What the Public Believes: How the Experts See it. *EPA Journal* 13, pp. 9-12.

Bandura, A. (1986). *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1997). *Self-Efficacy. The Exercise of Control*. New York: Freeman and Company.

Bord, R.J. & O'Connor, R.E. (1992). Determinants of Risk Perceptions of a Hazardous Waste Site. *Risk Analysis,* 12 (3), pp. 411-416.

Covello, V.T., McCallum, D.B., & Pavlova, M.T. (1989). Principles and Guidelines for Improving Risk Communication. In Covello, V.T., McCallum, D.B., and Pavlova, M.T. (Eds.): *Effective Risk Communication. The Role and Responsibility of Government and Nongovernment Organizations.* New York: Plenum.

Currall, S.C. & Epstein, M.J. (2003). The Fragility of Organizational Trust: Lessons from the Rise and Fall of Enron. *Organizational Dynamics,* 32 (2), pp. 193-206.

Cvetkovich, G. & Löfstedt, R. (1999). *Social Trust and the Management of Risk.* London: Earthscan.

Cvetkovich, G., Siegrist, M., Murray, R., & Tragesser, S. (2002). New Information and Social Trust: Asymmetry and Perseverance of Attributions about Hazard Managers. Risk Analysis, 22 (2), pp. 359-367.

Cvetkovich, G. & Winter, P.L. (2001). Social Trust and the Management of Risks to Threatened and Endangered Species. Presented at the annual meeting of the *Society for Risk Analysis,* Seattle, Washington, December 2-5.

Eagly, A. H. & Chaiken, S. (1993). *The Psychology of Attitudes.* San Diego: Harcourt Brace.

Earle, T. C. & Cvetkovich, G. (1995). *Social Trust: Toward a Cosmopolitan Society.* Westport, CT: Praeger.

Fessenden-Raden, J., Fitchen, J.M., & Heath, J.S. (1987). Providing Risk Information in Communities: Factors Influencing what is Heard and Accepted. *Science, Technology, & Human Values,* 12 (3/4), pp. 94-101.

Frewer, L. J., Scholderer, J., & Bredahl, L. (2003). Communicating about the Risks and Benefits of Genetically Modified Foods: The Mediating Role of Trust. *Risk Analysis,* 23 (6), pp. 1117-1133.

Gaskell, G., Allum, N., Wagner, W., Kronberger, N., Torgersen, H., Hampel, J., & Bardes, J. (2004). GM Foods and the Misperception of Risk Perception. *Risk Analysis,* 24 (1), pp. 185-194.

Gough, J. & Hooper, G. (2003). *Sharing the Future: Risk Communication in Practice.* Christchurch: CAE, University of Canterbury.

Greenberg, M., Spiro, H., & McIntyre, R. (1991). Ethical Oxymora for Risk Assessment Practitioners. *Accountability in Research,* 1, pp. 245-257.

Gregory, J. & Miller, S. (1998). *Science in Public: Communication, Culture, and Credibility.* New York: Plenum.

Griffin, R. J., Dunwoody, S., & Neuwirth, K. (1999). Proposed Model of the Relationship of Information Seeking and Processing to the Development of Preventive Behaviors. *Environmental Research,* 80, pp. S230-245.

Griffin, R. J., Powell, M., Dunwoody, S., Neuwirth, K., Clark, D., & Novotny V. (2004). Testing the Robustness of a Risk Information Processing Model. Paper presented to the Annual Convention of the *Association for Education in Journalism and Mass Communication,* Toronto, Ontario.

Griffin, R.J., Yang, J., Ter Huurne, E., Boerner, F., Ortiz, S., & Dunwoody, S. (2006). After the Flood: Anger, Attribution, and the Seeking of Information. Paper presented to the Annual Convention of the *Association for Education in Journalism and Mass Communication,* San Francisco, CA.

Groothuis, P. A. & Miller, G. (1997). The Role of Social Distrust in Risk-Benefit Analysis: A Study of the Siting of a Hazardous Waste Disposal Facility. *Journal of Risk and Uncertainty,* 15, pp. 241-257.

Hadden, S.G. (1991). Public Perception of Hazardous Waste. *Risk Analysis,* 11, pp. 47-57.

Huurne, E.F.J. ter & Griffin, R.J. (2007). Seeking Information about Industrial Risks: A Cross-Cultural Test of the Model of Risk Information Seeking and Processing. Paper presented at the *Society for Risk Analysis – Europe Annual Conference,* The Hague, The Netherlands.

Huurne, E.F.J. ter & Gutteling, J.M. (Forthcoming). Information Needs and Risk Perception as Predictors of Risk Information Seeking. *Journal of Risk Research.*

Kahlor, L.A. (2007). An Augmented Risk Information Seeking Model: The Case of Global Warming. *Media Psychology,* 10, pp. 414-435.

Kahlor, L.A., Dunwoody, S., Griffin, R.J., & Neuwirth, K. (2006). Seeking and Processing Information about Impersonal Risk. *Science Communication,* 28 (2), pp. 163-194.

Kahlor, L.A., Dunwoody, S., Griffin, R.J., Neuwirth, K., & Giese, J. (2003). Studying Heuristic-Systematic Processing of Risk Communication. *Risk Analysis,* 23 (2), pp. 355-368.

Kasperson, R.E., Golding, D., & Tuler, S. (1992). Social Distrust as a Factor in Siting Hazardous Facilities and Communicating Risks. *Journal of Social Issues,* 48 (4), pp. 161-187.

Kuttschreuter, M. (2006). Psychological Determinants of Reactions to Food Risk Messages. *Risk Analysis,* 26 (4), pp. 1045-1057.

Leiss, W. (1995). "Down and Dirty:" The Use and Abuse of Public Trust in Risk Communication. *Risk Analysis,* 15 (6), pp. 685-692.

Lion, R., Meertens, R.M., & Bot, I. (2002). Priorities in Information Desire about Unknown Risks. *Risk Analysis,* 22 (4), pp. 765-776.

Löfstedt, R.E. (2005). *Risk Management in Post-Trust Societies.* London: Macmillan.

Lundgren, R.E. & McMakin, A.H. (2004). R*isk Communication. A Handbook for* Communicating *Environmental,*

Safety, and Health Risks. 3rd Ed. Columbus, Richland: Battelle Press.

McComas, K.A. (2006). Defining Moments in Risk Communication Research: 1996-2005. *Journal of Health Communication,* 11, pp. 75-91.

McComas, K.A. & Trumbo, C.W. (2001). Source Credibility in Environmental Health-Risk Controversies: Application of the Meyer's Credibility Index. *Risk Analysis,* 21 (3), pp. 467-480.

Neuwirth, K., Dunwoody, S., & Griffin, R.J. (2000). Protection Motivation and Risk Communication. *Risk Analysis,* 20 (5), pp. 721–734.

Peters, R.G., Covello, V.T., & McCallum, D.B. (1997). The Determinants of Trust and Credibility in Environmental Risk Communication: An Empirical Study. *Risk Analysis,* 17 (1), pp. 43-54.

Poortinga, W. & Pidgeon, N.F. (2003). Exploring the Dimensionality of Trust in Risk Regulation. *Risk Analysis,* 23 (5), pp. 961-972.

Renn, O. & Levine, D. (1991). Credibility and Trust in Risk Communication. In Kasperson, R.E. and Stallen, P.J.M. (Eds.). *Communicating Risks to the Public,* pp. 175-218. Dordrecht, The Netherlands: Kluwer Academic Publishers.

Rimal, R.N. (2000). Closing the Knowledge-Behavior Gap in Health Promotion: The Mediating Role of Self-Efficacy. *Health Communication,* 12, pp. 219-237.

Rimal, R.N. (2001). Perceived Risk and Self-Efficacy as Motivators: Understanding Individuals' Long-Term Use of Health Information. *Journal of Communication*, 51 (4), pp. 633-554

Rimal, R.N. & Real, K. (2003). Perceived Risk and Efficacy Beliefs as Motivators of Change. Use of the Risk Perception Attitude (RPA) Framework to Understand Health Behaviors. *Human Communication Research*, 29 (3), pp. 370-399.

Rowan, F. (1996). The High Stakes of Risk Communication. *Preventive Medicine,* 25, pp. 26-29.

Siegrist, M., Cvetkovich, G., & Roth, C. (2000). Salient Value Similarity, Social Trust, and Risk/Benefit Perception. *Risk Analysis,* 20 (3), pp. 353-362.

Siegrist, M., Earle, T.C., & Gutscher, H. (2003). Test of a Trust and Confidence Model in the Applied Context of Electromagnetic Field (EMF) Risks. *Risk Analysis,* 23 (4), pp. 705-716.

Siegrist, M., Gutscher, H., & Earle, T.C. (2005). Perception of Risk: The Influence of General Trust, and General Confidence. *Journal of Risk Research,* 8 (2), pp. 145-156.

Sjöberg, L. (2001). Limits of Knowledge and the Limited Importance of Trust. *Risk Analysis,* 21 (1), pp. 189-198.

Slovic, P. (1987). Perception of Risk. *Science,* 236 (4799), pp. 280-285.

Slovic, P. (1993). Perceived risk, Trust, and Democracy. *Risk Analysis,* 13 (6), pp. 675-682.

Slovic, P. (1999). Trust, Emotion, Sex, Politics, and Science: Surveying the Risk Assessment Battlefield. *Risk*

Analysis, 19 (4), pp. 689-701.

Trettin, L. & Musham, C. (2000). Is Trust a Realistic Goal of Environmental Risk Communication? *Environment and Behavior,* 32 (3), pp. 410-426.

Trumbo, C.W. (1999). Heuristic-Systematic Information Processing and Risk Judgment. *Risk Analysis,* 19 (3), pp. 391-400.

Trumbo, C.W. & McComas, K.A. (2003). The Function of Credibility in Information Processing for Risk Perception. *Risk Analysis*, 23 (2), pp. 343-353.

Turner, M., Rimal, R., Morrison, D., & Kim, H. (2006). The Role of Anxiety in Seeking and Retaining Risk Information: Testing the Risk Perception Attitude Framework in Two Studies. *Human Communication Research,* 32, pp. 130-156.

Walker, G., Simmons, P., Irwin, A., & Wynne, B. (1999). Risk Communication, Public Participation, and the Seveso II Directive. *Journal of Hazardous Materials,* 65, pp. 179-190.

Witte, K. (1994). Fear Control and Danger Control: A Test of the Extended Parallel Process Model (EPPM). *Communication Monographs,* 61 (2), pp. 113–134.

6
General discussion

The aim of this thesis was to gain an in-depth understanding of the antecedents – direct and indirect determinants – of risk-related information behavior, which here was applied to external safety issues. The previous chapters reported the findings of various parts of the project, and discussed the insights that emerged. This chapter discusses the overall findings and the theoretical implications that emerge for the risk communication and risk psychology literature. Furthermore, implications for future research efforts will be discussed by suggesting how the insights gained during the project could be used to further study risk-related information behavior. Finally, practical recommendations for risk communicators in the field are described.

6.1. The Framework of Risk Information Seeking (FRIS)

Based on the findings of the studies reported in the previous chapters a framework of risk information seeking (FRIS) has developed (Figure 6.1). In short, FRIS is a model that identifies factors leading people to seek relevant risk information through various information channels or, alternatively, avoid additional information. As such, this model accounts for the various social-psychological risk-related factors that drive such decisions. The framework privileges the audience-based perspective of risk communication and offers guidelines for connecting the underlying processes of responses to risk-related information.

FRIS differs from previous models on information behavior in several ways. First, general models of information seeking (for example, Wilson, 1981; 1996; Ellis et al., 2002; Kuhlthau, 1991) refer to the motivation to seek information implicitly. As stated by Wilson (1999), "Rarely do such models advance to the stage of specifying relationships among theoretical propositions: rather, they are at a pre-theoretical stage, but may suggest relationships that might be fruitful to explore or test." (p. 250). Clearly, such models do little more than propose that information seeking behavior arises as a consequence of some need perceived by a person in some situation or context. Which factors define such a context, situation, or need remains somewhat elusive. The model presented here addresses these opacities by elucidating specific risk context factors and specific risk information utilities important to the process of risk-related information behavior.

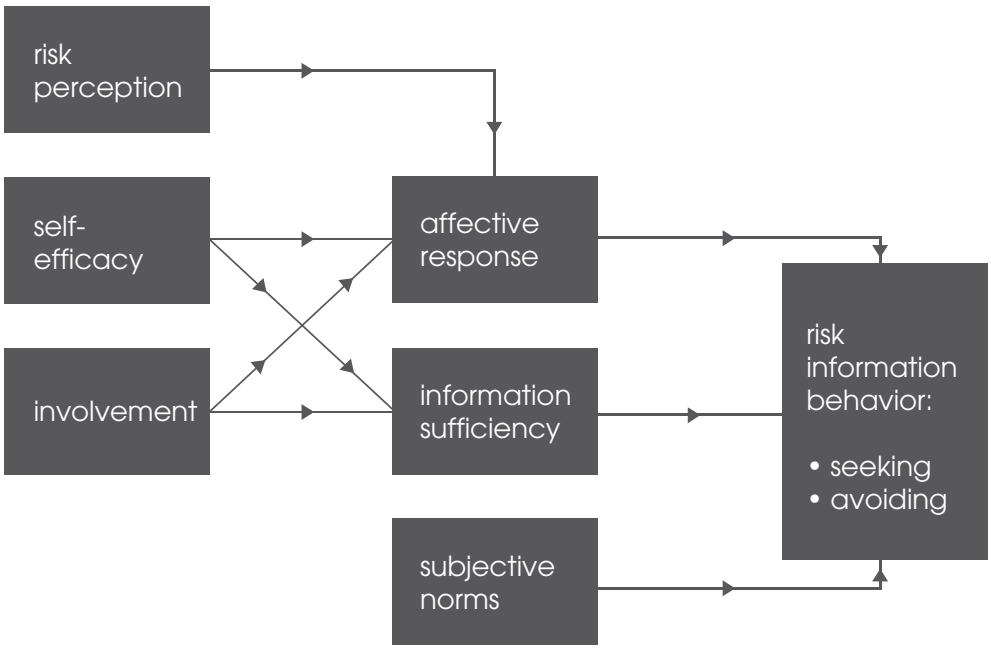


Figure 6.1. The Framework of Risk Information Seeking

Second, FRIS is a model that essentially builds on the specific factors relevant to the risk context and allows them to merit their own places in the model. The model explains the dynamic processes underlying the interacting variables in order to predict risk-related information behavior. As such, it differs from the more media- and mass communication-oriented models such as the risk information seeking and processing model (RISP; Griffin, Dunwoody, & Neuwirth, 1999), which aims to "help explain variation in how individuals respond to messages about health risks" (Griffin, Neuwirth, et al., 1999). The latter also incorporates and focuses on beliefs about information channels, media-related variables, and demographics in order to provide a more general overview of variables that might help explain the variety of responses to risk information. While such variables are valuable for general research purposes, consideration of these variables is of less significance for the specific goal of this thesis. In other words, FRIS focuses specifically on risk-related factors that motivate people in a specific risk context to actually search for risk information and which of these variables could be addressed in order to stimulate risk information seeking behavior among the general public. Therefore, the models could be seen as complementary, rather than competing, in explaining risk-related information behavior from different perspectives.

Third, FRIS is unique in recognizing the multidimensional nature of risk-related information behavior from a social-psychological perspective. The studies described in this thesis confirm that an individual's motivation to seek (or avoid) information about external safety risks is a holistic entity, which stems from various social-psychological drivers. Although information seeking behavior is prompted by a factual information gap, it could also occur without the awareness of such a gap (Godbold, 2006), and be triggered by emotions or social context. FRIS addresses the multidimensional nature of information behavior by acknowledging the variety of utilities people need information for.

6.2. The Process of Risk-Related Information Behavior

FRIS proposes that risk-related information behaviors can be captured through a three-stage process, represented by (1) risk context factors, (2) information utility perceptions, and (3) information behavior decisions.

6.2.1. Risk Context Factors

The starting point for risk-related information behavior is a particular situation that defines the specific risk context from which the information problems arise. Responding to an issue by acting towards a resolution is triggered by awareness and salience evaluation of that particular topic. This process involves judging the characteristics and perceived relevance of the issue to the self. With regard to the risk context, three such factors contribute to the awareness of the topic and induce possible information problems.

First, risk perceptions play a prominent role in responses to external safety issues (see Chapters 2, 3, and 4). Since people tend to judge risks according to their perception of the hazard, mostly in the absence of objective statistics, their risk perception is most often based on availability heuristics (Slovic, Fischhoff, & Lichtenstein, 1981). This availability heuristic refers to the individual's own frame of reference, including what a person remembers from previous events and what s/he has taken away from it, rather than evaluating what actually has taken place (Boholm, 1998). These heuristics explain why different people facing a similar risk context or hazardous situation hold different risk perceptions regarding the hazard. These perceptions should be taken into account when providing the public with risk information, since differences in risk perception lie at the heart of disagreements between experts and members of the general public (Slovic, 1987). Studies have found that the lay public often overestimates dangers from industrial hazards, such as external safety issues (Gregory, Slovic, & Flynn, 1996; Recchia, 1999). The studies reported in Chapters 3 and 4 found a relatively strong association between risk perceptions and affect, with higher risk perceptions enhancing stronger negative emotions, such as anxiety or worry. This finding confirms a wide range of earlier investigations that consistently found positive correlations between perceived risk and affective responses (for example, see Griffin et al., 2008; Kuttschreuter, 2006; Loewenstein et al., 2001; Finucane et al., 2000). By providing information that is unambiguous and easy to understand for members of the general public, the risk judgments and responses to risks could be directed towards a more realistic view of the dangers involved with the risks.

Second, perceived personal control or self-efficacy surfaced as an important factor in our model. Perceptions of efficacy have generally been absent from theorizing in the information-seeking realm (Afifi & Weiner, 2006). According to FRIS, a perceived lack of self-efficacy evokes affective responses and decreases senses of information sufficiency. The sense of being able to exert personal control over the hazard and possible outcomes as well as knowing what behavior to pursue to adequately protect the self from possible harm plays a major role in risk response and, in turn, information behavior decisions (see Chapters 4 and 5). FRIS suggests that, when risk and efficacy are made salient, risk perception and efficacy beliefs jointly affect subsequent action. A lack of control is frequently noted as a factor that increases risk perceptions. The risk perception attitude framework (RPA; Rimal & Real, 2003), for instance, posits that the effects of risk perceptions have to be considered in the context of efficacy beliefs. When risk perceptions are low, people will rely on efficacy beliefs to determine an appropriate course of action (Turner et al., 2006). With high risk perceptions, efficacy beliefs take on added importance because the heightened levels of risk not only act as motivational factors but also tend to generate anxiety (Witte, 1994). When individuals feel anxious or worried about their well-being as a result of increased risk perceptions, their perceived ability to exert personal control over the issue plays a critical role in how they behave (Witte, 1992; Nordin et al., 2002; Kuttschreuter, 2006; Lerner & Keltner, 2001).

As reported in Chapter 5, the public prefers to exert personal control over the possible hazards and outcomes, rather than rely on others, such as governments and industry. This preference might be due to the current trend of the public becoming increasingly distrustful of risk management activities (Williams, Brown, & Greenberg, 1999; Slovic, 1993). Communicators should address these preferences by promoting self-protective actions and preventive behaviors. Risk information must grant choice and empower individuals (Rowan, 1996). Providing information on the level of risk and what actions individuals could take (i.e., efficacy) influence the individual's willingness to take protective actions (McComas, 2006). Addressing both risk perceptions and self-efficacy is likely to provide a much richer explanation of risk-related information behavior and risk responses than by focusing on these variables separately. In addition, risk communication efforts should provide information about where to go for additional information in a specific risk context.

Third, the level of perceived issue involvement surfaced as an important factor in our model. Involvement is a construct that is rather new to the risk communication and risk psychology literature in general and in the risk information seeking arena specifically. According to FRIS, the level of issue-involvement influences one's risk-related information behavior. The construct of issue involvement represented in the FRIS model refers to what Apsler & Sears (1968) termed personal or situational involvement and represents personal interest as a result of the idea that the risk issues, situations, or messages can have significant consequences on one's own life (Cho & Boster, 2005; Andrews et al., 1990). The notion that a specific risk or hazard might affect one's well-being raises interest and relevance (Johnson, 2005; Celsi & Olson, 1988) that, in turn, makes one feel that the topic is important and s/he should learn more about it. The current studies found that involvement has a strong effect on risk-related information decisions and is significantly associated with risk perception, information needs (Chapters 2 and 4), and affective responses (Chapter 4). With heightened levels of involvement, people tend to have stronger affective responses and a lower sense of information sufficiency, which stimulates people to seek additional information. In addition, the current results indicate that elevated levels of involvement might directly stimulate one to search for additional information. As such, involvement seems to reflect an important stimulator in the risk information seeking context, since it comprises elements such as relevance and interest. The primary problem in defining involvement is that numerous antecedents and consequences of involvement have been confused with involvement per se (Andrews et al., 1990). Although an in-depth understanding of the antecedents of issue involvement remains somewhat elusive (see Chapter 4), a clarification of this nature would be of value to researchers seeking to conceptualize and manipulate involvement in their research. Hence, it would be valuable to build interest among the general public by addressing the personal importance of external safety issues in order to gain a higher level of engagement with the topic. This motivates people to think more and highlights the importance of seeking additional information.

6.2.2. Risk Information Utilities

According to FRIS, the driving force for risk-related information behavior is multidimensional by nature. That is, information needs in the risk context do not solely arise as the consequence of the perceived lack of knowledge about the issue. Rather, these needs refer to the basic goals one seeks to achieve by seeking information. As such, the utility of this information for the seeker should be the point of focus in studying information behavior in the context of risks. In accordance with Bosman and Renckstorf (1996), three overlapping motivations exist that determine an information need, including (1) an instrumental utility, (2) an intrinsic utility, and (3) a social utility. FRIS elaborates on these utilities by applying them to the specific risk context.

Instrumental Utility: Information Sufficiency

Instrumental utility refers to the need for information as a consequence of a perceived gap in knowledge, for example, to judge and evaluate the risks one faces. People seek information to reduce that gap. The current studies therefore applied the RISP model's concept of "information sufficiency" to the context of external safety issues. The main feature of the sufficiency principle is that it does not refer to the level of information needed per se to initiate the process, but instead focuses on level of knowledge or understanding that is sufficient or desired by the individual.

Although several studies have employed the sufficiency principle (for example, see Griffin et al., 2004, 2008; Kahlor et al., 2003, 2006; Trumbo, 1997; Johnson, 2005) to investigate risk-related information behavior, measuring it is still in its infancy and, therefore, remains somewhat exploratory. In general, information sufficiency is assessed indirectly by asking people to rate their current information base and their sufficiency threshold separately (for example, on a scale from zero to one hundred, or by Likert-type items). However, the results of the first study (Chapter 2) addressed questions regarding conceptualization of information sufficiency as an indirect variable since the use of indirect measures might cause difficulty for both researchers and respondents, which can easily be overcome by the use of direct measures. Regard to the concept of information sufficiency, which refers to the level of satisfaction with the amount of knowledge held regarding a topic for his/her own specific goals, a more direct measure would be valuable and valid in assessing the perceived level of information sufficiency. Therefore, an information sufficiency measure was developed (Chapter 4), which captured an overall assessment of (dis)satisfaction with the knowledge or information held. This measure generally overcame the difficulty in explicitly estimating how much risk information was available and the percentage of that information currently possessed, and was therefore more suitable for application in SEM analyses.

Furthermore, it was found that current knowledge directly affects intentions to search for additional information, which has been found in other studies as well (Griffin et al., 2008; Kahlor et al., 2006). Although not articulated by the original RISP model, the amount of knowledge people hold about a risk could affect their capacity to gain new information about it. As Tichenor et al. (1970) explain in their Knowledge Gap Theory, higher states of existing knowledge enhance capacities to understand and gain additional knowledge. Thus, succeeding

in understanding information in the past should give individuals more faith in their abilities to gather information in the future. This might be due to variation in levels of issue involvement or issue salience. Those perceiving the risk issue as more important or personally relevant, might require a deeper understanding of the topic, and therefore need more information. Because of their high involvement, despite their enhanced current knowledge base they will be motivated to seek information apart from evaluating sufficiency threshold or objective information need. Involved individuals will constantly search for new information. Those less involved, on the other hand, need other factors to drive information seeking behavior or should be motivated to think there is more information they should need or hold regarding the topic as compared to their current knowledge base. One possibility in motivating people with high levels of sufficiency is focusing on the perceived sufficiency threshold. With enhanced sufficiency thresholds, the sense of information shortcoming will be evoked and prompt people to create a need for information that they will then seek.

In sum, information sufficiency remains a variable worthy of further examination in the wake of similar analyses. Information sufficiency seems to have genuine potential for use in audience-based studies of information seeking because it (1) taps into the subjective experience of the individual rather than imposing an external criterion of knowledge, and (2) it acknowledges that information needs can vary with times and context.

Intrinsic Utility: Affective Responses

The notion of risk, by definition, includes a certain level of uncertainty about the likelihood of possible harm to individuals and their assets as well as the severity of possible consequences. This notion might then lead people to sense unpleasant feelings. One may try to reduce these feelings by seeking additional information. Whereas virtually all existing theories of decision making on risk are cognitive in nature and, therefore, assume that people base their choices on rational and calculating judgment (Loewenstein et al., 2001), the current studies confirmed the relative importance of the role of affect at the time of decision making. Risk judgment and decision research has only recently begun to incorporate affect when examining responses to risks (Lerner & Keltner, 2001). Affective responses, such as emotional reactions including anger, worry, or anxiety towards a risk issue refer to the intrinsic need for risk information. These responses directly motivate an individual to gather additional information about the issue at stake (see Chapters 3 and 4). Those who become more worried or anxious while thinking about the risks of external safety hazards are more likely to search for additional information. A possible explanation might be that uncertainty drives the information seeking process through affective responses. When sense runs out, the lack of understanding creates a state of uncertainty. Afifi & Weiner (2006) further developed and investigated the role of uncertainty related to feelings of anxiety. Their theory of motivated information management assumes that the awareness of a gap between levels of uncertainty pursued and held leads to anxiety. These affective states, then, motivate and direct the individual's information seeking.

The current studies approached affective responses as variables that cover a single-factor, general domain of negative emotions towards the risk issue. However, it is still rather unclear how different emotions evoke different responses to risks. According to the affect heuristic, people may judge risks by accessing a pool of both negative and positive feelings associated with the hazard (Finucane et al., 2000; Slovic et al., 2004). As such, more positive emotions, such as hope, may also affect one's responses to risks (Griffin et al., 2008). In addition, more extreme emotions, such as outrage, despair, or panic might lead to different risk information decisions, such as total message rejection (Witte, 1992; Lion, Meertens, & Bot, 2002). For example, Lerner & Keltner (2001) found that fear and anger activate contrasting responses to risks, which were mediated or moderated by appraisals of certainty and control. The effects of different emotions warrant further study. Specifically, future research efforts should further investigate the specific roles of different emotions in risk responses and risk-related information behavior. Considering the fact that this research area is rather young in the risk psychology literature in general and the risk information seeking literature specifically, continued attention in future risk studies is required (McComas, 2006). Evoking affect (without necessarily raising fears) may be an efficient way of motivating risk prevention or mitigation through the gathering of additional information. It can be concluded that emotions operate in parallel with cognition and can even override analytical reasoning in risk-related behavior (McComas, 2006). Cognitive needs are draped in affective responses so that they are as much felt as they are thought about.

Social Utility: Informational Subjective Norms

The social utility of risk information reflects the need for information as it is perceived useful in social relationships. Social utility refers to the notion of subjective social norms in which people may perceive that others expect them to be knowledgeable about the risk topic. That is, those perceiving greater pressure from other relevant people to stay on top of information about an issue are directly motivated to seek relevant risk information. Although seemingly quite counterintuitive to the study of risk information seeking to date, which generally assumes that the effect of social norms on information behavior decisions is mediated by information sufficiency (Griffin, Dunwoody, & Neuwirth, 1999), this direct relationship could be explained by a broad range of theories.

First, in risk perception research it is assumed that risks exist in a social context (Johnson, 1987) and risks are socially constructed (Slovic, 1998). That is, risks cannot be viewed as individual entities with objective dangers. Instead, risk judgments stem from subjective evaluations, social, political, and psychological factors. Accordingly, Slovic (1998) posits that the complex context in which risks exist leads to a "contextualist view". Johnson's (1987) social context approach to risk, for example, assumes that "relationships with other people affect the degree to which individuals attend to, understand, and use information about risks" (p. 103). That is, the social context in which risks exist could affect how people respond to risks and ultimately influence the extent to which they attend to and search for information about risks. For example, a substantial amount of governmental or mass media attention might lead to a socially constructed image of a certain risk. In such cases, people might get a stronger sense that others expect them to

be knowledgeable since the topic attracts a great deal of (media) attention and therefore is of greater significance from a social perspective.
From the social-psychological literature, the association between subjective norms and intended behavior can be explained by the theory of planned behavior (TPB; Ajzen, 1991; Ajzen & Fishbein, 2005). According to TPB, normative beliefs reflect one's subjective norms regarding the issue at hand. According to Kahlor (2007), subjective norms seem to shift in their role depending on the degree to which a risk poses a direct personal threat to the person. In cases of impersonal risks, informational subjective norms tend to be more strongly associated with information seeking in a more direct way (Kahlor et al., 2006; Kahlor, 2007). Kahlor (2007) and Kahlor et al. (2006) have forwarded explanations for these findings. First, they suggest that subjective norms could reflect "social interest", a term originating from the knowledge gap literature (Genova & Greenberg, 1979, p. 89). Kahlor (2007) concluded that "in the absence of an immediately perceptible personal impact, these considerations may play an increasingly important role in information seeking" (p. 431). This conclusion corresponds with the notion that the individual's social environment might increase the desire to gain knowledge by seeking information (Radecki & Jaccard, 1995), as this information could be helpful in social relationships. Furthermore, this conclusion links to the aspect of social desirability (see Chapter 2). People compare their abilities with other people's abilities and desire social approval and liking (Eagly & Chaiken, 1993). In such cases, individuals might be motivated to comply with other people's expectations and, therefore, think they should gather additional information.

Whereas risk perception studies widely acknowledge the influence of social context on risk responses, the adoption of social factors directly associated with risk-related information behavior is rather new. The study reported in Chapter 2 examined the social influence in terms of the individual's relationships with other people. In other words, the items reflected a common factor of how much weight the respondent placed on other people's behaviors or opinions. The observed effect might relate to one's motivation to comply with normal expectations of relevant others. In Chapters 3 and 4, the items used to assess social influence more specifically reflected one's expectations of relevant others to be knowledgeable about the topic. As such, this measure was more closely held to the specific context of risk information. However, since wordings were slightly different between the studies reported in Chapters 3 and 4, different results were found with respect to the magnitude of the effect. That is, the Dutch sample in Chapter 3 did not show a significant direct association between subjective norms and intended information behavior. This finding might be due to the fact that in the original Dutch sample these items were drawn from a measurement scale capturing a number of items that, although covering similar content, were not exact translations from the ones used in the Milwaukeean questionnaire. Chapter 4 then built on the development of the measurement instrument and reflects the most clearly written and specific items which could be used for future efforts to assess informational subjective norms in risk research.

In sum, informational subjective norms play a major role in risk-related information behavior. If individuals sense some social pressure to learn how to deal with potential hazards, or otherwise feel that being knowledgeable about a risk is part of their social role, they are more likely to engage in active risk information seeking. This might provide input for risk communication efforts in a sense that addressing these norms may be effective for encouraging people to seek information about risks, apart from necessarily raising their anxiety or sufficiency thresholds.

6.2.3. Information Behavior Decisions

As described in Chapters 1 and 4, individuals facing a threatening situation or a specific risk may respond differently to information about it. In general, a person may decide to perform one out of two modes of information behavior. Specifically, either s/he may decide to seek additional information, or s/he may decide to back away and try to avoid such information in the future. However, no general consensus about how these two types of behavior are connected is yet established among scholars. In information behavior studies (Wilson, 1999; Godbold, 2006), the avoidance of information is merely referred to as reflecting a lack of motivation to seek information. In such cases, information seeking and avoidance are regarded as equivalent (see Myers & Derakshan, 2000), with high scores on information seeking, by definition, resulting in low scores on avoidance, and vice versa. In contrast, some scholars claim that the avoidance of information is conceptually distinct from information seeking (Case et al., 2005; Kahlor et al., 2006), since low seekers are not necessarily high avoiders. Myers & Derakshan (2000), for example, found that those unlikely to distract themselves from additional information did not represent information seekers, which counters definition. One may conclude that avoidance includes the two information rejection modes of active (avoidance) and passive (distraction) rejection. The results of Chapter 4 indicate that avoidance and seeking with respect to external safety issues were strongly correlated, with those reporting stronger intentions to gather additional risk information being less likely to avoid such information, and vice versa. As such, information avoidance and information seeking could be considered counterparts.

The current studies found that deciding to avoid information could generally be captured by predictor variables similar to those affecting intentions to seek information. Tests of the framework of risk information seeking (Chapter 4) showed that both seeking and avoidance were significantly associated with the proposed antecedents and in the predicted direction. However, different patterns in predicting coping style were found with respect to the magnitude of the associations. Whereas negative emotions were the strongest predictors of intended seeking behavior, they had less an impact on deciding to refuse additional information. A possible explanation could lie in the magnitude and nature of affective responses assessed in this study. People did not get extremely anxious, scared, or worried when faced with external safety hazards in their surroundings. Also, the measures used to assess affective responses did not reflect extreme emotions, such as fear or panic. Studies described in the fear appeal literature state that fear might lead to total message rejection (Witte, 1992; 1994). The affective responses currently assessed possibly represent a different dimension of emotions. This seems especially reasonable since current studies found a

negative effect of emotion on information avoidance. Rather, it seems that some elevated level of emotions (such as worry) is needed to prompt people to seek information.

Information sufficiency, on the other hand, surfaced as the strongest predictor of deciding to avoid information. Those who were more satisfied with the amount of information held were more likely to engage in information avoidance behavior. An information gap perceived to be too small in size instantly discouraged information seeking behavior (Godbold, 2006). In such cases, individuals do not feel the urge to seek information because (1) they know there is a gap, but they feel they can deal with it, (2) people tell them there is a gap, but they can justify to themselves there is no gap, and (3) the relative importance of the gap can be minimized (Godbold, 2006). This implies that with respect to external safety issues information avoidance stems from a lack of a motivation to seek information. A possible explanation could be that the perceived importance of reducing an information gap is dependent on issue salience of the topic to the individual. The study reported in Chapter 4 found that information sufficiency was strongly associated with both involvement and self-efficacy. Thus, sensing that the topic is of minor personal interest or feeling quite capable of coping with the hazard may result in the idea that learning more about the topic is unnecessary. In turn, people perceive higher levels of information sufficiency and do not want to learn more about the topic. This idea might capture some form of optimistic bias, which refers to the tendency of people to believe that they are less at risk than others (Klein & Helweg-Larsen, 2002; Helweg-Larsen & Shepperd, 2001). A consistent finding within the optimistic bias literature is that greater perceived control over an issue or its outcome is associated with greater optimistic bias (Harris, 1996; Klein & Helweg-Larsen, 2002). This association was found to be even stronger among people who are less at risk as opposed to higher risk samples (Klein & Helweg-Larsen, 2002). Lower risk samples, in turn, will be less involved in the topic. Another situation in which a knowledge gap appears to be too small is when the perceived social pressure to be knowledgeable about the topic is lacking. Hence, the individual will not be motivated to reduce a possible gap, since it is not perceived useful or necessary in social relationships. This might occur when the issue at stake does not get any attention in the mass media, or the topic does not appeal to the interest of relevant others. When the information gap is small enough to ignore, either due to low levels of involvement or higher perceived personal control, the relative importance of information lacks and people will not even start information seeking. Rather, they decide to avoid such information. It then seems that the evaluation of the information insufficiency perceived by the individual is subject to a cost-benefit analysis before deciding to seek or avoid information.

Risk-related information behavior cannot be fully explained by a model. Information seeking may not occur at all when certain (external or internal) barriers in the process of information gathering interrupt the process. The criteria for making risk-related information choices may be influenced as much by environmental constraints, such as information available, requirements of the problem, time needed to come to resolution, or the relevancy of the content of the information retrieved (Kuhlthau, 1991). Many decisions are made with incomplete information or on the basis of beliefs (Wilson, 2006). People may not be able to see how to search usefully, they may not understand the

problem well enough or they may be unable to imagine the possibility of a solution. Furthermore, a danger may be felt that more information would decrease understanding of the risk topic in a manner beyond his or her power to navigate the risk. For example, a person may realize that the information he or she has encountered may be the "tip of the iceberg" and, therefore, decide to not even start the information search. These barriers or constraints may influence the adoption of risk-related information behavior but cannot be fully appreciated by a theory-based model. In contrast, risk communication efforts should focus on the antecedents of risk-related behavior which might be affected and stimulated in, for example, mass-media campaigns aimed at stimulating people to gather additional information about external safety.

6.3. Applying FRIS in Risk Research

6.3.1. The Risk Context

The current studies focused on the risks associated with handling, using, storing, and transporting hazardous industrial chemicals. The applicability of FRIS may be extended beyond its initial focus on external safety issues. The specific constructs captured by the model might apply to a wide range of risks, and are not confined to the boundaries of the risks involved in industrial chemicals. The model is falsifiable since it builds on existing theories and causal relationships from relevant theories, which have produced findings consistent with the current studies. Employing the specific constructs of the model to different types of risks might generate valuable insights into the topic under study. This raises the question of how the relationships depicted in FRIS will surface when applied to other types of risks. Examples include more personal risks, such as food-poisoning, illness-related issues, or sexual behavior. Although the mechanisms may differ from population to population and from situation to situation, the applicability of the model might continue to be valuable in different risk contexts. Since the components of the framework are constructed to represent mechanisms that specifically determine the individual's risk-related information behavior decisions, only the underlying indicators of the construct have to be reformulated for applicability in the context of the particular risk of interest.

6.3.2. Applicability of SEM

In the process of developing FRIS the studies reported in Chapters 2, 3, and 4 employed some form of structural equation modeling (SEM) for different analytical purposes. SEM is now a regularly used method for testing dependency or causal relations in the behavioral and social sciences (McDonald & Ringo Ho, 2002; Byrne, 2001; Kline, 2005), so a variety of procedures were employed in the current studies. In the context of risk-related information behavior, this approach is rather new to model development, and most studies still employ either a multiple regression approach (for example, see Griffin et al., 2008; Kahlor et al., 2003; Kahlor et al., 2006) or a one-shot SEM analysis (Johnson, 2005; Kahlor, 2007).

First, SEM was used for scale construction and scale refinement purposes (Chapter 2). Whereas the standard statistical techniques for evaluating a measurement instrument involve exploratory factor analysis, SEM was applied for confirmatory factor analysis purposes. In doing so, the measurement of latent variables relevant for the current studies could be evaluated and improved. This is of utmost importance in assessing psychological and theoretical constructs that can neither be observed nor assessed directly (Byrne, 2001). As such, operationally well-defined latent variables of interest increase the likelihood of actually measuring the behavior believed represented by the items.

Second, SEM was used for conducting multiple-sample path analysis. The ability to analyze a structural model across multiple samples, as reported in Chapter 3, is a unique feature of SEM compared to more traditional statistical procedures. In doing so, the opportunity was created to validate the hypothesized model across independent samples. Because that study focused on cross-validating the hypothesized causal relationships between relevant constructs, path analysis was employed. Path analysis allows testing of models of relationships among manifest variables, and no latent variables are included in the model. It is commonly used when manifest variables are of primary interest or when multiple indicators of latent variables are not available (McCallum & Austin, 2000). Since the main focus of the multiple sample study was to evaluate the validity of the hypothesized paths coefficients for regression of one variable onto another variable, scale scores were included in the analyses. By using scale scores, measurement error was not taken into account in the analysis. In this fashion, modeling was more closely related to the procedure of regression analysis. This means that outliers cannot be attributed to ambiguous items.

Third, the study reported in Chapter 4, presented the full structural equation model of the framework of risk information seeking. As such, both measurement and path models were included in the analyses. For full model testing purposes, this approach is preferred over a regression approach or observed variable SEM approach because it allows for the estimation of measurement error (Stephenson & Holbert, 2003). In addition, a "fully latent" model is highly desirable because it implies multiple-indicator measurement since each of the variables in its structural model is latent (Kline, 2005). In testing the full model, a good fit for the current framework was found. This finding indicates that (1) the model under study is well suited to explain the data from the study sample and (2) that the latent variables of interest are operationally well-defined.

6.3.3. Cross-Sectional Data based on Self-Reported Measures

The current studies are cross-sectional by design, which is a single-occasion snapshot of a system of variables and constructs (MacCallum & Austin, 2000). The key features are the concurrent measurement of variables and the fact that no firm conclusions regarding the causal effects can be made. Since the measurement took place at a single point in time, it cannot be determined whether the conclusions apply for the long term. However, the results of the different studies reported in this thesis, based on multiple samples, presented relatively similar insights and rather similar results on the causality and strengths of associations depicted by the model. Therefore,

one may assume that these results reflect a solid view of reality.

To further explore the validity of the present results, two additional research approaches may be valuable in future testing of FRIS. First, a longitudinal study could provide a more decisive answer as to whether the conclusions of this research still apply in the long term. Second, causality testing might be queried through conducting experimental research. Since the present studies rely on self-reported data, no firm conclusions can be drawn as to whether people respond and act in response to the issue as stated in their survey responses. A closer examination of the relationship between intended risk-related information behavior and actual behavior is needed. Although the results of the various studies more or less confirmed the results and insights that emerged from previous work, future studies could use a multi-method approach to unravel the complex relationship between an individual's behavior and risk information.

6.3.4. Risk Responses and Information Behavior - Information Behavior and Risk Responses

This thesis, following the receiver-oriented approach to risk communication, should be seen as an attempt to contribute to the receiver-oriented risk communication literature by providing additional insights into the individual and social-psychological processes underlying risk-related information behavior of individual citizens. As information seeking should be approached as an important input for developing future risk communication efforts, its role within the entire communication process needs additional research. A two-way communication of risks includes an evaluation of the communication efforts executed, for example, by actively listening to audience's needs and wants (Walker et al., 1999). As a consequence, the recipient should be considered to be in a central position in the communication process (see also Figure 1.2 in Chapter 1). Future studies could shed light on how initial responses to risks (the risk awareness factors) are influenced by risk information and risk information behavioral decisions. Since it is assumed that seeking additional information changes one's knowledge levels, attention must be given to the individual changed by this further information (Godbold, 2006). How are people's responses to and evaluations of risks affected by information? The model points to the complex relationship between knowledge and information in which one does not just add information to change knowledge in some predictable way. Rather, outcomes are dependent on the individual's information use and processing strategies employed. That is, do people actually elaborate on the information and knowledge gained by adopting preventive behaviors and taking protective actions in the future?

6.4. Practical Implications

Each individual's risk information seeking behavior is multidimensional, varies across times and contexts, and can be stimulated by effective risk communication efforts. From these conclusions, some valuable implications for risk communication practice can be proposed.

6.4.1. Address the Unstable Nature of Information Needs

The results of this dissertation highlight the importance of providing risk information that is permanently available to audience members, in order to allow them to learn more on a topic whenever perceived necessary. FRIS provides the audience-based approach to risk communication and acknowledges the multidimensionality of risk-related information behavior driving forces. That is, the basic goals one seeks to achieve by seeking information consist of a variety of information utilities for specific purposes. These utilities might change over time and situations. Various factors described in the current model affect the need for information as well as the information behavior processes. But what is ultimately most important is the recognition that different people have different informational needs and that these needs can vary across times and contexts. Because of this varying intensity of information needs, information seeking behavior varies as well. With greater needs for information, such as when making a major decision or being worried about an issue, people may do everything they can to satisfy their desire for input. After the need for information is met (or the person give ups) one returns to a more passive state of information seeking (Case, 2007). In addition, when a topic becomes more important or salient in one's live, the information seeking fashion will become more active, such as in the time following an accident involving industrial chemicals in one's neighborhood or with major changes in external safety issues in the community. These types of information seeking could be characterized as active risk information seeking. In such cases, one will end up in a more non-routine mode of information seeking, such as consulting the Internet, or retrieving information from local government agencies. When issue saliency declines, people are less motivated to search actively beyond the habitual information seeking mode and will return to a more passive, routine seeking mode. Therefore, the permanent availability of risk information supplied in different formats and through different media is ultimately important to facilitating the variety of information needs to the public and could contribute external safety issues to more active and involved audiences.

6.4.2. Impersonal Risks as Personal Relevant Risks

External safety issues comprise environmental risks and, therefore, could be classified as "impersonal risks". Impersonal risks are those risk issues not posing a direct threat to the self or loved ones (Griffin et al., 2008; Kahlor, 2007; Kahlor et al., 2006). Examples include global warming and environmental pollution. As such, impersonal risks are seen as less voluntary in the sense that one chooses not to be exposed to a specific risk, as is the case with more personal risks, such as smoking and dietary issues. Therefore, the motivation to mitigate risks and the perceived relevance is most often lower than personal risks. As described by Eagly & Chaiken (1993) in their Heuristic-Systematic Model, people are motivated to put more effort into reaching a sufficient level of knowledge about an issue when the topic becomes personally relevant. Although its impact has been widely acknowledged in various fields of health risk communication (Alazsweski, 2005), research on environmental risk communication has paid significantly less attention to personal relevance (Kahlor et al., 2006). The studies reported in Chapters 2 and 4 found that personal relevance (the significance of a topic to one's personal situation (Rucinski, 2004)) together with involvement (the individual's perception that a topic is important to them and that

the issue affects their self-interest (Heath, Liao, & Douglas, 1995)) significantly increased risk perception and risk information needs regarding risks from hazardous industrial chemicals that, in turn, affect intentions to seek information. Particularly in the context of industrial risks, which are or could become relevant for many people to some extent, the level of perceived personal relevance might play a part in predicting information needs and information seeking behavior. Research conducted in the mid 1980s highlighted the relative importance of personal relevance in effective risk communication. Keeney and Von Winterfeldt (1986), for example, recommended a paradigm shift in which risk communication primarily focuses on the personal relevance of the risks for the lay public. They question the quantitative approach (i.e., objective risk assessments by numbers) for risk communication employed by many communication practitioners. This quantitative approach to communicating risks generally neglected the more qualitative content, which is more meaningful to the lay audience. Gutteling (1991), for example, found that risk estimates by means of numbers do not correlate with risk perception. This premise was supported by Covello, Von Winterfeldt, and Slovic (1986), who stated that:

> "Most federal regulatory agencies view risk problems from a societal or macro-perspective. As a result, most analyses by government agencies provide only aggregate or population statistics for the community or nation as a whole. Aggregate or population statistics are, however, usually of little interest to individual citizens, who are most likely to view risks from a micro-perspective and to be more concerned about risks to themselves or to their loved ones than about risks to society or the community as a whole." (p. 177).

According to these views, in order for risk communication to have its intended effect, messages should address the perceived personal relevance of the topic to the individual. As was found in the studies described in Chapters 2 and 4 of this thesis, people feeling more engaged in a topic have a stronger need for information, whether that is cognitive, affective, or social. As such, risk messages regarding external safety issues are expected to better appeal to the members of the target audience when their personal relevance is addressed. That is, risk information provision should primarily be developed and executed at the local level, and directed at area residents in specific communities or cities. In such cases, people would perceive the messages to be of personal importance to them, since they are the specific target group. To reach a certain level of perceived personal relevance, communicators may profit from first putting effort into building interest in the topic before trying to influence knowledge or behaviors. As was concluded from the study reported in Chapter 5, individual citizens primarily require more qualitative information. For example, they want to know what they could do themselves to protect them self and others from possible harm and where they could go for additional information on the issue. However, by providing such information to the public, they might be less motivated to stay on top of information in the future, since elevated levels of self-efficacy are positively associated with information sufficiency, which in turn, bears a negative influence on intended seeking efforts. This outcome could be prevented by making risk issues more personally relevant and making the audience feel that the issue of external safety is important to them. Such appeals are likely to have an impact on the likelihood that audiences will attend more to available risk information – even in the absence of a compelling personal threat.

6.4.3. Use the Receiver-Oriented Approach to Educate the Public

Chapter 5 presented some informational preferences among members of the target audience. Attention should be paid to the perceived personal control of the receiver. The current results suggest that people primarily require information about what one could do to exert personal control over the risk or the possible outcomes. Researchers and risk communication practitioners should be reminded of the importance of an audience-based perspective in risk communication. In general, that means understanding how non-experts evaluate risk information, how they use information to make decisions about risk, and generally providing audience members with the information they need rather than giving them only what the experts feel they should have. The individual is actively involved in finding meaning that fits with what he or she already knows, which is not necessarily the same answer for all, but makes sense within a personal frame of reference. Information from various sources is assimilated into what is already known through a series of choices. Formal organized sources interact with informal sources from everyday life experiences (Kuhlthau, 1991). The personal meaning that the user seeks from the information becomes as critical a consideration for risk communication design. As such, risk communication practice is not a case of "one size fits all", but should address the specific situation for each community. These communication efforts will always have to compete with other contents.

However, it is important to recognize that no single approach to risk communication will do. Attention to the conveyance of quantitative information must go hand-in-hand with attention to the role of contextual factors in affecting risk perception and in raising issues not addressed by the quantitative information. To assume that the audience's need for specific information is all, and there is no objective knowledge that should be communicated, is as blind as assuming that only quantitative data are salient. For example, when public risk perceptions regarding a chemical plant exceed real risks and could therefore be seen as blown out of proportions, this discrepancy needs to be addressed in information supplies. In such cases, effective information supplies could be employed to reduce public concerns (Rohrmann, 2000). Such an educating approach could be accepted by the public to a certain extent, provided that the education process is mutual and takes account of public concerns (Renn & Levine, 1991). The challenges here involves making people want or need that objective information as well by effective communication efforts.

6.5. Conclusion

This thesis, following the receiver-oriented approach to risk communication, provides an in-depth analysis of the reasons why and how people are motivated to search for additional risk information through various information channels. It adds to our understanding of the role of various psychological factors to risk-related information behavior and suggests important directions for future research. A model representing risk-related information behavior decisions should incorporate three realms of activity, including cognitive - evaluation of one's information shortcomings; affective - feelings experienced; and social - subjective norms. Risk communication

and risk psychology researchers could apply this model in further examining risk-related information behaviors in a wide array of risks. Communication practitioners could profit from this framework in applying a more receiver-oriented approach to risk communication efforts. Sustained exploration into the nature of risk information seeking process as it relates to a receiver-oriented approach, greater recognition of available communication options and continued testing of the FRIS model in various contexts will contribute in important ways to our understanding of individuals as risk information seekers.

References

Afifi, W.A. & Weiner, J.L. (2006). Seeking Information About Sexual Health: Applying the Theory of Motivated Information Management. *Human Communication Research,* 32, pp. 35-57.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes,* 50, pp. 179-211.

Ajzen, I., & Fishbein, M. (2005). The Influence of Attitudes on Behavior. In D. Albarracín, B. T. Johnson, & M. P. Zanna (Eds.). *The Handbook of Attitudes,* pp. 173–221. Mahwah, NJ: Erlbaum.

Andrews, J.C., Durvasula, S., & Akhter, S.H. (1990). A Framework for Conceptualizing and Measuring the Involvement Construct in Advertising Research. *Journal of Advertising,* 19 (4), pp. 27-40.

Apsler, R. & Sears, D.O. (1968). Warning, Personal Involvement, and Attitude Change. *Journal of Personality and Social Psychology,* 9 (2), pp. 162-166.

Boholm, A. (1998). Comparative Studies of Risk Perception: A review of Twenty Years of Research. *Journal of Risk Research,* 1 (2), pp. 135-163.

Bosman, J. & Renckstorf, K. (1996). Information Needs: Problems, Interests, and Consumption. In K. Renckstorf (Ed.), *Media Use as Societal Action,* pp. 43-52. London: John Libbey.

Byrne, B.M. (2001). *Structural Equation Modeling with Amos: Basic Concepts, Applications, and Programming.* Mahwah, N.J.: Erlbaum.

Campbell, I. (2000). *The Ostensive Model of Developing Information Needs.* Glasgow: University of Glasgow.

Case, D.O., Andrews, J.E., Johnson, D.E., & Allard, S.L. (2005). Avoiding versus Seeking: The Relationship of Information Seeking to Avoidance, Blunting, Coping, Dissonance, and Related Concepts. *Journal of the Medical Library Association,* 93 (3), pp. 353-362.

Case, D.O. (2007). *Looking for Information. A Survey of Research on Information Seeking, Needs, and Behavior.* San Diego, CA: Academic Press.

Celsi, R.L. & Olson, J.C. (1988). The Role of Involvement in Attention and Comprehension Processes. *Journal of Consumer Research,* 15, pp. 210-224.

Cho, H. & Boster, F.J. (2005). Development and Validation of Value-, Outcome-, and Impression-Relevant Involvement Scales. *Communication Research,* 32 (2), pp. 235-264.

Covello, V. T., Von Winterfeldt, D., & Slovic, P. (1986). Risk Communication: A Review of the Literature. *Risk Abstracts* 3 (4): 172–182.

Duncan, O.D. (1975). *Introduction to Structural Equation Models.* New York: Academic Press.

Eagly, A.H. & Chaiken, S. (1993). *The Psychology of Attitudes.* San Diego: Harcourt Brace.

Ellis, D., Wilson, T.D., Ford, N., Foster, A., Lam, H.M., Burton, R., & Spink, A. (2002). Information Seeking and

Mediated Searching. Part 5. User-Intermediary Interaction. J*ournal of the American Society for Information Science and Technology,* 53 (11), pp. 883-893.

Finucane, M. L., Alhakami, A., Slovic, P., & Johnson, S. M. (2000). The Affect Heuristic in Judgments of Risks and Benefits. *Journal of Behavioral Decision Making*, 13, pp. 1-17.

Genova, B., & Greenberg, B. (1979). Interest in the News and the Knowledge Gap. *Public Opinion Quarterly,* 43, pp. 79-91.

Godbold, N. (2006). Beyond Information Seeking: Towards a General Model of Information Behavior. Information Research, 11(4), paper 269 (available at http://InformationR.net/ir/11-4/paper269.html).

Gregory, R., Slovic, P., & Flynn, J. (1996). Risk Perceptions, Stigma, and Health Policy. *Health & Place,* 2 (4), pp. 213-220.

Griffin, R.J., Dunwoody, S., & Neuwirth, K. (1999). Proposed Model of the Relationship of Information Seeking and Processing to the Development of Preventive Behaviors. *Environmental Research,* 80, pp. S230-245.

Griffin, R.J., Neuwirth, K., Giese, J., & Dunwoody, S. (1999). The Relationship of Risk Information Processing to Consideration of Behavioral Beliefs. *Proceedings of the Annual Meeting of the Association for Education in Journalism and Mass Communication.* New Orleans, Louisiana: August, 3-8.

Griffin, R.J., Neuwirth, K., Dunwoody, S., & Giese, J. (2004). Information Sufficiency and Risk Communication. *Media Psychology,* 6, pp. 23-61.

Griffin, R.J., Yang, J., Ter Huurne, E., Boerner, F., Ortiz, S. and Dunwoody, S. (2008). After the Flood: Anger, Attribution, and the Seeking of Information. *Science Communication,* 29 (3), pp. 285-315.

Harris, P.R. (1996). Sufficient Grounds for Optimism? The Relationship between Perceived Controllability and Optimistic Bias. *Journal of Social and Clinical Psychology,* 15, pp. 9-52.

Heath, R.L., Liao, S., & Douglas, W. (1995). Effects of Perceived Economic Harms and Benefits on Issue Involvement, Use of Information Sources, and Actions: A Study in Risk Communication. *Journal of Public Relations Research,* 7(2), pp. 89-109.

Helweg-Larsen, M. & Shepperd, J.A. (2001). Do Moderators of the Optimistic Bias Affect Personal or Target Risk Estimates? A Review of the Literature. *Personality and Social Psychology Review,* 5 (1), pp. 74-95.

Johnson, B.B. (1987). Accounting for the Social Context of Risk Communication. *Science & Technology Studies,* 5 (3/4), pp. 103-111.

Johnson, B.B. (2005). Testing and Expanding a Model of Cognitive Processing of Risk Information. *Risk Analysis,* 25(3), pp. 631-650.

Kahlor, L.A., Dunwoody, S., Griffin, R.J., Neuwirth, K., & Giese, J. (2003). Studying Heuristic-Systematic Processing of Risk Communication. Risk Analysis, 23 (2), pp. 355-368.

Kahlor, L.A., Dunwoody, S., Griffin, R., & Neuwirth, K. (2006). Seeking and Processing Information about Impersonal Risk. *Science Communication,* 28, pp. 163-194.

Kahlor, L.A. (2007). An Augmented Risk Information Seeking Model: The Case of Global Warming. *Media Psychology,* 10, pp. 414-435.

Keeney, R. L., and Von Winterfeldt, D. (1986). Improving Risk Communication. *Risk Analysis,* 6 (4), pp. 417–424.

Klein, C.T.F. & Helweg-Larsen, M. (2002). Perceived Control and the Optimistic Bias: A Meta-Analytic Review. *Psychology and Health*, 17 (4), pp. 437-446.

Kline, R.B. (2005). *Principles and Practice of Structural Equation Modeling.* 2nd Edition. New York: Guilford Press.

Kuhlthau, C.C. (1991). Inside the Search Process: Information Seeking from the User's Perspective. *Journal of the American Society for Information Science*, 42(5), pp. 361-371.

Kuttschreuter, M. (2006). Psychological Determinants of Reactions to Food Risk Messages. *Risk Analysis*, 26 (4), pp. 1045-1057.

Lerner J.S. & Keltner, D. (2001). Fear, Anger, and Risk. *Journal of Personality and Social Psychology,* 81(1), pp. 146-159.

Leiss, W. (1996). Three Phases in the Evolution of Risk Communication Practice. *Annals AAPSS*, 545, pp. 85-94.

Lion, R., Meertens, R.M., & Bot, I. (2002). Priorities in Information Desire about Unknown Risks. *Risk Analysis,* 22 (4), pp. 765-776.

Loewenstein, G.F., Weber, E.U., Hsee, C.K., & Welch, N. (2001). Risk as Feelings. *Psychological Bulletin,* 127(2), pp. 267-286.

MacCallum, R.C. & Austin, J.T. (2000). Applications of Structural Equation Modeling in Psychological Research. *Annual Review of Psychology,* 5, pp. 201-226.

McComas, K.A. (2006). Defining Moments in Risk Communication Research: 1996-2005. *Journal of Health Communication,* 11, pp. 75-91.

McDonald, R.P. & Ringo Ho, M-H. (2002). Principles and Practice in Reporting Structural Equation Analyses. *Psychological Methods*, 7 (1), pp. 64-82.

Miller, S.M. (1987). Monitoring and Blunting: Validation of a Questionnaire to Assess Styles of Information Seeking under Threat. *Journal of Personality and Social Psychology,* 52 (2), pp. 345-353.

Myers, L.B. & Derakshan, N. (2000). Monitoring and Blunting and an Assessment of Different Coping Styles. *Personality and Individual Differences*, 28, pp. 111-121.

Nordin, K., Liden, A., Hansson, M., Rosenquist, R., & Berglund, G. (2002). Coping Style, Risk Perception, and Satisfaction in Subjects Attending Genetic Counseling for Hereditary Cancer. *Journal of Medical Genetics,* 39, pp. 689-694.

Radecki, J.M., & Jaccard, C. (1995). Perceptions of Knowledge, Actual Knowledge and Information Search

Behavior. *Journal of Experimental Social Psychology,* 31, pp. 107-138.

Recchia, V. (1999). *Risk Communication and Public Perception of Technological Hazards* (Part One). FEEM Working Paper, No. 81-99.

Renn, O. & Levine, D. (1991) Credibility and Trust in Risk Communication. In R.E. Kasperson and P.J.M. Stallen (Eds.). *Communicating Risks to the Public,* pp. 175–214, Kluwer, Dordrecht.

Rimal, R.N. & Real, K. (2003). Perceived Risk and Efficacy Beliefs as Motivators of Change. Use of the Risk Perception Attitude (RPA) Framework to Understand Health Behaviors. *Human Communication Research*, 29 (3), pp. 370-399.

Rioux, K. (2005). Information Acquiring-and-Sharing. In K.E. Fisher, S. Erdelez & L. McKechnie (Eds.). *Theories of Information Behavior,* pp. 169-173. Medford, N.J: Information Today, Inc. (ASIST Monograph Series).

Rohrmann, B. (2000). A Socio-Psychological Model for Analyzing Risk Communication Processes. *Australasian Journal of Disaster Studies*, 2000-2. Retrieved March 12, 2008 from http://www.massey.ac.nz/~trauma/issues/2000-2/rohrmann.htm.

Rowan, F. (1996). The High Stakes of Risk Communication. *Preventive Medicine,* 25, pp. 26-29.

Rucinski, D. (2004). Community Boundedness, Personal Relevance, and the Knowledge Gap. *Communication Research*, 31(4), pp. 472-495.

Savolainen, R. (2005). Everyday life information seeking. In K. E. Fisher, S. Erdelez & L. McKechnie (Eds.), *Theories of information behavior* (pp. 143-148). Medford, N.J: Information Today, Inc. (ASIST Monograph Series).

Sjöberg, L. (1998). Worry and Risk Perception. *Risk Analysis,* 18 (1), pp. 85-93.

Slovic, P., Fischhoff, B., & Lichtenstein, S. (1981). Perceived Risk: Psychological Factors and Social Implications. *Proceedings of the Royal Society of London. Series A, Mathematical and Physical Sciences,* 374 (1764), pp. 17-34.

Slovic, P. (1987). Perception of Risk. *Science,* 236, (4799), pp. 280-285.

Slovic, P. (1993). Perceived Risk, Trust, and Democracy. *Risk Analysis*, 13 (6), pp. 675-682.

Slovic, P. (1998). The Risk Game. *Reliability Engineering and System Safety,* 59, pp. 73-77.

Slovic, P. (1999). Trust, Emotion, Sex, Politics, and Science: Surveying the Risk Assessment Battlefield. *Risk Analysis,* 19 (4), pp. 689-701.

Slovic, P., Finucane, M.L., Peters, E., & MacGregor, D. (2004). Risk as Analysis and Risk as Feelings: Some Thoughts about Affect, Reason, Risk, and Rationality. *Risk Analysis,* 24,(2), pp. 311-322.

Tichenor, P.J., Donohue, G.A., & Olien, C.N. (1970). Mass Media Flow and Differential Growth in Knowledge. *The Public Opinion Quarterly,* 34(2), pp. 159-170.

Trumbo, C.W. (1997). Heuristic-Systematic Processing and Risk. *Paper presented to the Association for Education in Journalism and Mass Communication annual convention, Chicago, Ill.*

Turner, M., Rimal, R., Morrison, D., & Kim, H. (2006). The Role of Anxiety in Seeking and Retaining Risk Information: Testing the Risk Perception Attitude Framework in Two Studies. *Human Communication Research,* 32, pp. 130-156.

Weinstein, N.D. (1984). Why it Won't Happen to Me: Perceptions of Risk Factors and Illness Susceptibility. *Health Psychology,* 3, pp. 434-457.

Weinstein, N.D. (1989). Optimistic Biases about Personal Risks. *Science,* pp. 1232-1233.

Williams, B.L., Brown, S., & Greenberg, M. (1999). Determinants of Trust Perceptions among Residents Surrounding the Savannah River Nuclear Weapons. *Environment and Behavior,* 31 (3), pp. 354-371.

Wilson, T.D. (1981). On User Studies and Information Needs. *Journal of Documentation*, 37 (1), pp. 3–15.

Wilson, T.D. and Walsh, C. (1996). *Information Behaviour: An Interdisciplinary Perspective.* Sheffield: University of Sheffield Department of Information Studies.

Wilson, T.D. (1999). Models in Information Behavior Research. *The Journal of Documentation,* 55 (3), pp. 249-270.

Wilson, T.D. (2006). A Re-Examination of Information Seeking Behaviour in the Context of Activity Theory. *Information Research,* 11 (4), paper 260 [Available at http://Information R.net/ir/11-4/paper260.html].

Witte, K. (1992). Putting the Fear back in Fear Appeals: The Extended Parallel Process Model. *Communication Monographs,* 59, pp. 329–349.

Witte, K. (1994). Generating Effective Risk Messages: How Scary Should your Risk Communication be? In B. Burleson (Ed.). *Communication Yearbook,* 18. Thousand Oaks, CA: Sage, pp. 229-254.

Samenvatting

In de huidige risicosamenleving, met mondige burgers en een groeiende bezorgdheid over de blootstelling aan risico's in het alledaagse leven is een belangrijke rol weggelegd voor communicatie over die risico's. Mensen weten zelden veel over de risico's waaraan zij in het dagelijks leven worden blootgesteld. Bij velen zal bijvoorbeeld de kennis over externe veiligheidsrisico's niet verder gaan dan dat het iets te maken heeft met 'gevaarlijke industriële stoffen'. Blootstelling aan externe veiligheidsrisico's is in de moderne, geïndustrialiseerde samenleving echter onontkoombaar. Een adequate communicatie over deze risico's wordt gezien als belangrijk middel om bij te dragen aan een veiliger samenleving. Uitgangspunt is dat een effectieve risicocommunicatie er toe kan leiden dat mensen beter geïnformeerd zijn over de externe veiligheid in hun omgeving en de bijbehorende risico's. Een grotere kennis en risicobewustzijn zullen er toe leiden dat burgers beter in staat zijn adequaat te reageren op risicovolle situaties of rampen. Daarmee kunnen gevoelens van onveiligheid worden gereduceerd en zal de samenleving uiteindelijk een stukje veiliger worden.

Het effectief communiceren over externe veiligheidsrisico's blijkt echter een moeizaam proces te zijn. De relatief jonge discipline van risicocommunicatie heeft de afgelopen jaren een grote verandering doorgemaakt. In de laatste decennia is duidelijk geworden dat de traditionele, 'top-down benadering', d.w.z. het eenvoudigweg vertellen van de 'objectieve waarheid' over risico's, niet volstaat. Groeiende inzichten in en veranderende perspectieven ten aanzien van risicocommunicatie hebben een nieuw tijdperk van risicocommunicatie doen ontstaan waarin een meer democratische, 'bottom-up benadering' van risicocommunicatie wordt beschreven. Uitgangspunt is dat risicocommunicatie meer is dan het verspreiden van een getal dat volgt uit een kansberekening, of het publiek voorzien van slechts die informatie waarvan de overheid of experts denken dat nodig is. Risicocommunicatie kan wellicht beter worden beschouwd als een interactief proces tussen burgers en andere partijen. Het is daarom essentieel om risicocommunicatie te benaderen als een voortdurend proces waarbij de wensen en behoeften van het publiek ten aanzien van risico-informatie in ogenschouw moeten worden genomen. Specifiek betekent dit dat de informatievoorziening over risico's wordt afgestemd op hoe het publiek risico's beoordeelt en de doeleinden waarvoor zij informatie over risico's gebruiken. Inzicht in de behoeften en gevoelens van mensen is noodzakelijk om relevante risico-informatie aan te kunnen bieden die ook daadwerkelijk gebruikt wordt.

Tegelijkertijd met de veranderende perspectieven op risicocommunicatie, is ook het domein van communicatiemedia aan verandering onderhevig. De recente ontwikkelingen op het gebied van communicatietechnologie en media zijn bij uitstek geschikt om de meer bottom-up, ontvangergeoriënteerde vorm van risicocommunicatie uit te voeren. De explosieve groei van het internetgebruik en de mogelijkheden die dit medium biedt, maken het mogelijk om risico-informatie up-to-date te houden en permanent beschikbaar en toegankelijk te maken voor het publiek. De individuele burger kan dan zelf op zoek gaan naar voor hem relevante risico-informatie op momenten dat hij dat nodig acht.

Om het uiteindelijke doel van een veiliger samenleving te bereiken, moet het risico-informatie zoekgedrag van burgers worden gestimuleerd. De praktijk laat zien dat het publiek nogal terughoudend omgaat met de recentelijk ontwikkelde en geboden mogelijkheden, zoals de digitale risicokaarten. Voor zowel de aanbieders van risico-informatie als vanuit wetenschappelijk perspectief is inzicht in het gedrag van de 'risico-informatieconsument' van essentieel belang om de processen die ten grondslag liggen aan het risico-informatie zoekgedrag beter inzichtelijk te maken.

De cruciale vraag is nu welke factoren het risico-informatie zoekgedrag van burgers beïnvloeden. Met andere woorden: wat motiveert mensen om persoonlijk relevante risico-informatie te gaan zoeken, bijvoorbeeld op het internet? En daarnaast: welke determinanten kunnen worden beïnvloed teneinde het publiek te stimuleren risico-informatie te gaan zoeken? Om antwoord te geven op deze vragen, zal inzicht verschaft moeten worden in de beïnvloedende factoren en de processen die ten grondslag liggen aan risico-informatie zoekgedrag. Een model dat inzicht geeft in deze processen kan een belangrijke bijdrage leveren aan en aanknopingspunten bieden voor een meer effectieve risicocommunicatie.

Het onderzoek beschreven in dit proefschrift richt zich op de theoretische en empirische ontwikkeling van een dergelijk model. Dit model is genaamd Framework of Risk Information Seeking (FRIS). De focus van FRIS ligt op (1) de 'actieve' burger die op basis van zelf vergaarde informatie een oordeel vormt over risico's of wint aan zelfredzaamheid en (2) de identificatie van risicogerelateerde sociaal-psychologische factoren die mensen stimuleren op zoek te gaan naar risico-informatie.

Theorieën over informatie zoekgedrag gerelateerd aan het risicodomein zijn schaars. Eén van de eerste relevante modellen is het relatief jonge Risk Information Seeking and Processing model (RISP; Griffin et al., 1999). Volgens RISP is de belangrijkste voorspeller van risico-informatie zoekgedrag de perceptie van een informatietekort. Deze informatiebehoefte wordt geconceptualiseerd als 'information sufficiency' en vertegenwoordigt de perceptie van een kloof tussen de aanwezige hoeveelheid kennis ten opzichte van de benodigd geachte kennis om adequaat met risico's om te kunnen gaan. Een belangrijk kenmerk van RISP is dat media- en persoonsgerelateerde variabelen een belangrijke rol spelen. Daarmee worden de specifieke risicogerelateerde factoren enigszins naar de achtergrond geschoven. De focus van FRIS ligt daarentegen op het verschaffen van inzicht in de rol van deze risicogerelateerde factoren in het risico-informatie zoekproces van het publiek.

De studies beschreven in dit proefschrift vertegenwoordigen een stapsgewijze procedure in de ontwikkeling van FRIS. De eerste studie (hoofdstuk 2) richt zich op het inzichtelijk maken van relevante concepten die de intenties tot risico-informatie zoekgedrag beïnvloeden, gebaseerd op uitgebreid literatuuronderzoek. Daarnaast worden meetinstrumenten ontwikkeld en gevalideerd. Gebaseerd op data van vragenlijstonderzoek onder een steekproef van de Nederlandse bevolking

worden de hypotheses ten aanzien van de causale verbanden tussen relevante concepten getoetst in een tentatief theoretisch model. De bevindingen leiden tot een aantal modificaties en aanvullingen op concepten en causale verbanden beschreven in het RISP model.

In hoofdstuk 3 wordt vervolgens een onderzoek uitgevoerd om de validiteit van deze nieuwe inzichten te toetsen en integreren in het bestaande RISP model. Door middel van een vergelijkende studie tussen data verzameld in Nederland en de Verenigde Staten is de aangepaste versie van het RISP model getoetst. De belangrijkste vinding is dat risico-informatie zoekgedrag niet uitsluitend wordt voorspeld door een cognitieve informatiebehoefte (discrepantie tussen hoeveelheid aanwezige informatie en benodigd geachte informatie), maar in belangrijke mate wordt voorspeld door zowel affectieve respons en subjectieve normen ten aanzien van risico-informatie.

Op grond van de verworven kennis en inzichten uit de voorgaande studies, wordt in hoofdstuk 4 het FRIS model vormgegeven en getoetst. FRIS veronderstelt dat het risico-informatie zoekgedrag bestaat uit drie fasen. Allereerst is er de fase waarin mensen zich bewust worden van het belang van het risico. Hierin spelen de risicoperceptie, de mate van betrokkenheid en zelfeffectiviteit een rol. Dit bewustwordingsproces beïnvloedt de 'utility' van risico-informatie, ofwel het doel of de toepassing waarvoor men risico-informatie nodig heeft (fase 2). Risico-informatiebehoefte is dan ook een multidimensioneel concept, bestaande uit zowel cognitieve (information sufficiency), affectieve (affectieve respons) als sociale (subjectieve normen) informatiebehoeftes. Vervolgens bepalen de affectieve respons, de mate van information sufficiency en subjectieve normen ten aanzien van risico-informatie de manier waarop mensen met risico informatie om gaan (zoeken danwel vermijden; fase 3).

In hoofdstuk 5 verschuift de aandacht naar de informatievoorkeur van het publiek. Hierbij ligt de focus op het belang van enerzijds het vertrouwen in eigen kunnen om adequaat met risico's en eventuele gevolgen om te gaan (zelf-effectiviteit) en anderzijds het vertrouwen in verantwoordelijke instanties om adequaat met risico's en eventuele gevolgen om te gaan (institutioneel vertrouwen). Maar de vraag naar de relatieve betekenis van deze twee vormen van vertouwen bij het voorspellen van de risicorespons en risico-informatiebehoefte is tot nog toe onbeantwoord gebleven.

Daarom wordt in dit hoofdstuk onderzocht welke van de twee het sterkste effect hebben op zowel affectieve respons als information sufficiency. Zoals verwacht, vertonen mensen met zowel een lage zelfeffectiviteit als een laag vertrouwen de sterkste gevoelens van angst, bezorgdheid of woede ten aanzien van de risico's en de grootste behoefte aan risico-informatie. Mensen met zowel een hoge zelfeffectiviteit als een groot institutioneel vertrouwen heeft significant minder sterke negatieve gevoelens en minder behoefte aan risico-informatie. Zelfeffectiviteit blijkt echter een krachtiger voorspeller te zijn van zowel affectieve respons als information sufficiency.

Daarnaast is ook de vraag relevant aan welke informatie mensen behoefte hebben en of de mate

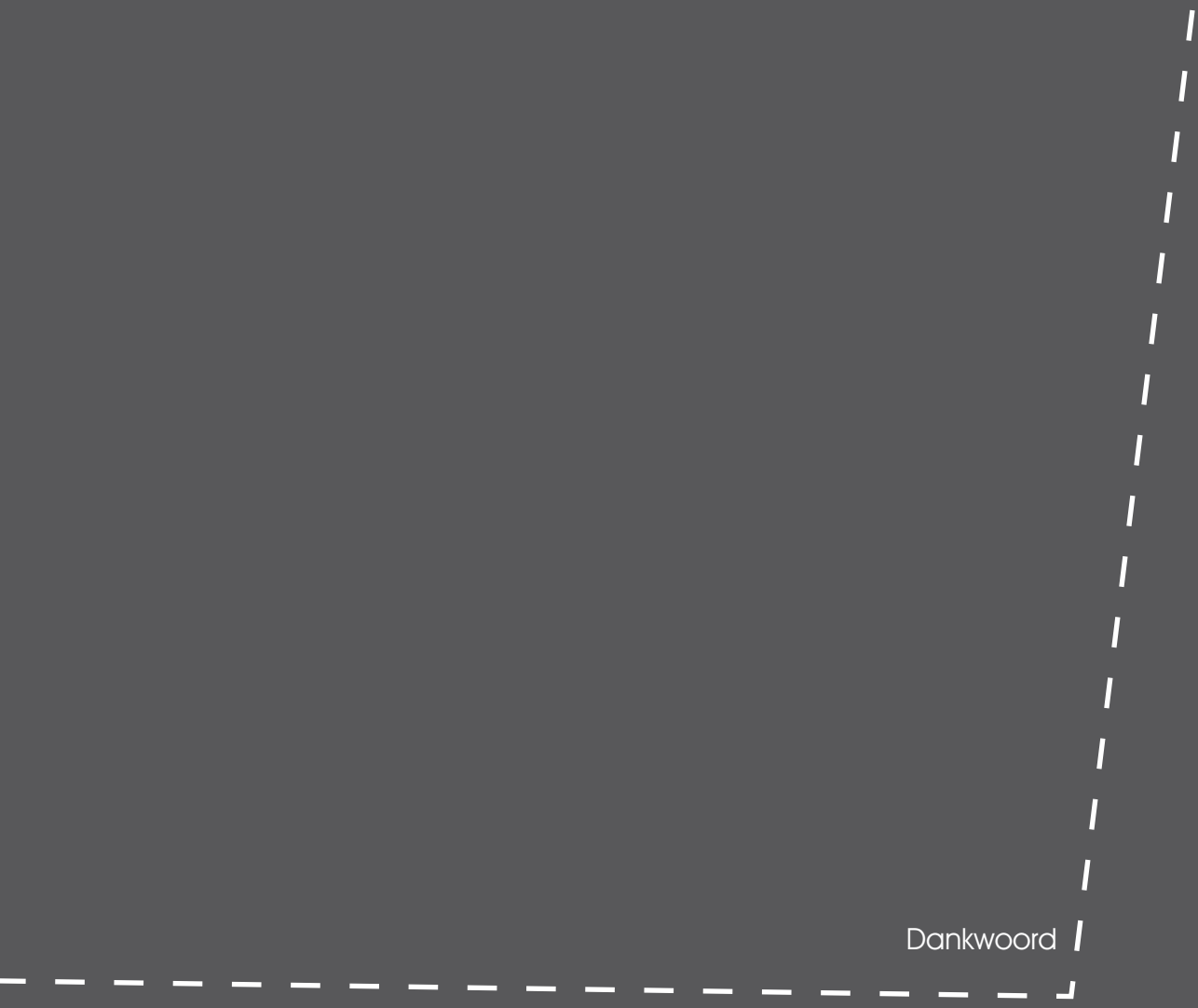
van zelfeffectiviteit en institutioneel vertrouwen hierop van invloed is. Over het algemeen hebben mensen een grote behoefte aan risico-informatie en willen veel van de beschikbare informatie hebben om een oordeel te vormen over de externe veiligheidsrisico's in hun leven. De resultaten suggereren dat mensen met een lage zelfeffectiviteit meer behoefte hebben aan informatie om hun zelfredzaamheid te vergroten. Mensen met weinig vertrouwen in verantwoordelijke instanties, daarentegen, hebben meer behoefte aan informatie over wat overheden of het bedrijfsleven doet om de risico's te minimaliseren.

In hoofdstuk 6 worden de resultaten uit dit proefschrift samengevat en bediscussieerd in een bredere context. Samenvattend heeft het onderzoek beschreven in dit proefschrift meer inzicht gegeven in hoe de intentie tot risico-informatie zoekgedrag zich manifesteert bij het algemene publiek. Uit de bevindingen is gebleken dat het niet alleen de cognitieve informatiebehoefte is die mensen motiveert om risico-informatie te zoeken, maar dat affectieve en sociale factoren een minstens zo belangrijke rol spelen. Daarmee erkent FRIS het multidimensionele karakter van informatiebehoefte en risico-gerelateerd informatie zoekgedrag.

FRIS is een model dat de sociaal-psychologische factoren specifiek gerelateerd aan het risicodomein herbergt. Daarom kan het worden toegepast op verschillende risicodomeinen. Communicatieprofessionals kunnen het gebruiken bij de opzet en uitvoering van een meer ontvangergeoriënteerde communicatie over risico's. In meer algemene zin dient risicocommunicatie voortdurend gericht te zijn op de veranderende risicocontext enerzijds en de veranderende cognitieve, affectieve en sociale informatiebehoeften van het publiek anderzijds.

De resultaten van dit proefschrift hebben consequenties voor de inhoud van risicoboodschappen. Om burgers te stimuleren zelfredzamer te worden en zelf op zoek te gaan naar risico-informatie, is een uitgebalanceerde combinatie van communicatiestrategieën noodzakelijk. Een nationale media campagne, bijvoorbeeld, zou kunnen worden ingezet om het risicobewustzijn te vergroten en daarnaast mensen te stimuleren relevante risico-informatie te gaan zoeken. De inhoudelijke risico-informatievoorziening zal dan voornamelijk moeten plaatsvinden op het lokale of regionale niveau, waarbij direct kan worden ingespeeld op het dynamische karakter van zowel de externe veiligheidsonderwerpen als informatiebehoeftes van het publiek.

De in dit proefschrift gepresenteerde resultaten kunnen derhalve helpen bij het systematisch inspelen op de informatiebehoefte van burgers en zo bijdragen aan een meer effectieve risicocommunicatie. Daarnaast blijft het relevant om nader te onderzoeken met welke strategie en inhoudelijke boodschappen de kennis, perceptie, gevoelens, en uiteindelijk ook het gedrag van het algemene publiek het meest effectief zijn te beïnvloeden. In aanvulling op deze inhoudelijke benadering dient het onderzoek ook een vervolg te geven aan het toetsen van het model in verschillende risicodomeinen en doelgroepen.


Dankwoord

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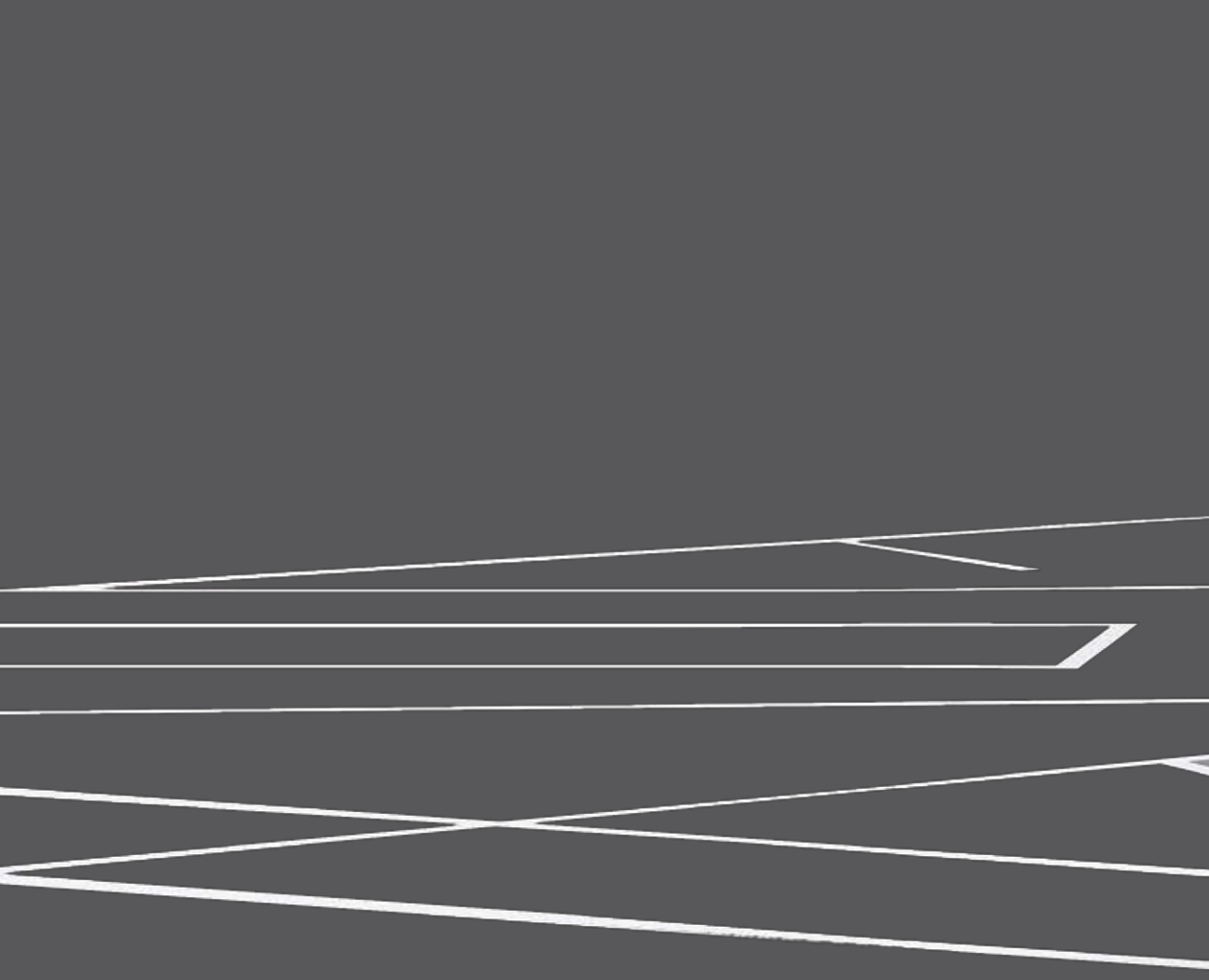
Ellen ter Huurne
Mei 2008



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