Public Perceptions Of Climate Change:

Risk, Trust, and Policy

by

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ABSTRACT

Global climate change (GCC) is among the most important issues of the 21st century. Adaptation to and mitigation of climate change are some of the salient local and regional challenges scientists, decision makers, and the general public face today and will be in the near future. However, designed adaptation and mitigation strategies do not guarantee success in coping with global climate change. Despite the robust and convincing body for anthropogenic global climate change research and science there is still a significant gap between the recommendations provided by the scientific community and the actual actions by the public and policy makers.

In order to design, implement, and generate sufficient public support for policies and planning interventions at the national and international level, it is necessary to have a good understanding of the public's perceptions regarding GCC. Based on survey research in nine countries, the purpose of this study is two-fold: First, to understand the nature of public perceptions of global climate change in different countries; and secondly to identify perception factors which have a significant impact on the public's willingness to support GCC policies or commit to behavioral changes to reduce GHG emissions. Factors such as trust in GCC information which need to be considered in future climate change communication efforts are also dealt with in this dissertation.

This study has identified several aspects that need to be considered in future communication programs. GCC is characterized by high uncertainties, unfamiliar risks, and other characteristics of hazards which make personal connections, responsibility and engagement difficult. Communication efforts need to acknowledge these obstacles, build up trust and motivate the public to be more engaged in reducing GCC by emphasizing the

multiple benefits of many policies outside of just reducing GCC. Levels of skepticism among the public towards the reality of GCC as well as the trustworthiness and sufficiency of the scientific findings varies by country. Thus, communicators need to be aware of their audience in order to decide how educational their program needs to be.

DEDICATION

I dedicate my dissertation work to my family and friends. A special feeling of gratitude to my loving wife, Ariane Middel, as well as for my very special parents, Brigitte and Hans Hagen, and my sister Eva. Their words of encouragement and limitless support accompanied me throughout my time as a doctoral student and I am very grateful for having them in my life.

I also dedicate this dissertation to my many friends in the United States and back in Germany who have supported me throughout the process. I will always appreciate all they have done.

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INTRODUCTION

Problem Statement & Identification of Study Variables

Global climate change (GCC) is among the most important issues of the 21st century and has become a significant policy topic at United Nations recent conferences. In addition, there is no question that activities in the form of Climate Action Planning are occurring at local levels in the U.S. Adaptation to and mitigation of climate change are some of the salient local and regional challenges scientists, decision makers, and the general public face today and will be in the near future. The list of possible negative effects of climate change is long and several impacts of GCC can already be observed in individual countries or regions as well at a global scale. Measurable today are an increase in air and water temperature, reduced frost days, a higher rate and magnitude of heavy rain in some areas and yet drought in other regions, a rise in sea level, and reduced snow cover, glaciers, permafrost, and sea ice (IPCC, 2007). The indirect impacts of these changes will most likely affect human health, water supply, agriculture, coastal areas, and numerous other aspects of society and the natural environment.

The existing body of knowledge already presents an important amount of possible information on planning interventions and policies needed to respond to and cope with global warming and climate change (TRB, 2009; IPCC, 2007; Newman et al., 2009). Nevertheless certainly more experience and understanding is needed on institutional capacities and public attitudes as well as dealing with uncertainties for more effective responses. Designed adaptation and mitigation strategies, however, do not guarantee success in the fight against global climate change (Handmer, 2003) and we do not know

what needs will be, as major challenges approach highly vulnerable zones in the future. Despite the robust and convincing body for anthropogenic global climate change research and science (IPCC, 2007) there is still a significant gap between the recommendations provided by the scientific community and the actual actions by the public and policy makers (Blake, 1999; Kollmuss & Agyman, 2002; Arvai et al., 2006; Abbasi, 2006).

Since the World Metropolitan Organization (WHO) and the United Nations Environment Programme (UNEP) established the Intergovernmental Panel on Climate Change (IPCC) in 1988 the scientific efforts to understand GCC grew significantly. So far, with the help of thousands of scientists, the IPCC has released four "Climate Change Assessment Reports" which asses the available scientific information relevant for improving the understanding of climate change and its possible environmental and socioeconomic impacts. As a result, the IPCC is considered the leading institution for the assessment of climate change and for monitoring the scientific work done worldwide regarding climate change. The fourth and latest report released in 2007 finally states clearly that (with a likelihood of 90-99%) that global climate change is driven by human emissions of heat-trapping gases and that greater environmental damages can be expected in the future.

Nevertheless, the strong findings presented by the scientific community have not transferred into long-term, comprehensive, and legally binding policy commitments especially on the national and international level. So far scientists and the media have failed to communicate the urgency of the situation successfully to policy makers and the lay public (McBean & Hengeveld, 2000; Summerville & Hassol, 2011). Simultaneously, the way governments operate in most democratic societies is another reason for the gap be-

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tween the scientific evidence for anthropogenic climate change and the actual actions by the public and policy makers (Held &Hervey, 2009; Meadowcraft, 2009; Wheeler, 2009). For instance, the short-term electoral cycles make it very difficult for the existing forms of governance to take actions against GCC. Due to the short-term electoral cycles, politicians are constantly concerned with their own career, which impacts their ability to make tough policy decisions that require a large amount of political capital (Held & Hervey, 2009). Global climate change, however, is a very complex issue that is characterized by high uncertainties requiring long-term policies and measurements (IPCC, 2007). Mitigation strategies such as higher energy taxes or fuel prizes and costly adaptation measurements such as flood barriers are hard to communicate to the public without losing potential voters (Meadowcraft, 2009). As result and due to the pressure on governments to present results that can be evaluate every 4 to 5 years, policy debates tend to focus more on topics and policies that can be implemented in a short amount of time, do not require additional taxes, and can be witnessed by the public (Held & Hervey, 2009). Another constrain for the existing forms of governance to achieve substantial reductions of GHG emissions is that the short-term electoral cycles are changing the political landscape constantly. New elections might result in new leadership from a party which has a different agenda regarding climate change than the previous party (Wheeler, 2009). This emphasizes the importance of the public perception of climate change. Only if the public believes strongly in the need for mitigating climate change and is willing to commit to the required behavioral changes, elected officials will address this long-term challenge effectively.

The way the public processes information, how they perceive threats and other perceptional issues has a significant effect on how and to what degree mitigation and adaptation strategies are supported. Nonetheless, very little is known about public opinion and perceptions about climate change, especially at the international level (Leiserowitz, 2010; Schneider et al., 2010). One of the primary reasons for this phenomenon is the limited number of multinational surveys addressing public perceptions of global climate change and its threats (Brechin, 2003; Leiserowitz, 2005). However, public risk perceptions and the understanding of climate change and public beliefs play a vital role for successfully overcoming the challenges of global climate change in the next decades. In order to design, implement, and generate sufficient public support for policies and planning interventions at the national and international level, it is necessary to have a good understanding of the public's perceptions regarding GCC (Read, 1994; Bord et al., 1998; Moser, 2006, Moench, 2007).

The public's perceptions of GCC and the resulting behavior and degree of policy support for various mitigation options can be linked to the way the threats of GCC are communicated. This is one aspect of this study. Establishing accurate knowledge among the public regarding the risks, threats and other aspects of GGC is very important and a key challenge for decision-makers and communicators. Without effective communication, the public may become distrustful of the science and may not be willing to support the necessary policies to reduce greenhouse gasses and support adaptation investments.

Yet, the field of climate change communication research, especially as a tool to change public behavior and foster public acceptance of adaptation and mitigation strategies, is still relatively young (NRC, 2010a). Nevertheless, risk communication is already

acknowledged as an important tool in climate change policy and research (Wardekker, 2004). We know from prior studies that when people have better understanding of GCC science, they tend to be more supportive of mitigation efforts (Read et al., 1994; Bord et al., 1998). The purpose of this study is two-fold: First, to understand the nature of public perceptions of global climate change in different countries; and secondly to identify perception factors which have a significant impact on the public's willingness to support GCC policies or commit to behavioral changes to reduce GHG emissions. Factors such as trust in GCC information which need to be considered in future climate change communication efforts will also be dealt with in this dissertation.

Research Questions, Theories, & Hypotheses

  Research questions. This study has four underlying central research questions, of which the answers provide the necessary insights for improving the understanding of the public's perceptions of GCC and behavioral attitudes in different countries as well as for providing recommendations to enhance GCC communication. The research questions are as follows:

1. *What are the public's perceptions of GCC in terms of threat and risk, saliency of the issue, trust in GCC information, and acceptable public strategies?*

2. *What importance do GCC risk perceptions and attitudes play in the public's willingness to support mitigation and adaptation strategies*

3. *How do the public perceptions regarding climate change and attitudes toward mitigation and adaptation strategies vary by socioeconomic factors?*

4. *What role do level of knowledge and perceptions of trust and responsibility play in the public's level of support for adaptation and mitigation policies?*

This research contributes to the existing body of knowledge in the areas of risk perception and risk communication as well as their interrelationships, directed at global climate change and strategies. GCC is characterized by high levels of risk but also high levels of uncertainties. The data collected here and the insights gained will permit decision-makers to make better informed decisions in terms of developing, communicating, and implementing the appropriate climate change policies and strategies to successfully mitigate and adapt to the impacts of global climate change.

Foundational theory supporting the research. As a scholarly endeavor we do not know very much about what risk perception factors influence the public's perceptions of GCC and if these perceptions differ from other natural threats of disasters. Therefore, this research is based on the psychometric paradigm (Fischhoff et al., 1978, & Slovic et al.,1984) and seeks to advance the theories of "bounded rationality" (Simon, 1956 & 1959) and "cultural cognition" of natural phenomenon (Douglas & Wildavsky, 1982). The psychometric paradigm presents a theoretical framework that implies that risk means different things to different people due to the influence of different psychological, social, institutional, and cultural factors (Slovic, 2000). This paradigm assumes through appropriate survey design, different scaling methods, and multivariate analysis to capture public risk attitudes and perceptions that are relevant to improve climate change communication programs but fundamentally see how risk perceptions are associated with public policies on mitigation and adaptation.

The theory of bounded rationality asserts that the decision making process of individuals is limited due to incomplete information available, cognitive limitations, and restricted amount of time to make decisions (Gigerenzer & Selten, 2001). As a result,

these constraints force individuals to construct a simplified model of the world to deal with. Within the framework of bounded rationality the key principle is the concept of 'satisficing' (Slovic, 2000), which means that a person strives to attain a satisfactory solution and not necessarily an optimal level of achievement. For this research, knowledge of the workings of the public's bounded rationality regarding the complex issue of GCC allows decision-makers and communicators to improve climate change communication programs and strategies. Thus, fostering behavioral change and improving the support for policies addressing the causes and potential negative impacts of GCC. Therefore, this study will test different variables that impact risk perception and risk communication.

Based on the cultural theory of risk (Douglas & Wildavsky, 1982), the theory of cultural cognition implies that individuals perceive risks according to their sense of commitment to one or another idealized form of social ordering (Thompson et al., 1990; Kahan 2011 & 2012). According to this theory, the individual's perception of the risk and threats regarding GCC is derived from and reinforced by the values they have in common with the people they are connected with. Therefore, compared to the theory of bounded rationality, the theory of cultural cognition argues that differences among the public's GCC perception are mostly caused by conflicts between opposing groups whose members' cultural outlooks dispose them to form particular perceptions (Kahan, 2010; Douglas et al., 2006).

Based on these concepts the study will test different aspects that impact risk perceptions and the effects of these perceptions to policy predispositions and attitudes. In particular, this study examines the relationships between impacts of heuristics, trust, val-

ues and social amplification on GCC perception and the support for various mitigation and adaptation strategies to improve risk communication efforts.

Heuristics. When laypeople are faced with the task to determine risks, they usually do not have statistical evidence on hand to base their decision on. Instead they rely on assumptions based on what they remember hearing or observing about the risk they are confronted with (Slovic, 1987). As pointed out by Short (1984), social influences impacting the response to hazards are mainly transmitted by friends, family, fellow workers and respected public officials media. Moreover, since the 1980s, researchers, especially in the field of psychology, were able to identify various general rules that guide people in forming their perception. Known as heuristics, these judgment rules are applied by laypeople to reduce difficult mental tasks to simpler ones (Kahneman et al., 1982; Makofske & Edelstein, 1988).

The heuristic known as the 'availability heuristic' is very important for the formation of risk perceptions (Tversky & Kahneman, 1973). By applying this heuristic, people judge an event as probable or frequent if instances of it are easy to imagine or remember. Since events that happen more often are usually easier to imagine and recall than unusual, rare, events, the availability heuristic is often an appropriate cue. However, other factors such as a recent disaster can affect 'availability' and thus distort risk judgments. Several studies identified errors caused by using this heuristic (Lichtenstein et al., 1978). Research demonstrates that the people's judgments are moderately accurate in a global sense but there is also evidence that shows serious misjudgments reflecting the availability bias. For example, rare causes of death are often overestimated by lay people and common causes of death are underestimated. Another example, discussed in the study

by Lichtenstein et al. (1978), is that homicides were perceived more frequent than diabetes or stomach cancer. These biasing effects of memorability and imaginability present a barrier to open, objective discussion of risk (Slovic, 2000).

Other significant heuristics are the 'confirmation heuristic' and the 'overconfidence heuristic'. Once a person forms an opinion, the 'confirmation heuristic' can result in a situation where new evidence is misinterpreted or altered in order to support the initial conclusion. For people who apply the 'confirmation heuristic', new evidence regarding the issue of GCC only will appear reliable if it is consistent with one's initial beliefs (Slovic et al., 1984; Department of Health (UK), 1997). For example ambiguous data may be interpreted as a confirmation. Furthermore, contrary evidence may be filtered out because they are perceived as unreliable, erroneous, or unrepresentative. The 'overconfidence heuristic', on the other hand, suggests that people often have too much confidence in their own judgments (Slovic et al., 1981; Department of Health (UK), 1997). Research suggests that overconfidence can prevent the public to realize how little they know about GCC and how much additional information they need regarding the risks, threats, and possible adaptation and mitigation strategies (Slovic, 2000).

Thus, if the heuristics are invalid for the risk faced they can lead to large and persistent biases, thus impacting public risk assessment, judgment and policy preferences. This study will advance this theory by examining those perceptual factors that influence the public's risk perception of GCC and affect the level of awareness and concern, personal behavior, and climate policy support. Another theory scrutinized is that lay people dealing with uncertainties tend to over- or underrate the risks and threats (Slovic, 2000). In the case of nuclear power risk perception research shows that the public tends to over-

rate the risks of radiation leading to large social amplification effects and behavior. This research will test if the lay public also over- or underrates the risks and possible impacts of GCC. The overrating of GCC risks may result in a pattern of policy preferences different than responses for underrated hazard risks. The study will test these relationships.

Trust. The role of trust is another important aspect that influences risk perception (Van de Vusse, 1993; Slovic, 1997; Department of Health (UK), 1997). Trust is a multi-faceted concept that includes cognitive, affective, and behavioral dimensions (Bradbury et al., 1999). Moreover, trust is also a dynamic process taking place at the individual, the institutional, and the ideological level (Tait, 2011). Besides building trust through inter-personal relations, people can also hold trust in organizations and institutions (Hardin, 2006), or in ideological values and norms (Luhmann, 1979, Blackburn & Simon, 1998). These layers in which trust operates are not mutually exclusive (Tait, 2011).

To date various risk communication programs in Europe and the US only show limited effectiveness (Cvetkovich & Loefstedt, 1999). Research shows that the failure of risk communication are significantly influenced by the public's trust in the communicator and in the ability of certain individuals, industries , or institutions responsible for risk management (Renn & Levine, 1991; Kasperson et al., 1992; Nye, 1997). In most circumstances, new information is first judged based on the credibility of its source (Department of Health (UK), 1997). If there is no trust in the source, any message is likely to be disregarded, no matter how well intentioned and well delivered. Impacting the level of trust towards risk communicators and risk managers are factors such as perceived competence, objectivity, fairness, consistency, and goodwill. Especially in areas characterized by high uncertainties, as in GCC, trust plays a vital role in the success if risk communica-

tion and implementation of policies. Moreover, trust is not only a necessary precondition for successful GCC communication but it can also be improved by well-developed communication strategies (Misztal, 1996). Trust in organizations whose risk management policies impact communities and the environment is vital in order to reduce complexity and generate social cooperation (Cvetkovich & Loefstedt, 1999). Therefore, the theory tested in the context of GCC is that distrust of certain individuals, industries, scientists, or institutions responsible for GCC risk management is strongly linked to the level of risk perceived (Bord & O'Connor, 1990; Slovic et al., 1991; Mushkatel & Pijawka, 1992).

Social values. Social values are another aspect that impacts risk perception as well as risk acceptance (Slovic, 1987). The important role of social values became apparent when studies of risk perception showed that exaggerated public concern was not just a result of the public's ignorance or irrationality (Slovic, 2000). Instead, the public's reaction to risk could be linked to sensitivity to technical, social and psychological qualities of hazards that were not well or at all communicated in technical risk assessments. For example, qualities such as uncertainty in risk assessments, perceived inequity in the distribution of risks and benefits, and aversion to being exposed to risk that were involuntary, not under one's control, or dreaded. Cultural theorists argue that our world-views and our values play an important role in public risk perception and behavior (Douglas, 1966 & 1970; Douglas & Wildavsky, 1982; Douglas et al., 1998). Thus, worldviews and values have a strong impact on how the risk and threats of GGC are perceived and to what degree different strategies are supported (Hulme, 2009; Kahan et al., 2011). For instance, members of the Republican Party tend to hold more conservative values compared to their counterparts in the Democratic Party. As a result, republicans are often

more skeptical towards the concept of human induced climate change and view policy measures as regulatory burdens and thus are less likely to support any GCC policies.

Social amplification. Another aspect complicating how people perceive, evaluate and act on GCC risk is 'the social amplification of risk' concept (Hulme, 2009). ' Social amplification of risk' (Kasperson et al., 1988) implies that risks are communicated through different signals such as images, signs, and symbols. By interacting with psychological, institutional or cultural processes in society, these signals can amplify or attenuate the perception of risks and their manageability. The public is embedded in this complex web of interactions where risks are symbolized, translated and interpreted in numerous ways and by multiple actors. This study will advance the theory of social amplification by determining where GGC is positioned on the hierarchy of environmental hazards in terms of its potential for social amplification.

Underlying hypotheses. The discussed theories test different hypotheses guiding the research of this study. The hypotheses are based on the existing body of knowledge in the areas of risk communication and risk perception. Chapter 2 provides a detailed discussion of the existing literature in these two areas. These hypotheses guide the complex data analysis necessary for most of the research questions. Furthermore the insights gained, provide the means for answering these research questions and to accomplish the overall purpose of this study. The underlying hypotheses of the research questions are as follows:

1. *The public's perceptions of GCC in terms of threat and risk, saliency of the issue, trust in GCC information, and acceptable public strategies vary among countries*

2. *The public's general support for mitigation and adaption policies is linked to the way they perceive 1) the level of consequences from possible environmental changes and 2) the general level of threat resulting from GCC*

3. *The general attitude and public risk perceptions of GCC can be largely explained by socio-economic variables*

4. *The public's perception towards climate change is the main reason for the 1) low policy support, 2) willingness to pay for GCC policies, and 3) willingness to change their behavior related to mitigation and adaptation*

Research Justification

Existing research suggests that many people do not have a full understanding of the issues inherent in global climate change. A significant part of the public is not aware of the precise nature, causes, and possible negative impacts of global climate change. Despite its widespread media coverage (Bostrom et al., 1994), lay mental models of global climate change suffer from several basic misconceptions (Bostrom et al., 1994; Kempton et al., 1995; Bord et al., 1998; Lorenzoni et al., 2005; Leiserowitz, 2010). Misconceptions, such as that GHG emissions are just a form of air pollution (Kempton 1991; Brenchin, 2003; Lorenzoni et al., 2005), result in the public support for the wrong policies. For example, many people believe and support traditional pollution controls are the solution to decrease GHG emissions. However, actions such as filters and strengthening pollution controls do not stop GHG emissions leading to global climate change (Prinn et al., 2005). Climate change communication can help to advance public understanding of the issue of global climate change, inform them about possible solutions, emphasize the impact of personal choices and behavior, and encourage public deliberation resulting in

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support for adaptation and mitigation policies and measurements (Leiserowitz, 2005; Smith, 2005; Moser, 2006; Frumkin & McMichael, 2008; Ockwell et al., 2009). However, for improved or enhanced communication broader and deeper knowledge of the public's risk perception and cultural values are needed.

Today, only a limited number of risk and GCC communication programs exist and past efforts have not been successful (Kempton 1997, Moser, 2006, Lorenzoni, 2007). To this point no trustworthy communication strategies exists, which functions as a basis for developing GCC communication programs. More research is needed! So far, communication strategies and programs are not very effective in creating a better and widely shared understanding of the climate change issue among the public, increasing the public support for climate policies, establishing a sense of urgency, or fostering behavioral changes (Wardekker, 2004). One important shortcoming of past climate change communication efforts was the fact that they were not tailored towards particular audiences, thus disregarding aspects such as social values or cultural characteristics (Kahan et al., 2011). Instead, past communication efforts mostly focused only on the science and overall impacts of GCC (Moser, 2006). Research also shows that GCC communication programs fail due to the lack of incorporating knowledge about risk perceptions including questions on trust, how science is converged, moral issues, uncertainties, the nature of the threat, and other factors (Wardekker, 2004).

Therefore, this study looks at the public risk perception of GCC in different countries while focusing on various key topics important to the design and implementation of communication programs. Furthermore this research will test various theories discussed earlier in the field of heuristics, trust, social and cultural factors, social amplification, and

risk communication. Thus, add to the body of knowledge regarding the psychometric paradigm and the theory of bounded rationality. This will enable the development of communication programs which are tailored to the particular audience acknowledging their level of awareness, actual knowledge, degree of concern, perceived risk, and other central factors.

Theoretical Framework

Based on the existing literature a theoretical framework was developed (Figure1) to answer the research questions as well as to test the underlying hypotheses. The framework centers on the importance of psychometric and other factors that impact the public's risk perceptions of GGC and its role in behavior and policy.

As shown in Figure 1, global climate change forces policy makers to continuously develop and implement adaptation and mitigation policies. In order to implement these strategies successfully the risks of GCC and the responding policies need to be communicated to a public in a way that ensures their support. As noted before, it is crucial for the success of any GCC policy that the public supports is and is willing to commit to behavioral and policy changes. Nevertheless, communication efforts can only be successful if they incorporate the factors in public risk perceptions. Therefore, the theoretical framework in this study supports the argument that different mediating factors impact the public's perceptions towards GGC communication and risk. These factors are categorized into the three different groups - 'GGC Events', 'Psychometric Factors', and 'Uncertainty of GGC' and are displayed in the center of Figure 1.
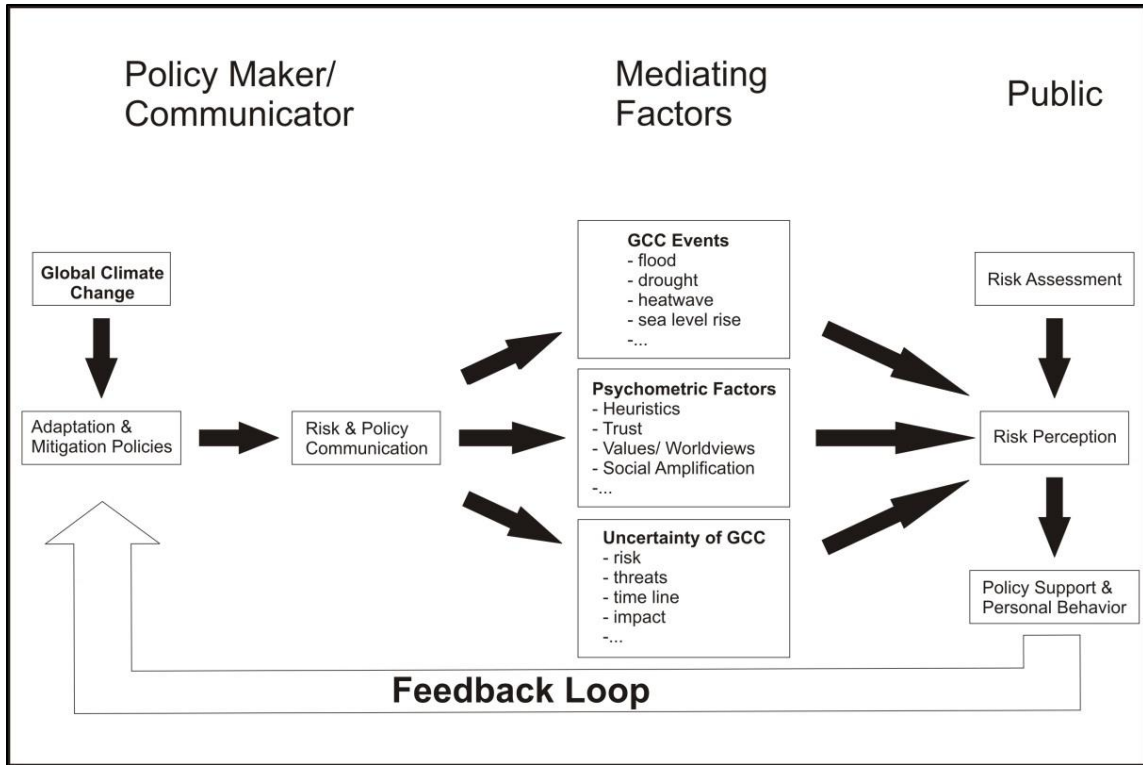
Figure 1. Theoretical Framework of this Dissertation Research   Own Illustration

As illustrated in the upper right corner of the theoretical framework, in addition to

the mediating factors individuals' own risk assessment is also a factor that impacts the

personal perception of GCC risks and the successfulness of communication programs.

Based on the perceived risk the public assesses the personal risk resulting from GCC and

decides whether or not they are willing to support important climate policies and change

their behavior. Nevertheless, even the best-designed communication programs, based on

the strongest social and decision science produce only best guesses about how to formu-

late messages (Pidgeon & Fischhoff, 2011). Thus, empirical testing is always needed on

order to determine how effective the current communication strategy is (Moser, 2010).

This is represented by the feedback loop shown at the bottom of Figure 1. Yet, despite the

critical importance of climate change communication, such evaluations are remarkably

rare. Instead, most communications rely on intuitive notions of what to say and how to say it. A scientific approach to communication science, however, requires the systematic feedback provided by empirical evaluation (Moser, 2010).

In order to test the mediating factors and support the validity of the proposed theoretical framework the study has completed an international public survey of nine countries. The 9 countries include: the United States, Canada, Mexico, Brazil, Spain, Germany, the United Kingdom, the Netherlands, and Japan. The collected survey data allows analyzing the public's risk perceptions of GCC, their willingness to support climate policies, and their readiness to commit to behavioral changes. This provides vital information for the feedback loop, which supports policy makers and communicators to evaluate whether or not implemented policies and communication programs are successful or need to be improved. The survey instruments as well as the other research methods applied are discussed in detail in chapter 3, which focuses on the methodology for this study.

Chapter 2

LITERATURE REVIEW

The following literature review is divided into four main sections with various thematic subsections providing an overview of the body of knowledge in the areas of risk perception and communication relevant to the issues of global climate change in the context of the study's questions. The literature review first provides an overview of the history and key foundational literature on risk perception and risk communication research. The second part focuses specifically on the public's risk perception of and attitudes towards global climate change. This section is followed by an in depth discussion of the gap between the science and recommendations provided by the scientific community on the one hand, and the still strong public dissension over climate change on the other. The final part addresses the existing body of knowledge in terms of how existing climate change communication efforts, especially by the mass media, have enforced misconceptions, skepticism, and reluctance to act among the lay public.

Literature Background

Since the beginning of the 1980s the body of knowledge has grown considerably in the fields of risk perception and risk communication (Slovic et al., 1981; Slovic, 1987 & 2000; Wardekker, 2004). A major reason for this increase in knowledge was due to industrialists and regulators who recognized that the public believes that they are faced with more risk today than in the past and that levels of risk will continue to increase in the future (Slovic, 1997).

Studies done in the fields of geography, sociology, political science, anthropology, and psychology contributed significantly to the current understanding of risk perception

(Slovic, 2000). Whereas geographical research first focused on examining the human behavior faced by natural hazards, studies addressing risk perception and behavior later included technological hazards as well (Burton et al., 1978). Sociologists (Short, 1984) and anthropologists (Douglas & Wildavsky, 1982) discovered that perceptions and acceptance of risk are embedded in social and cultural factors. Short (1984) pointed out that the social influences impacting the response to hazards are mainly transmitted by friends, family, fellow workers and respected public officials. Research within the field of psychology regarding risk assessment and perception started with empirical studies addressing probability assessment, utility assessment and decision-making processes (Edwards, 1961).

Risk communication first focused on public misconceptions regarding risk (Wardekker, 2004). Initially not much attention was paid towards the public's perceptions, instead only the expert's estimates were acknowledged (Department of health (UK), 1997). During this time, the typical method for risk communication was to 'put risk into perspective' and long lists of numerous risk comparisons were created (Slovic, 1987; Department of Health (UK), 1997; Wardekker, 2004). These comparisons, however, can be misleading, dissatisfying, and are difficult to use responsibly and effectively. Therefore, such comparative lists can be counterproductive (Freudenberg & Rursch, 1994) and even threaten the credibility of the risk communicator (Slovic, 2000). In time, researchers started to acknowledge the importance of lay risk perception and studies began to examine what actually does cause public concern and why (Slovic, 1987; Department of Health (UK), 1997).

Since the 1980s, the growing body of knowledge shows that perceived risk is both quantifiable and predictable (Slovic, 1987; Gaerling & Golledge, 1993) and that psychometric techniques are applicable to identify similarities as well as differences regarding risk perceptions and attitudes among groups (Slovic, 2000; Simmons, 2007). Moreover, research shows that the concept of 'risk' means different things to different people.

Risk Communication efforts are often needed to present and simplify complex technical material, influenced by uncertainty, and difficult for laypersons to understand (Slovic, 1986). Thus, in order to enhance successful programs, communicators must gain a good understanding of the limitations of current scientific risk assessment and the idiosyncrasies of the human mind. In particular, it is important to realize that the public's risk perceptions are rooted in theoretical models based on assumptions and subjective judgments. Thus, incomplete assumptions and judgments most likely result in inaccurate risk assessments or perceptions.

Furthermore, even when faced with solid evidence through information and educational programs, research shows that people's beliefs change slowly and disagreements about risk do not automatically disappear (Nisbett & Ross, 1980). Strong initial views are resistant to change; because once they are formed they influence how subsequent information is interpreted. Thus, new evidence appears reliable and informative if it is consistent with one's initial beliefs; contrary evidence on the other hand, is likely to be viewed as unreliable, erroneous, or unrepresentative (Wardekker, 2004).

However, if people do not have strong prior opinions the situation is quite different. In that case, these persons are deeply influenced by the way the risk is formulated

and presented to them (Tversky & Kahneman, 1981). The fact that subtle differences in how risks are presented can have marked effects suggests that those responsible for information programs have considerable ability to manipulate perceptions and behavior. This possibility raises ethical problems that must be addressed by any responsible risk-information program (Wardekker, 2004).

Taken as a whole, insights gained by researching public risk perception have important implications for communication efforts (Slovic, 1987). The public's basic conceptualization of risk does reveal important concerns to communicators, which experts tend to overlook in their risk assessment (Renn, 1991). Relying on statistics alone is not enough for guiding personal or public decision policies. Instead, risk perception is not only determined by accident probabilities, annual mortality rates, or mean loses of life expectancy, but also by numerous other characteristics of hazards such as uncertainty, controllability, catastrophic potential, equity and threat to future generations (Wardekker, 2004). The classic risk perception factors (Slovic et al., 1981; Slovic, 1987) can be organized into different dimensions and are as follows:

- Dread Risk

    o Controllability, Dread, Global/not-global catastrophic, Fatal/not-fatal consequences, Equity, Catastrophic/individual High/low risk to future generations, Easily/not-easily reduced, Risk increasing/decreasing, Voluntary/involuntary, Clarity and importance of expected benefits, Harmful intentionality, Inescapable by taking personal precautions, Man-made rather than natural sources

- Unknown Risk

- Observable/not-observable, Known/unknown to those exposed, Effects immediate/delayed, Old/new risk, Risks known/unknown to science, Contradictory statements from responsible sources

- Exposure
    - Number of people exposed to the risk, Personal exposure, Identifiable rather than anonymous victims

- Other
    - Probability of undesired consequences

Research suggests that risk perception factors belonging to the area of 'Dread Risk' have the biggest impact on what risks are considered as high, why people want a risk reduced, and why they call for strict regulation (Slovic, 1987). For example the location of nuclear facilities falls into this category, whereas GCC can be considered to most people as an unknown risk.

Public Perceptions of GCC

The existing body of knowledge in the field of public perception regarding global climate change has been growing considerably. Research shows that risk perception has a significant impact on individual and group behavior and thus needs to be considered when developing global climate change policies and strategies (Slovic, 2000). Nevertheless, global climate change perception is still a relatively new survey topic. The existing body of literature also suggests that perceptions change over time due to factors such as extreme events, amount of media coverage or level of reporting, economic conditions, scientific information, values and worldviews, among other factors.

In contrast to the very limited number of studies on climate change perceptions at the international level there is a significant body of knowledge available for the United States. Although no formal national assessment exists in terms of the public perception of global climate change, numerous representative scientific studies and different opinion polls do provide important insights. The first surveys in the United States were conducted in the early 1980s, but strong public interest did not emerge before 1988 (Bord et al., 1998). The key year was 1988 for the development of public concern for global climate change for two reasons. First, at that time, the United States was hit by a severe drought and heat wave. Second, and even more important, James Hansen, who at the time was the director of NASA's Goddard Institute for Space Studies, gave testimony before Congress that global climate change had begun. As a result, more empirical studies were conducted and media coverage as well as public interest increased in the United States.

Overall, the existing body of GCC research and the perception surveys supports the argument that the American public is aware of global climate change, believes that it is real, and is highly concerned about it (Leiserowitz et al., 2005 & 2010; Ockwell et al., 2009; DEFRA, 2002 &2007; Dessai et al., 2004; Seacrast et al., 2000; Henry, 2000; Bord et al., 1998; Read et al., 1994; Bostrom et al., 1994). However, research also identified contradictions in American climate change risk perception and policy preferences (Rosenstone et al., 1997; O'Connor, 1999; Moser, 2006; Leiserowitz et al., 2010). On the one hand, the US public strongly supports a range of national and international policies to mitigate global climate change; on the other hand, several carbon tax proposals are strongly opposed. Thus, the public indeed largely supports policy action at the national and international scale, but resists tax policies that directly affect them. At this juncture,

very little is known about the level of public acceptance and willingness to support climate change policies and possible international differences. However, having such knowledge would point out key areas communication programs would need in order to increase public support for GGC policies developed in their own country and internationally. Therefore this study will test, public support and acceptance for a set of adaptation and mitigation strategies in different countries as well as their willingness to commit to behavioral changes.

Furthermore existing data suggests that that current public engagement with global climate change is low. Despite the clear implication of mitigation strategies for individual values, choices, and behaviors the demand for energy for domestic use and transportation is increasing in many developed countries (DEFRA, 2008). Moreover, pro-environmental behavior as a response to the causes and possible negative impacts are even more limited (Maibach et al., 2009; O'Neil & Hulme, 2009; Whitmarsh 2009). We now know that only a limited number of people are willing to do more than advance domestic energy conservation and even less are prepared to take actions to adapt to climate change.

Risk perception literature draws from the concept 'locus of control', which refers to the extent to which individuals believe that they control events that affect them (Rotter, 1966). For many hazards the public feels that applicable strategies exist in which they can be engaged in. However, GCC is characterized by high uncertainties, unfamiliar risks, and other characteristics of hazards which make personal connections and engagement difficult. This if further emphasized by the fact that GCC is more and more considered as a 'Black Swan' (Taleb, 2010; Winston, 2010, Curry 2011a). According to Nassim Nicho-

las Taleb (2007) Black Swan rare events are characterized by high uncertainties, are un-anticipated, and lead to misconceptions among the lay public. The theory was developed to explain "1) the disproportionate role of high impact, hard to predict, and rare events that are beyond the realm of normal expectations in history, science, finance and technology, 2) the non-computability of the probability of the consequential rare events using scientific methods, 3) the psychological biases that make people individually and collectively blind to uncertainty and unaware of the massive role of the rare event in historical affairs (Curry, 2011b).

In fact the argument can be made that the issue of GCC includes two Black Swans (Winston, 2010). The first Black Swan is GCC climate change itself with all its uncertainties, misconceptions, and the clear gab between the recommendations provided by the scientific community and public attitude and behavior. The second Black Swan is the global effort necessary to successfully mitigate and adapt to GCC. The policies needed and behavioral changes required to reduce GCC will require a fundament shift away from today's business-,policies, and lifestyle-models. If and how the necessary policies will ever developed and implemented is very uncertain, especially since past global GCC treaties have mostly failed. Many hope that effective communication efforts can foster a personal connection to GCC, raise the level of concern, and thus increase the level of support for mitigation and adaptation policies as well as the willingness among the public to engage in a more sustainable behavior.

In the case of the United States, existing surveys show that although concern about climate change has increased over the past two decades, climate change is still considered a low priority in the context of other issues American society is confronted with

today (Leiserowitz et al., 2005 & 2010; Ockwell et al., 2009; DEFRA, 2002 &2007; Dessai et al., 2004; Seacrast et al., 2000; Henry, 2000; Bord et al., 1998; Read et al., 1994; Bostrom et al., 1994) . Americans regard both the environment and climate change as relatively low national priorities (Dunlap & Scarcce, 1991; Bord et al., 1998; Leiser-owitz et al., 2005, 2010, Ockwell et al., 2009). For example, in a 2000 Gallup poll, the environment ranked 16th on Americans' list of most important problems facing the country today (Dunlap & Saad, 2001). Moreover, global climate change ranked 12th out of 13 environmental issues, just below urban sprawl. Thus, Americans seem to be highly concerned about global climate change as an individual issue, yet think it is less important than nearly all other national or environmental issues comparatively. Leiserowitz (2005) states that the low standing of global climate change as a public concern reflects a widespread public perception that the issue is removed in space and time. Ockwell et al. (2009) adhere to the same conclusion, arguing that the American public believes global climate change will primarily affect future generations and less developed countries. Furthermore, public concern for global climate change is influenced by various and serious uncertainties, public misconceptions, miscommunication, and by competition for agenda seeking attention on an overwhelming socio-environmental agenda (Seacrest et al., 2000; Leiserowitz, 2005; Smith, 2005; Moser 2006; Kempton, 1991; Lorenzoni et al., 2005). As a result, the concept of "dangerous" global climate change is not only contested among scientists and policy makers but among the American public as well.

Gaps between Scientific & Public Understanding of GCC

The existing literature presents different explanations for the public dissensus over climate change, especially considering the broad consensus among the scientific

community regarding the reality and risks of GCC. The predominant ways in which the public tends to think about the issue of global climate change increases the likelihood of systematic misunderstandings (Weber & Stern, 2011). For example, people who rely on personal experience to determine the likelihood and level of threat of global climate change can easily underestimate or overstate the real risks (Weber, 1997). Furthermore, due to the complexity and uncertainties of climate change, mental models are often incorrectly applied in the context of global climate change (Bostrom, 1994). Instead of making judgments based on scientific evidence, decision making processes are often driven by affect, values, or worldviews (Slovic, 1987).

The different reasons for the controversy over GCC and the gap between scientific and public understanding, relevant to this study, can be categorized into two different groups. These two groups are 'lay mental models and misconceptions' and 'worldviews and cultural values'. The following paragraphs provide an in-depth discussion of the existing body of knowledge in these two areas.

Lay mental models & misconceptions. According to several studies, the public may not be totally aware of the causes of GCC and have misconceptions of what GCC is, many distrust the science of GCC, or believe it is not an urgent topic, but distant in time and space (Hartley et al., 2011; Pidgeon & Fischoff 2011; Unger 2000). Surveys show that many Americans believe the GCC impacts other populations in other countries but not in the United States. Furthermore, only a small number among the US public connects GCC to direct health impacts. This demonstrates a clear gap between lay modes and expert assessments illustrated in the current IPCC reports (2007) or the report published

by the U.S. Global Change Research Program (Thomas et al., 2009) which focuses specifically on GCC impacts in the United States.

The existing body of knowledge, for the United States, shows that lay mental models of global climate change suffer from numerous misconceptions. This can be explained by misunderstandings of the science underlying global climate change (Lorenzoni et al., 2005). According to Kempton (1991), new information on global climate change is categorized by the public into four concepts or mental models. The most popular misbelieve is that global climate change is caused by increased ultraviolet light entering the atmosphere due to stratospheric ozone depletion. Although some interdependencies exist, these are only secondary, tertiary, or lesser effects. In addition, many public beliefs about ozone depletion are false or incomplete. For example, survey participants blamed aerosol for GCC despite the fact that they have been banned in the USA for decades. Whereas the ozone hole is a well-established concept in the American public consciousness, the greenhouse effect is only being recognized as a subset of the ozone hole phenomenon. Another popular misconception is that GHG emissions are just a form of air pollution (Kempton 1991; Brenchin, 2003; Lorenzoni et al., 2005). As a result, many people believe and support traditional pollution controls as the solution to increasing GHG emissions. However, actions such as filters and strengthening pollution controls alone do not stop global climate change. The air pollution model focuses on industrial smokestacks and vehicle sources, which are a major source of GHG emissions.

However, by applying this mental model to global climate change, the public does not recognize the negative impact from seemingly nonpolluting sources such as farming, ranching, or leaking refrigeration (Kempton 1991). The third concept, plant photosynthe-

sis, also plays an important role in the public's misconception of global climate change. The majority of survey participants in several studies (Bostrom et al., 1994; Read et al., 1994 Kempton 1991, 1997; Henry, 2000) showed a sufficient understanding of the concept that trees absorb CO_2 and produce oxygen. This knowledge, combined with increasing media reports of forest destruction, led to the misconception that all atmospheric oxygen could be exhausted due to deforestation. Consequently, fighting deforestation is among the most popular policy responses to mitigate and adapt to global climate change (Henry, 2000; Leiserowitz, 2006; DEFRA 2007).

However, the contribution of growing plants to atmospheric oxygen is almost entirely offset by the decay of plants after their death. To increase atmospheric oxygen, dead plants would have to be buried before decomposing (Kempton, 1991). The fourth important misconception is that people underestimate the temperature change required for severe climate induced effects (Kempton, 1991, 1997; Seacrest et al., 2000; Dessai et al., 2004; Leiserowitz, 2006). To many Americans, an average temperature rise of less than 10°F does not seem very harmful, because they are familiar with high winter to summer temperature swings and major geographical differences in temperature. Because climate change impacts occur with small temperature changes, the public may not feel a high urgency to develop and support mitigation or adaptation strategies for global climate change. Knowledge of the misconceptions and public imagery within a country is important in order to develop effective communication programs on an international and national scale.

Worldviews & cultural values. Worldviews and values can have a strong impact on how the risks and threats of global climate change are perceived by the public (Slovic,

2000; Hulme, 2009; Kahan et al., 2011) and thus influence policy support and the willingness to commit to behavioral changes. Research in this field, however, is still very theoretical based and not many studies providing empirical data for validation are available at this point. The existing literature argues that perceptions of risks, such as those related to GCC, are socially constructed and can vary by culture, human development, affluence, national experience with risks, and demographics (Slovic, 2000). Furthermore, cultural theorists argue that our world-views and our values play an important role in public risk perception and behavior (Douglas, 1966 & 1970; Douglas & Wildavsky, 1982; Douglas et al., 1998).

More recently, several studies support the argument that an insufficient level of knowledge, the inability to asses technical information by the lay public, or the resulting reliance on inappropriate cognitive heuristics, do not explain the gap between the science and the public (Weber & Stern, 2011; Kahan et al., 2011; Kahan, 2010; Verwij et al., 2006). These studies acknowledge that public understanding of GCC needs improvement, but emphasize that the issue is not illiteracy among the lay public. Instead, people who doubt the reality of human induced climate change and its negative impacts don't lack knowledge but have a different understanding of the topic and thus interpret scientific results differently.

Worldwide, awareness of GCC is growing and is penetrating further into sociopolitical and cultural life. As a result, understanding how belief systems and perceptions impact public discussions of global climate change and possible responses become increasingly important. Research suggests that disagreements about the issue of GCC exist because people view their responsibilities to future generations differently, value humans

and nature in different ways, have different attitudes to climate risk, and are influenced

by cultural cognition (Douglas & Wildavski, 1982). The theory of cultural cognition im-

plies that the individual's risk perception of GCC is formed and reinforced by values that

they have in common with others. Thus, proponents of this school of thought argue that

the disagreements over GCC are in fact a conflict between groups that are separated by

more general opposing perceptions of environmental and technological risks based on

their members cultural outlooks (Verweij et al., 2006; Kahan, 2010).

A recent empirical study by Kahan et al. (2011) shows that high scientific literacy

and numeracy among the lay public can enforce cultural polarization and widen the gap

between social groups with opposing worldviews and values. The data suggest that peo-

ple who dismiss the reality or dangers of GCC based on their values become even more

dismissive. On the other hand, people who already believed in human-induced GCC and

were concerned about possible negative impacts became even more concerned after being

exposed to scientific literature. Overall, the study participants with high levels of scien-

tific literacy were somewhat more likely to dismiss the seriousness of GCC compared to

people with lower levels. Thus, instead of believing in GGC and supporting adaptation

and mitigation policies, public misconceptions of GGC risks are most likely enforced as

they become more knowledgeable. In order to improve the public's attitude towards GCC

policies and their willingness to commit to behavioral changes, communication efforts

cannot focus on presenting knowledge alone (National Research Council, 2005; Weber &

Stern, 2011)

This study aims to advance the theory, through empirical evidence, that we disa-

gree about climate change because we have different belief systems (Hulme, 2009) medi-

ated through culture. Furthermore, the insights gained will improve the understanding to what degree mental models, scientific illiteracy and misconception, and cultural values effect GGC risk perception, behavior, and policy support.

Climate Change Communication

Although, the field of climate change communication research is still relatively young (NRC, 2010a), studies have already identified key aspects, guiding principles and barriers to improving communication and education efforts (Leiserowitz, 2005; Smith, 2005; Moser, 2006; Frumkin & McMichael, 2008; Ockwell et al., 2009).

Guiding principles & barriers. The so-called 'information deficit model', assumes that the people are 'empty vessels' waiting to be filled with information which will propel them into rational action, has impacted much communication efforts (Irwin & Wynne, 1996). Current research, however, criticizes this approach as inappropriate and ineffective (Whitmarsh et al., 2009). These communication efforts do not take into account the heterogeneous nature of the public. As discussed above, public groups can differ in their values and have diverse resources which make them interpret and use information differently (Kahan et al., 2011; Weber & Stern, 2011). Therefore, an important reason why people disagree about climate change is not that they do not understand current communication programs. Instead, communication programs fail to acknowledge that an individual's position to climate change represents certain values and worldviews that separate different cultural groups from one another (Kahan et al., 2011).

This is not to say that education is not part of an effective public communication effort but rather that it should be based on elements such as an understanding of individu-

als' existing knowledge, their concerns, worldviews and values, and their abilities to react to the challenges of global climate change. Moreover, disregarding these elements can increase the public dissensus over climate change and decrease support for climate change policies. Communication strategies should be designed with great caution since people tend to dismiss information which is contrary to their worldview as a direct assault on their values and the competence of the persons they trust (Kahan et al., 2011).

In her study, "Talk of the city: engaging urbanities on climate change" Susanne Moser (2006) addresses questions about key audiences, appropriate messengers, framings and messages, reception of climate change information, and the choice of communication mediums and formats to achieve different communication and engagement goals. The author argues that past global climate change communication efforts were not tailored towards a particular audience, but only focused on the science and overall impacts. Moser explains that editors, scientists, and policy makers alike always have to ask themselves who the audience is they are trying to communicate with. Moser shows that it is important to choose appropriate language and frames to talk about the issue of global climate change and possible mitigation or adaptation policies and strategies. Moser defines effective climate change communication as "any form of public engagement that actually facilitates an intended behavioral, organizational, political and other social change consistent with identified mitigation and adaptation goals". Moser (2006) concludes that information or knowledge is not enough to change someone's behavior. Instead, the key challenge of effective communication is to motivate the public to begin and sustain the required behavioral changes.

The role of the mass media & the scientific community. The existing body of knowledge points to the mass media as a significant contributor to the current dissensus over global climate change, especially in the United States (Antilla, 2005 & 2010; Leiserowitz, 2005; Nelkin 1995; Boykoff, 2004; Smith, 2005). Mass Media, however, is simultaneously also considered a key part of successfully communicating GCC and increase public policy support. Research shows that the way the public perceives GGC is strongly influenced by how and to what degree the media communicates the existing scientific knowledge (Wilkins, 1993; Mazur and Lee, 1993; Mormont and Dasnoy, 1995; Trumbo, 1996; Brulle et al., 2010).

Leiserowitz (2005) links the recent decline of public concern over GCC to the way global climate change is presented in the mass media. His and similar studies point out that since 1988, when global climate change was a front-page story, television network coverage declined by 50% and national newspaper coverage dropped by 25% (Frame Works Institute, 2001). The severe drought, the heat wave, and James Hansen's testimony before Congress in 1988 led to a dramatization and amplification of the topic by the media and environmental groups, and concern peaked in 1998 (Bord et al., 1998). Simultaneously, scientific journals increasingly emphasize the uncertainty in global climate change predictions and public interest faded with the onset of cooler, wetter summers (Unger, 1992; Smith, 2005).

Not only the amount of media coverage is important, however, but the way global climate change is presented is significant as well. The different sources for potential shortcomings of GCC communication by the media can be traced back to the actual professional norms journalists rely on (Boykoff & Boykoff, 2007). These norms can be

grouped into first- and second-order journalistic norms and can lead to the misrepresentation of the science behind GCC and thus spark an informational bias regarding anthropogenic climate change. First-order journalistic norms include personalization, dramatization and novelty, whereas secondary norms consist of authority-order and balance.

According to Gans (1979), due to the first-order journalistic norm of personalization the media tends to focus on individuals instead on group dynamics or social processes. Therefore, in the context of GCC, the focus on individuals affected by impacts of GCC the media shifts the public attention only to a small part of GCC enforcing the general public's believe that climate change is an issue removed in time and space. Furthermore, by focusing on short-term events and often disregarding the causes or long-term trends the media encourages public misconceptions and skepticism towards anthropogenic GCC (Boykoff & Boykoff, 2007).

The second first-order norm, dramatization, is also very important for understanding the media's reporting on GCC. In order to increase reader- or viewership the media tends to focus on only current and highly visible crisis instead of providing a broader and complete representation of the issue, the causes, or the solutions (Wilkins & Paterson, 1987, Sheppard, 2012). As previously discussed in chapter 4 the survey data show that people tend to believe that GCC is in general a serious threat but not necessarily to themselves, but to plants and animals as well as to people in other countries. The media often disregards GCC impacts that are less visible or dramatic because of the lack of excitement or controversy. Simultaneously, the limited media coverage addressing potential solutions is often rather simplistic focusing on high profile policies such as wind turbines or electric vehicles, while disregarding lesser known solutions with similar or even higher

benefits. In addition the often complicated scientific language behind GCC and high degrees on uncertainties makes it very difficult for journalists to report on global climate change while conforming to the dramatization norm (Ungar, 2000). As a result, the incomplete coverage of GCC makes it difficult for the public to recognize the connections between the impacts and causes, as well as positive solutions they should be considering. Instead, GCC is often perceived as an issue removed in time and space which does not require immediate action.

The final first-order norm, novelty, also represents significant barrier to adequate and comprehensive GCC communication by the media (Leornard, 1990; Wilson, 2000). Journalists are always looking for the new and breaking story which results in a preference for covering crisis instead of chronic social or environmental problems such as GCC. Thus, the actual causes or long term consequences are often disregarded in today's 24 hour news cycle. Furthermore, since GCC is a slowly evolving trend of which many of the impacts are not visible yet, it seldom is considered prime-time news material (Boykoff, 2011).

All three of these first-order norms enforce the second-order journalistic norms, authority-order and balance, which also pose significant barriers to unbiased reporting on GCC. When dealing with complex issues, journalists often rely on the opinions of high-profile figures such as government officials, business leaders, scientists, and others (McManus, 2000; Boykoff & Boykoff, 2007). This can lead to a so called authority-order bias where journalist may be relying on experts with their own agendas or even conflicting point of views. In the context of GCC this can result in the unjustified diffusion or amplification of public concern influencing public trust in authority figures and policy

decision making (Lorenzoni and Pidgeon, 2006; Pidgeon and Gregory, 2004). Therefore, journalists need to be cautious when dealing with their sources that they don't become agenda-builders for different interest groups who are trying to use the media as a delivery vehicle for their own communication objectives (Driedger, 2008).

Probably the most influential norm that determines the type of GCC coverage by the media is balanced reporting. Unfortunately, this second-order journalistic norm has a significant impact on the public's perception of GCC (Franklin & Blyton, 2011) and enforces the public misconception that the reality and dangers of climate change is still highly debated within the scientific community (Boykoff, 2008). In general, the goal of balanced reporting is to ensure unbiased reporting by giving equal attention to the arguments of all conflicting parties involved (Entman 1989). However, in the context of GCC this norm can be a substantial barrier to successful and objective GCC communication. By focusing on a balanced coverage of GCC the media gives even consideration to the arguments of GGC critiques as to the overwhelming scientific body of evidence that supports anthropogenic climate change (Nelkin, 1995; Boykoff & Boykoff, 2004).For example, a study conducted in the United States (Boykoff & Boykoff, 2004) shows that over a 15 year period the majority of the media reports about GCC gave roughly equal attention to the two opposing arguments that a) GCC is caused by human behavior and b) that natural functions alone can explain the rise in the average global temperature.

As a result, the media enforces the public misconception that the reality and dangers of climate change is still highly debated within the scientific community (Boykoff, 2008). This presents a significant barrier to public's willingness to fully commit to behav-

ioral changes or support climate change policies (Antilla, 2010) and thus needs to be addressed in future communication efforts.

Furthermore, Smith (2005) points out that the notions of danger caused by global climate change are significantly mediated by news and other broadcast and published sources. Smith argues that the scientific community and policy-makers need to be more aware and critical of how global climate change is portrayed in the media. The author criticizes that scientists and policy specialists are seemingly concerned and reluctant to present their arguments in a news context. Smith believes that scientists are afraid of losing credibility through simplification by the news stations, giving up control of statement to editors, and the fear that their amount of work is not being recognized in a short two minute news segments. Furthermore, Smith points out an important shortcoming for presenting global climate change in the way news stories are ordered during a broadcast. The author states that the organization of topics from local to national to global scales and by subject categories makes it difficult for editors to place global climate change. As global climate change is characterized by impacting and interacting on and between all spatial scales and various categories, the topic is usually placed by editors at a global scale.

As a result of declining, and inappropriately balanced and conceptualized media coverage, the American public is inclined to underestimate possible negative impacts on the local scale and therefore do not support adaptation and mitigation strategies to the degree necessary. Furthermore the scientific community has failed as well to communicate the effects of GCC in a comprehensive and easy to understand manner to the public or the media (Sheppard, 2012). Scientists publish their work in scientific journals which are full of terminology the public is unfamiliar with and heavy with information that is often ab-

stract, complex, remote, depressing, and at times overwhelming. Moreover the way scientists communicate their findings, for example through journal articles, conferences, or reports do usually not allow interaction or querying by the lay public. For the public this makes personal connections and engagement difficult. As a result the public perceive. This study aims, through thematic literature review and survey analysis to identify perceptional factors which need to be considered in future communication efforts to reduce current misconceptions, change attitudes, and increase support for GCC policies

Chapter 3

METHODOLOGY

In addition to various thematic literature reviews the methods utilized in this research also consist of survey research and analysis at the national and international level to answer the four research questions central to the dissertation topic of GCC public perceptions, policy support, and behavior. The insights gained from the following research questions allow for identifying the factors which help to understand the nature of public perceptions of global climate change in different countries as well as to identify perception factors which have a significant impact on the public's level of support for mitigation and adaptation policies, the willingness to commit to behavioral changes, and on the success of future communication efforts.

1. *What are the public's perceptions of GCC in terms of threat and risk, saliency of the issue, trust in GCC information, and acceptable public strategies?*

2. *What importance do GCC risk perceptions and attitudes play in the public's willingness to support mitigation and adaptation strategies*

3. *How do the public perceptions regarding climate change and attitudes toward mitigation and adaptation strategies vary by socioeconomic factors?*

4. *What role do levels of knowledge and perceptions of trust and responsibility play in the public's level of support for adaptation and mitigation policies?*

Based on the data that will be collected, this research will identify common themes among the nine studied countries in terms of GCC risk perception, attitudes, and behavior that can inform and improve communication efforts on the international scale. Furthermore, the study will also show differences between countries related to the public

perceptions of GCC and its inherent issues. These country specific characteristics need to be acknowledged and addressed by communication efforts at the national scale.

Analytical Framework

The following describes the study's analytical framework for the research as shown in Figure 2. The study is divided into 4 different phases. Phase 1 includes a comprehensive literature review which provides the foundation for the research objectives and the rationale for risk perception research on GCC, and it certainly informs us of the importance of working with the key variables and questions during the development of the survey instrument. Phase 1 also includes the development and of the survey instrument. Phase 2 consists of the data collection by launching the survey in 9 countries. The survey instrument and the process of the data collection are discussed in detail in the following sections. After the all data has been collected Phase 3 focuses on the analysis of the survey data guided by the four research questions of this study. The statistical methods applies consist of frequency analysis, cross tabulation, as well as different regressions and are discussed in depth together with the underlying hypotheses in last two sections of this chapter. The final Phase consists of the discussion and conclusions focusing on the goals of this dissertation; identifying the factors which help to understand the nature of public perceptions of global climate change in different countries as well as to identify perception factors which have a significant impact on the public's level of support for mitigation and adaptation policies, the willingness to commit to behavioral changes, and on the success of future communication efforts. Moreover, the newly gained knowledge is put into perspective with the existing body of literature and the underlying theories discussed in chapter 1.

PHASE 1 — LITERATURE REVIEW

Risk Perception
- Underlying Theories
- Risk Perception literature
- Perception of GCC

Risk Communication
- Risk & climate communication literature
- Guiding principles and barriers

Survey Research
- Past studies
- Data availability
- Methods applied
- Repeating themes

Development of Survey Instrument

PHASE 2 — DATA COLLECTION

9 Countries
- Brazil
- Canada
- Germany
- Japan
- Mexico
- Netherlands
- United Kingdom
- United States
- Spain

Survey Topics
- Political saliency
- Level of awareness
- Risk perception
- Concern over GCC
- Attitudes & beliefs
- Trust & responsibility
- Policy support
- Behavior

Representative Sample
18 years and older
Level of education
Household Income
Region
Gender
Age

PHASE 3 — ANALYSIS

What are the public's perceptions of GCC in terms of threat and risk, saliency of the issue, trust in GCC information, and acceptable public strategies?

What importance do GCC risk perceptions and attitudes play in the public's willingness to support mitigation and adaptation strategies?

How do the public perceptions regarding climate change and attitudes toward mitigation and adaptation strategies vary by socioeconomic factors?

What role do level of knowledge and perceptions of trust and responsibility play in the public's level of support towards adaptation and mitigation policies?

PHASE 4 — DISCUSSION & CONCLUSIONS

- The nature of public perceptions GCC in different countries
- Perception factors which have a significant impact on the public's willingness to support GCC

Figure 2. Analytical Framework of this Dissertation Research   Own Illustration

Literature Analysis

Throughout this study only literature from scientific books, peer reviewed journal articles and reports published by research institutes or governmental organizations are

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considered. The literature review examines and discusses the underlying theories of risk perception and communication related to natural threats and hazards, past climate perception studies and surveys, and specific climate change literature including issues related to hazards perceptions, mitigation, adaptation, and national policies. The purpose of this review is to identify the key areas and questions the survey instrument addresses, such as the level of public awareness, knowledge regarding GCC science and impacts, level of public concern, perceived risk, trust perceptions, willingness to pay or sacrifice to mitigate and adapt to potential negative impacts of global climate change, and sociodemographic factors. The literature review also provides the theoretical basis for answering the six research questions of this study and justifies the research.

The literature analysis also focuses on risk communication, relevant to the purpose of this study identifying barriers and shortcomings in exiting communication efforts impacting GCC public risk perception, attitudes, and behavior.

Survey Research

The second phase of the study starts with the implementation of the international survey, followed by the analysis of the retrieved data in Phase 3. Survey instruments present a valuable tool to capture the public's perceptions towards global climate change and, as illustrated in Figure 3, is a key component of this study.

In this study nine countries are surveyed using internet panels, ensuring a demographically representative sample for each country. This allows sampling a large population, while asking the same questions, thus establishing consistency and collecting standardized, quantifiable, and empirical comparative data. The internet panels present a cross-section of all age groups of 18 years and above, gender, income groups, different regions
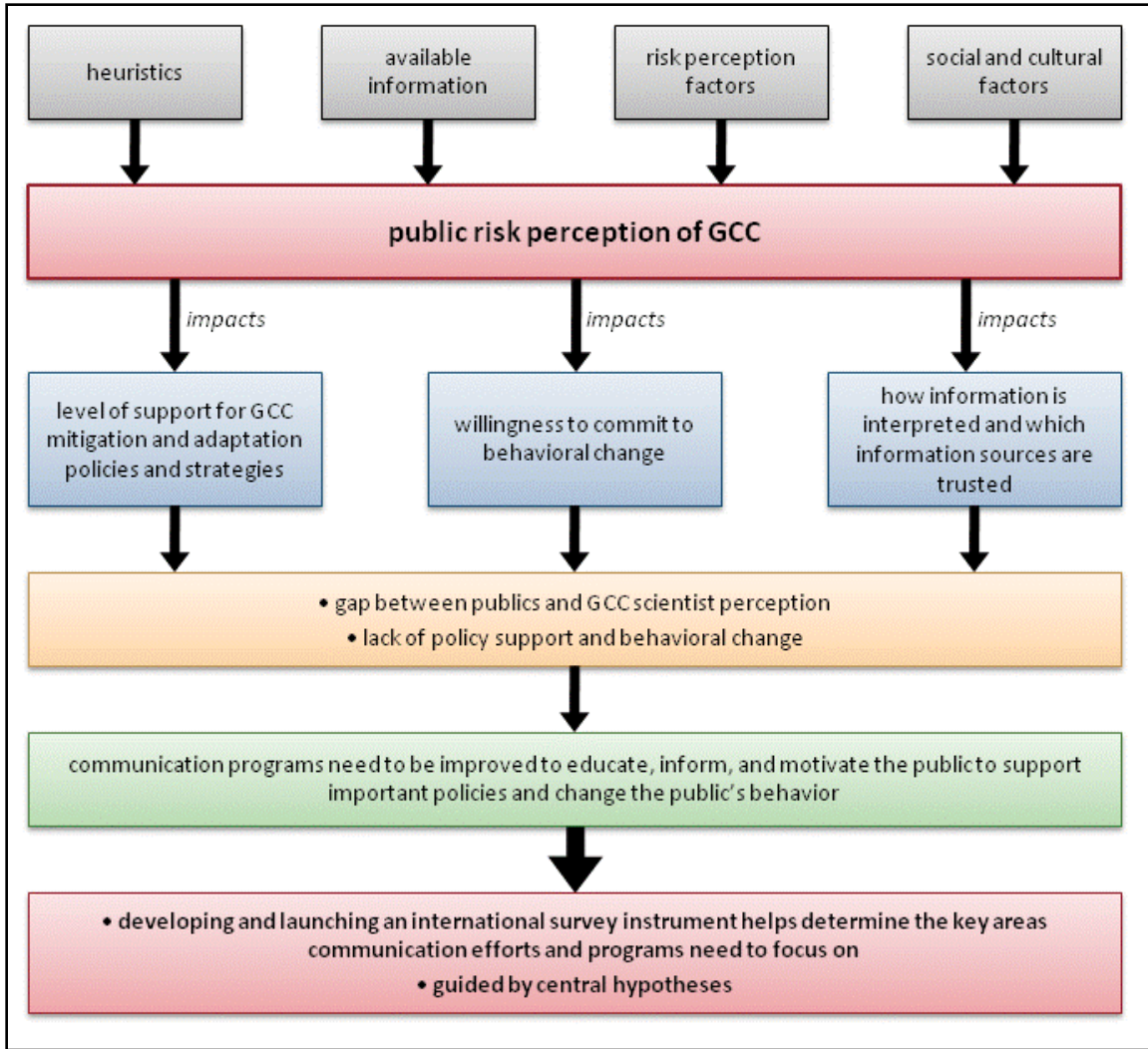
Figure 3. Risk Perception and Survey Research Framework   Own Illustration

of the country, and level of education. Relying on internet panels as sampling frames has

several advantages over other survey methods, such as telephone, mail, or personally ad-

ministered surveys (Fowler, 2008). Email or web based surveys allow coverage of a wide

geographical area with relatively low costs. In addition, internet surveys allow the partic-

ipants to choose their own time to answer the questions, which can increase the response

rates (Babbie, 2007). Furthermore, the responding panel members know that they will

remain anonymous throughout the entire process. It is impossible to link certain answers

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to certain people since the database only assigns an ID number to each person without their name or address. This is very important, since the survey addresses personal feelings, behavior, and knowledge regarding the issue of GCC.

Nevertheless, there are also some pitfalls which need to be avoided when using this internet survey method (O'Leary, 2004, Dillman et al., 2009; Fowler, 2009). The survey questions have to be well designed and easy to understand, because the respondents do not have the opportunity to clarify questions. Furthermore, it is very likely that follow-up emails need to be sent out; otherwise the response rate can be low. The survey instrument itself needs to avoid complex terms and language or double negatives. Both can confuse the participants of the survey. Other pitfalls are created by poorly wording are ambiguous and double-barreled questions. Ambiguous questions can happen easily, because frames of reference can be highly divergent. Double-barreled questions address more than one issue, but only ask for one response. In both cases, the answer cannot be analyzed beyond doubt. Biased, leading or loaded questions and statements, present another common pitfall in survey research. So-called 'ring true' statements are phrases people are likely to agree with because of the tone.

There is also the danger of placing statements in surveys to which in general the respondent agrees but not without elaborating. Instead, the respondent is forced to either agree or disagree. Formulating leading questions can happen quite easily and is often done for political purposes. However, questions and statements which are not unbiased or specific will lead to viable results. Other aspects being problematic for the respondent are recall dependent questions, offensive questions, questions which assume certain knowledge, and questions with unwarranted assumptions (Fowler, 2008; O'Leary, 2004).

The questions should be relevant, and the respondents must be willing to answer to generate trustworthy data leading to credible results and conclusions.

Survey instrument. The survey instrument developed for this study is divided into 8 sections with questions grouped together according to specific themes. The first part of the survey asks the participants about the importance they place on government to reduce, prevent, or improve upon various societal problems. Questions in this section provide the data necessary to determine how important the issue of global climate change is to the public compared to other societal challenges. The second section asks several questions about the level of awareness of various aspects of global climate change. Therefore, questions focus on what GCC means to the participants and whether or not they feel informed in terms of the causes, impacts, and existing mitigation or adaptation measurements. Another segment of the survey addresses the public's perceptions about the risks and threats of a number of global environmental problems. The aim of this section is to determine if the public believes in the reality of GGC and what they believe the level of consequences will be in the near future compared to other environmental impacts. The fourth part of the questionnaire focuses specifically on the public's level of concern over global climate change. The participants are questioned about their level of concern regarding various possible impacts of global climate change.

Furthermore, this section also has questions regarding the risk of GCC causing various natural disasters worldwide and within the countries participating in this study. The next section confronts the survey participants with scientific facts and other statements surrounding GCC to determine the public's attitude and beliefs regarding the existing scientific data, the scientific community, causes of GCC, renewable energy, and other

aspects important to the development of successful communication programs. The sixth part focuses on the issue of public trust and responsibility regarding GCC. Questions in this section will provide the data necessary to determine which source of information the public trusts as a potential communicator of climate change policies. The next section introduces possible climate change mitigation and adaptation policies and examines the level public of support regarding different GCC mitigation and adaptation strategies. Furthermore, the participants are asked how much they are willing to change their behavior or pay extra money to reduce the main causes of GCC.

Finally, the last part of the survey asks about the participant's general level of concern about the environment. In addition to these questions each survey participant also provides his or her age, gender, household income, level of education, and the region they live in. The resulting comprehensive database also provides an opportunity to compare the study's results to related studies, especially in the United States. Although, there is very little information available on how the public perceives the risks and threats of Global Climate Change at local and national levels although the Center for Climate Change Communication at Yale University provides annual data for the United States (Leiserowitz, 2012).

Criteria for selection of surveyed countries. To ensure credibility, the countries selected for this study must establish validity or authenticity within the surveyed population sample (Yin, 1994). This means that the findings can directly be assumed to a larger population. The use of internet panels requires that people from all social groups must have access to the internet and the skills necessary to participate. In the case of Africa this cannot be guaranteed and thus no countries representing the African continent are sur-

veyed in this study. The internet is not as available in rural developing areas as it is in developed countries and the limited amount of time and funding disallows face-to-face surveys for these countries. Therefore, the countries participating in this study are the United States, Canada, Mexico, Brazil, Spain, Germany, UK, Netherlands, and Japan.

The Unites States (US) is an obvious choice being a Superpower, the second highest GHG emitter, the richest country in the world, and there have been significant political debates over GCC (IPCC, 2007). Global agreements to reduce GHG emissions and adapt to global climate change stand and fall with the involvement of the US. Mexico is among the top 20 largest economies in the world and former President Calderon ranked the environment and global climate change very high on his priority list (Booth, 2010). Mexico is the only developing country that has developed complete inventories of all its greenhouse gas emissions in order to reduce GHG emissions significantly. However this goal can only be achieved if the public supports climate change policies and measurements. Moreover, with the outcome of the latest 2012 Mexican presidential elections the public's support and demand for climate change policies becomes even more important. Without public pressure the newly elected president Enrique Peña Nieto will most likely not focus on environmental issues (Reuters, 2012) nor achieve the goal set by the past legislation to cut greenhouse gas emissions by 30 percent from business-as-usual levels by 2020 and by 50 percent by 2050. Canada is confronted with an annual temperature increase of 1.2 degrees Celsius recorded between 1948 and 2005. This increase is significantly higher than the global average of 0.74 degrees Celsius (IPCC, 2007). As a result, sea level rise could become a serious threat to coastal communities requiring adaptive measurements supported by the public (WWF-Canada, 2011). Including the US, Mexico

and Canada into this research also allows an examination of a representative population sample of the North American continent.

Germany is located in the center of the European Union (EU) and is among the G8 countries with one of the strongest economies worldwide. Within the EU, Germany is one of the driving forces for achieving a global climate treaty (Weidner & Mez, 2008). Furthermore, during the current economic downturn, Germany is much less affected compared to the rest of the EU, and as a result, the country will most likely have even bigger political capital in the near future impacting European climate change policy (Hill, 2011). Spain on the other hand is among the countries in Europe heavily impacted by the worldwide economic crisis. The country's tourism industry was estimated in 2006 to be the second largest in the world, and since then, declined (Bank of Spain, 2010). Although Spain is among the leading countries in terms of solar power and renewable energy production, declining tourism and high unemployment rates will most likely dominate political discussions and policies likely reducing support for environmental or climate change initiatives. As a result the country already decreased its investments in renewable energy significantly (PEW Center, 2010). Nevertheless, the large shore line and the resulting tourism make successful climate change adaptation to sea level rise and possible floods necessary in the near future. The Netherlands are widely considered as trend-setting when it comes to successful planning policies and strategies. Furthermore, one third of the country is below sea level facing the North Sea to the north and west. As a result, the Netherlands already successfully cope with weather extremes such as storm floods and sea level rise. In the future other countries will increasingly face these challenges as well due to global climate change. The 4th European country surveyed in this study is the UK.

Together with Germany and France, the UK is a very influential country within the European Union and also worldwide. In terms of global climate change its national government launched a campaign in 1991 for energy conservation with the goal to educate the public about the global implications of local actions (Hinchliffe, 1996).

Japan is chosen because it is an insular state, an economic driving force of the region, and part of the world's largest and most populous continent, Asia. Similar to Canada one of the major impacts of global climate change will be ocean related disasters. The final country to be surveyed is South America's largest economy, Brazil (Worldbank, 2010). The country is home to the Amazon, one of the greatest ecosystems and forests of the planet. This fragile and biologically diverse ecosystem makes Brazil very vulnerable to global climate change, increasing the risks of wildfires releasing even more greenhouse gases (SciDevNet, 2007). Moreover, the likely change of rainfall patterns due to global climate change will result in less water resources and supply, especially in the already drought-affected northeastern part of Brazil.

Statistical analysis. The majority of the questions in the survey are closed-ended multiple choice questions, which are usually easy to code and to analyze statistically (Henerson et al., 1987). They mainly consist of 'Likert-type scaling' which are balanced equally. This means that in order to prevent biases, in balanced Likert-scales the number of favorable and unfavorable answer categories is equal. The Likert-scales used in the survey instrument are mostly 5 to 7 point scales with the answers for example ranging from strongly disagree to strongly agree with a neutral answer possibility in-between. The survey instrument was tested and reviewed by different researchers experienced in survey research to ensure the validity of the Likert-scales and other multiple choice questions.

The data gathered from the survey is mostly analyzed using a wide range of statistical methods. This study applied basic statistical methods such as frequency distributions and descriptive statistics, as well as advanced methods including standard multiple regression, stepwise regression, and ANOVA (Field, 2009). In addition, based on the collected survey data, new variables were coded and indexes were created to gain further insight and a more holistic understanding of the interrelationships of risk perception and risk communication as well as the barriers to successful public climate change communication. For example, the survey instrument does not directly ask if the participants belong to one of the three groups: those who do not believe climate change is happening at all, those who think climate change is happening but is a natural event and not human caused, those that believe it is happening and is human caused. However, answers to different survey questions were used to determine to what degree the participant believes climate change is real and allows the creation of a new "GGC believer" variable based on these specific answers. This new variable coded allows categorizing the survey participants into different groups based on their attitudes towards the reality of GCC and if it is natural or human caused. These types of additionally created variables were used as independent and dependent variables in different regressions in order to analyze the research questions and underlying hypotheses.

Within the scientific literature there is an ongoing debate about using Likert-type data and scales for standard multiple regression analysis (Jamison, 2004; Brown, 2011). The debate focuses on the question if Likert-scales can be treated as interval data, which is a key assumption that has to be met for multiple regression analysis (Field, 2009). Skeptics argue that data is lost if Likert-scales are treated as interval data resulting in un-

derestimating the actual strength of the relationship (correlation coefficient (R)) between the predictor ant outcome variables (Owuor, 2001).

However, a study by Labovitz, (1975) tested the differences between using ordinal categorized data and continuous variables in regression analyses and concluded that categorical data, such as Likert-type scaling, can be analyzed as continuous data. This finding was further supported by James & Wan (1996) whose statistical tests show that not using "true" interval data does not greatly affect Type 1 or Type 2 errors. This means that is highly unlikely that standard regressions based on Likert-type data would show false relationships between variables that do not exist in reality. In addition, different quantitative studies in the field of medical and psychology research (Baggaley & Hull, 1983; Maurer & Pierce, 1998, Vickers, 1999) proved that Liker-scales can indeed be analyzed effectively as interval scales and fulfill all the assumptions needed for the standard and stepwise regression methods applied in this dissertation.

Despite the ongoing discussion among scientists and statisticians, especially in the field of social sciences, in which this dissertation is situated as well, Likert-type data is consistently treated as interval data and used for regression analysis (Johnson & Slovic, 1995; Peters et al.. 1997; Sjoeberg, 1998; Leiserowitz, 2006). For example, in their published study "Presenting Uncertainty in Health Risk Assessment: Initial Studies of Its Effect on Risk Perception and Trust" Branden B.Johsnon and Paul Slovic (1995) showed through multiple regression analysis based on Likert-type survey questions that public reactions to environmental problems are less impacted by the presentation in the media compared to general factors of risk attitudes and perceptions. Peters et al. (1997) focused on the role of the perception factors trust and credibility as key elements in environmental

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risk communication. The study applied standard multiple regressions to test the hypothesis that trust and credibility are strongly impacted by three independent factors - perceptions of knowledge and expertise, perceptions of openness and honesty, and perceptions of concern. The majority of these factors were measured through survey questions using four-point, Likert-type scaling. Based on the psychometric paradigm, which is also the methodological foundation of this dissertation research, Sjoeberg (1998) examined the relationships between world views, political attitudes, and risk perceptions using multiple regressions with scores provided by Likert-type data. The study showed that approximately 10 percent of the variance in one factor could be explained by the remaining two. Another study, specifically in the context of GGC, used survey data from the United States used multiple regressions to test if GCC risk perceptions and policy support are influenced by experiential factors (Leiserowitz, 2006). The details of this study were already discussed in chapter 2, but the study did use a similar analytical framework as this dissertation research. These studies are well known and their findings are considered as important contributions to the existing body of knowledge

Nevertheless, additional steps were taken to further decrease the likelihood of information loss and wrong results as well as to acknowledge the arguments by skeptics, who caution the use of Likert-type scales as interval data. Research suggests that when Likert-type data is used is multiple regression analysis the estimates improve if the answer scales have more than three points and a sample size of 300 participants (Owuar, 2001). Both points are considered in this study, as no Likert-scale used has less than 4 points and the smallest country sample consists of over 500 people. Furthermore, Brown (2001) argues that indexes created from Likert-type data not only further reduce the like-

lihood for errors (Wan, 1996; Jamison 2004), but are actually "true" interval data. As a result, the vast majority of regressions performed in this dissertation use different additive indexes from Likert-type survey questions as dependent variables.

The additive indexes created from the survey data focus on the areas of the public's general support for mitigation and adaptation policies in general, their preparedness to change their behavior, as well as their willingness to pay more for GCC policies. Furthermore, indexes are also created for specific themes. For example, in addition to the general indexes for the public's support for mitigation or adaption strategies, indexes are also created for the public support regarding energy efficiency policies, economic incentives, and planning strategies. These different indexes are created based on different sub-questions which have in common an overarching theme such as general support for mitigation polices or general willingness to commit to behavioral changes. Similar as the new variables mentioned above, the different indexes will be used in various regressions as dependent and independent variables. The main indexes created for this study are the following:

- *Index 1: Overall support for mitigation polices*

- *Index 2: Overall support for adaption polices*

- *Index 3: Overall public willingness to pay more for GCC strategies*

- *Index 4: Overall public willingness to commit to behavioral changes*

- *Index 5: Overall level of consequences perceived by the public from environmental changes*

- *Index 6: Overall public's perceived level of threat from GCC*

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The basic analysis consists of frequencies and various cross-tabs for all 9 countries combined and for each country separate. The basic analysis of the frequencies and percentages of the survey answers allowed comparing the countries and identifying the significant differences between countries in various areas that are addressed in the survey instrument. Together with the results from various crosstabs between indexes, differences and possible correlations identified were explored through advanced statistical methods such as different regressions and ANOVA. The descriptive analysis also prepared the large amount of survey data into a manageable size.

Standard multiple regressions were used to illustrate how independent variables (such as demographics, attitudes toward climate change, or trust in climate science) are related to the dependent variables (such as willingness to pay, policy support, or person connection towards climate change). These relationships were further explored through stepwise regressions to determine the subset of independent variables that has the strongest relationship to each dependent variable. It is important to note, that throughout the statistical analysis, depending on the underlying hypothesis, numerous variables were used as independent as well as dependent variables in different regressions.

The results from the survey research and from the previously conducted literature review provided the insights necessary to address the research questions of this study. Furthermore, this analysis points out possible misconceptions among the lay public, identify trusted communication channels and identify the key areas communication efforts need to focus on to improve the success of current and future GCC policies.

Underlying hypotheses & main variables. The following section provides an overview and justification of the main hypotheses, variables and statistical methods used to address the research questions during the 4th phase of this study.

Hypothesis 1. The public's perceptions of GCC in terms of threat and risk, saliency of the issue, trust in GCC information, and acceptable public strategies vary among countries"

This research is based on the psychometric paradigm, (Fischhoff et al., 1978, & Slovic et al.,1984) that implies that risk means different things for different people. Therefore, we can assume that public perceptions in the context of GCC vary among countries with different cultural and economic backgrounds.

This hypothesis was tested by comparing the basic frequencies and means of the relevant survey questions and determining statistically differences among the answers provided by the surveyed population within the nine countries. In addition to these questions the results of 4 different indexes were compared as well. The indexes present the overall support for mitigation and adaptation policies, the public's general readiness to change their behavior, as well as their willingness to pay more for GCC strategies. This basic analysis relying on descriptive statistics helped identifying patterns between countries and provided the foundation for the more complex statistical analytical methods, which were necessary for the following hypotheses.

Hypothesis 2. *"The public's general support for mitigation and adaptation policies is linked to the way they perceive 1) the level of consequences from possible environmental changes and 2) the general level of threat resulting from GCC"*

Research shows that risk perception has a significant impact on individual and group behavior and thus needs to be considered when developing global climate change policies and strategies (Slovic, 2000). For example, research linking perceptions of risk to acceptance and opposition to specific technologies, such as nuclear power have shown that the higher the perceived risk the higher the opposition by the public towards such technologies (Slovic et al, 1981).

Furthermore, recent studies emphasize the important role of emotions, such as level of concern and perceived level of threat, in the decision-making process (Finucane et al., 2000; Loewenstein et al., 2001, Paton, 2008, NRC, 2010b). This leads to the assumption that such relationships also exist in the context of natural hazards resulting from global climate change. Therefore the hypothesis was developed to test if the public's support of policies and strategies to reduce the causes and impacts of natural hazards resulting from GGC also correlate to the public's risk perception of GCC?

The hypothesis was tested through frequency distribution analysis and crosstabulations. The frequency analysis focused on survey questions addressing the public's perceived level of consequences from environmental changes over the next 20 years, the level of support for mitigation and adaptation policies, and the perceived level of threat resulting from GCC over the next 50 years. In a second analytical step crosstabs were created to test for relationships between mitigation and adaptation attitudes (support) and the public's perceived level of consequences from different environmental changes such

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as global climate change and level of threat resulting from global climate change in particular. The crosstabs were used to identify differences among the nine countries in terms of the significance of these relationships.

Hypothesis 3. *"The public's perception towards climate change is the main reason for the 1) low policy support, 2) willingness to pay for GCC policies, and 3) willingness to change their behavior related to mitigation and adaptation"*

As pointed out by the literature (Rotter, 1966), if the public believes that they can control the events that affect them, they also are likely to feel that applicable strategies exist in which they can be engaged in (locus of control concept). However, GCC is characterized by high uncertainties, unfamiliar risks, and other characteristics of hazards which make a personal connection and engagement more difficult (Maibach et al, 2009; O'Neil & Hulme, 2009; Whitmarsh 2009). Research suggests that current public engagement with global climate change is low (Leiserowitz, 2004) impacting public policy support and behavior.

The hypothesis was tested by conducting various multiple regressions, using six independent variables and sixteen dependent variables. The public's preference towards four general climate change strategies and the level of belief in the reality of global climate change were used to describe a person's attitude towards GCC. The remaining four independent variables focused on the public's level of concern regarding possible dangerous impacts of GCC on different geographical and personal levels as well as time-scales. The dependent variables used for the regressions included different additive indexes, based on survey answers from various survey questions, as well as single survey

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questions addressing the public's willingness to pay more or commit to behavioral changes to mitigate and adapt to GCC.

Hypothesis 4.*The general attitude and public risk perceptions of GCC can be largely explained by socio-economic variables"*

This is another key main hypothesis that needs to be tested. Similar to the previous hypothesis two main regression analyses types are utilized consisting of standard multiple regressions and stepwise regressions. The independent variables include various socio-economic characteristics of the surveyed population such as, age, gender, household income, and level of education. The dependent variables cover the answers to different survey questions related to public's GCC perception in terms of its risks, threats, level of concern and consequences, timeframe for potential impacts, and behavioral attitudes towards specific mitigation and adaptation policies.

The reason for testing the impact of different socio-economic characters of the survey participants on general GCC attitude and public risk perceptions is rooted in past perception research in the areas of technological and natural hazards (Burton et al., 1978; Douglas & Wildavsky, 1982; Short, 1984, Slovic, 2001) arguing that perceptions are socially constructed and can vary by culture, human development, affluence, and demographics. Furthermore, this research is a multinational study including different socio-economic characteristics. As a result, we can assume that socio-economic characteristics are a potential factor impacting public's risk perception and policy support,

Chapter 4

PUBLIC PERCEPTIONS OF GLOBAL CLIMATE CHANGE

Relevant social science literature (Krimsky & Golding, 1992; Kasperson et al, 1995; Slovic 2000 & 2010) shows that threats, whether from natural phenomena and from technological origins are perceived differently based on national experience with the hazard, geography (coastal areas verses inland territory), stage of economic development, and the nature and type of the hazard. There is also evidence that these public perceptions of risk may change over time (Loewenstein & Mather, 1990; Gomez et al., 1992; Tate, 2003). Because the concepts and knowledge of global climate change impacts are relatively new, unlike floods and hurricanes, there are little data on how people perceive the causes of GCC to be, the nature of the threats over time and space, and our abilities and willingness to resolve the problems through policy support and behavioral changes. The existing body of knowledge is also limited regarding the public's predispositions concerning trust in the information about GCC and its sources. This chapter presents the first stage of the survey data analysis while answering the first underlying research question of this study.

- *What are the public's perceptions of GCC in terms of threat and risk, saliency of the issue, trust in GCC information and acceptable public strategies?*

By examining basic frequencies and significant country differences, this section of the dissertation addresses how the public perceives the issue of GCC at the international level by looking at survey results in nine countries. These include Canada, United States, Mexico, Brazil, Spain, Netherlands, Germany, the United Kingdom as a whole, and Japan. In particular, using descriptive statistical analysis methods, this section takes a

close look at how the survey participants responded to questions dealing with the potential threats and risks of GCC, the saliency of the issue, trust in GCC information and their sources, and possible policies and strategies which require the public's support.

This first analysis compares results of key survey questions between countries, providing the insights necessary to answer the first research question. Moreover, by identifying key differences and similarities among countries and relationships between important variables, the descriptive exploration of the survey data provide the foundation for more sophisticated statistical analytical methods necessary for answering many of the remaining research questions. In addition, since policy makers do not have a good understanding of where various publics stand on climate change strategies, policies, priorities and what will be acceptable and supportive. The analyzed survey data in this chapter can assist policy-makers in evaluating the appropriate choices to make and what would be seen as publically acceptable decision-making.

The total sample size accounted for 7,261 households. The sample size for each country was large enough to provide the ability to generalize to each country with a 99 percent confidence level and a ± 4% margin of error. As shown in Table 1 the sample size per country ranges from 539 for Canada to 947 participants in the United States. The surveys' household selections were not entirely random, but random within the parameters of socio-economic categories and ownership of computers. The sampling process was guided by two parameters. First, every respondent has to be at least 18 years old. Second, the total population sample for each country represented the country's socioeconomic characteristics in terms of age, household income, level of education, gender, and spatial distribution.

Table 1

Survey Sample Sizes per Country

Country	Sample Size
United States of America (USA)	947
Netherlands (NET)	866
Japan (JP)	829
Mexico (MEX)	826
Spain (ESP)	821
Germany (GER)	824
United Kingdom (UK)	809
Brazil (BRA)	800
Canada (CAN)	539

Therefore, the nine countries were surveyed using internet panels consisting of demographically representative samples for each country. The internet panels were provided by the company Survey Sampling International (SSI) which also hosted the survey and collected the data. The survey instrument was tested and reviewed to validate if the English version would correspond to other languages in terminology and meaning. Key statistical concepts applied in this chapter on the international and national scale, were basic descriptive methods such as frequencies and percentages, means, standard deviations as well as non-parametric tests such as the Kruskal-Wallis Test.

Frequencies, percentages and means were used to illustrate the public's perceptions towards different aspects of GCC relevant to the first research question and the study overall as well as to identify response patterns among countries. In order to compare the means of several survey answers between countries, the standard deviations were calculated to ensure that the mean is a good representation of the data. Therefore, the standard deviation was used to determine whether or not the mean could be used to compare survey questions between different samples. In the cases of the standard deviation

confirming the mean as a well representation of the data from a particular survey question, the Kruskal-Wallis test was performed to examine if the means are also significantly different between the countries. The Kruskal-Wallis test is the non-parametric counterpart to one-way independent ANOVA analysis. The collected survey data are not normally distributed nor can the homogeneity of variance be assumed throughout the data set. Therefore, the Kruskal-Wallis test was used which is free of assumptions about how the data is distributed and does not require homogeneity of variance to test if means are significantly different between groups (Devore, 2004). The output of this test in SPSS includes a significance value. As long as this value is below .05 the country means are significantly different. The Kruskal-Wallis test also provides mean rank scores which allows grouping as well as identifying outliers among the nine countries.

Analysis

   Saliency. An important aspect of the public perceptions of global climate change is where people position that issue in the context of other problem areas the government focuses on. The idea of the relative importance of where GCC is ranked among all the other socio-economic problem areas confronting populations is known as *political saliency* – how important the problem is for government to act on. One question in the survey instrument measured political saliency by asking the participants to indicate how important it is for government to act on nine separate problem areas. One of these nine areas was "reducing global climate change". The participants were asked to rank the nine issues by rating the level of importance for the government to act on a 4-point Likert-scale. The scale was coded to analyze the answers as categorical data.

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Table 2

Global Trends for Political Saliency of GCC

All Countries Combined	1 unimportant	2 low im- portance	3 important	4 Very im- portant	Mean
Lowering the rate of vio- lent crime	1.3%	4.1%	32.9%	63.7%	3.56
Improving the nation's schools	1.1%	5.2%	34.0%	59.8%	3.52
Reducing poverty	1.2%	6.1%	36.5%	56.2%	3.48
Increasing employment	1.1%	2.9%	29.7%	66.4%	3.61
Reducing global climate change	5.4%	15.1%	41.2%	38.3%	3.12
Improving air and water quality	1.8%	12.2%	45.1%	40.9%	3.25
Preventing global terror- ism	2.6%	12.8%	39.8%	44.8%	3.27
Eliminating illegal drugs	3.8%	15.2%	37.0%	44.0%	3.21
Developing a comprehen- sive. clean energy policy	2.9%	13.0%	42.5%	41.5%	3.23

For this purpose each answer was assigned a numerical value from 1 to 4, where 1 is 'unimportant', 2 is 'low importance', 3 is 'important', and the value 4 represents the answer option 'very important'. The political saliency of the climate change is also used as an indicator for the public's level of concern regarding global climate change

The results shown in Table 2 illustrate the frequencies, percentages and means for all nine countries combined, indicating the global trend in terms of the political saliency of global climate change. The total sample size was 7261 participants. With a mean of 3.12 (Std. Deviation ±.857), the results show that out of the nine societal issues, the least salient issue for the government to place importance on is global climate change. The mean value suggests that people do believe that climate change is an important problem, but certainly not the most pressing issue. Only 38.3 percent the surveyed public of nine

selected countries find climate change a 'very important' issue for government, far below violent crime, schools, employment and poverty. However, when you combine the two categories 'important' and 'very important', almost 80 percent of the participants want government to be involved. Nonetheless, the public views this topic as the least important issue for governments to act on.

Looking at the data for each country individually, among the nine issues in the political saliency question, reducing global climate change ranks in the bottom third. In the United Kingdom, United States, and Netherlands the issue of GCC ranks last among all listed issues. Based on the same 4 point Likert-scale as the previous table, Table 3 shows the percentages, the mean values and. standard deviations, for each of the nine countries individually regarding the level of importance the government should place on reducing GCC. The table emphasizes the countries which stand out on either ends of the scale.

Except for the Brazilian sample, less than 50 percent of the participants in all other countries indicated that the government should treat GCC as a very important policy priority. This is followed by Mexico with 49.8 percent and Spain's 42.9 percent strongly supporting governmental action. The lowest percentile in this category was the Netherlands with only 21.2 percent expressing that their government should handle GCC as a very important issue. Interestingly, the 15.7 percent of survey respondents in the United States characterizing the reduction of GCC as unimportant politically is significantly higher compared to all other countries. Furthermore, three countries stand out when combining the 'unimportant' and 'low importance' categories

Table 3

Political Saliency of GCC by Country

Country	1 unimportant	2 low importance	3 important	4 very important	Mean	Std. Dev.
BRA	2.4%	7.3%	31.4%	59.0%	3.47	.73
MEX	3.9%	7.7%	38.6%	49.8%	3.34	.78
ESP	3.3%	10.5%	43.4%	42.9%	3.26	.77
GER	3.5%	11.9%	41.7%	42.8%	3.24	.80
JP	2.3%	7.7%	53.1%	32.9%	3.17	.72
CAN	3.7%	16.0%	42.3%	38.0%	3.15	.82
UK	6.3%	19.5%	43.5%	30.7%	2.99	.87
USA	15.7%	18.9%	35.4%	30.0%	2.80	1.04
NET	5.2%	31.5%	42.0%	21.2%	2.79	.83

In the Netherland 36.7percent of survey participants believe that GCC should not be addressed by the government at all or only as a low priority issue, followed by the United States with 34.4 percent and the United Kingdom with 25.8 percent.

The mean values of each country suggest that countries can be grouped together based on how the public perceives the political saliency of GCC. As a result the countries were divided into three groups. Group 1 consists of the countries Brazil and Mexico. With mean scores ranging from 3.34 to 3.47, the data show that the survey participants in these two countries take GCC very seriously and want their governments to be strongly involved. Spain, Germany, Japan and Canada also seem to want their governments to place a high level of importance on reducing GCC. However, the means of these countries suggest that the participants do not want their government to put as much importance on GCC activities as compared to Brazil and Mexico. The mean scores of the second group range from 3.15 (Canada) to 3.26 (Spain).The third group consists of the three countries with a mean score below 3.00, United Kingdom, USA and Netherlands.

In addition, in all three countries the percentage of people who do not perceive GCC as an important issue is above 20 percent.

This grouping of nine countries is supported by the Kruskal-Wallis test which was performed to confirm that the means are significantly different among the nine country groups.. The test suggests, with a significance level of $p < 0.01$, that there is a significant difference among the nine countries in terms of how the public perceives the political saliency of reducing GCC, thus indicating a relationship between the two variables 'country of origin' and 'level of importance for government to be involved in reducing GCC'. However, the relationship between socio-economic variables and GCC are discussed in the next chapter.

The mean rating of each country confirms the validity of the country grouping. The mean rank of Brazil (4473.02) and Mexico (4153.34) are significantly different from the mean ratings of the countries belonging to group 3, United Kingdom (3294.53), United States (3294.53), and Netherlands (2808.80). Japan's and Canada's mean scores are very similar, confirming the decisions to place them in the same group.

A different question in the survey asked the participants for their level of agreement with the statement 'I worry about GCC because there is no strong political will to prevent it'. Similar to the previous question discussed above, this statement was designed to measure how the public perceives their government's current level of involvement with the issue of GCC. The public's level of agreement was measured on a 5-point Likert-scale, where the value 1 is strongly disagree, 5 is 'strongly agree', and the middle value 3 represents 'undecided'.

Table 4

Public Perceptions regarding the Political Will to Prevent GCC

"I worry about GCC because there is no strong political will to prevent it"							
Country	1 strongly disa-gree	2 disagree	3 undecided	4 agree	5 strongly agree	Mean	Std. Dev.
MEX	2.7%	5.4%	11.1%	35.0%	45.8%	4.16	1.00
BRA	2.4%	5.0%	10.0%	42.3%	40.4%	4.13	.95
ESP	3.4%	6.6%	25.7%	38.9%	25.5%	3.76	1.01
GER	3.9%	10.3%	25.5%	36.7%	23.7%	3.66	1.07
JP	2.2%	7.2%	34.1%	43.1%	13.4%	3.58	.89
CAN	5.8%	10.0%	26.7%	35.1%	22.4%	3.58	1.11
UK	7.9%	11.7%	35.1%	32.1%	13.1%	3.31	1.09
USA	14.4%	9.9%	28.3%	30.4%	17.0%	3.26	1.26
NET	5.4%	22.5%	27.4%	33.1%	11.5%	3.23	1.09

The frequency distribution for all nine countries shows that over 65% of the public either agrees or strongly agrees with the notion that the political will to address GCC is insufficient. Close to 21percent are undecided and 13percent of the survey participants either disagreed or even strongly disagreed (5.5 percent). The mean score of 3.79 is between the two answer categories 'undecided' and 'agree' and suggests that the public tends to agree with the statement 'I worry about GCC because there is no strong political will to prevent it'. Table 4 displays the percentages per answer category, the mean scores, and standards deviations for each country separately. In the table the nine countries are ranked from largest to smallest according to their mean value. As in the previous table, illustrating the survey results of the political saliency of reducing GCC (Table 3), the order of the countries is identical. Populations that indicated that they want their government to act on GCC as important also believe that the political will to do so is deficient. Again, Mexico and Brazil are at the top with over 80 percent of the participants agreeing

or strongly agreeing with the statement that they worry about GCC due to the lack of political will to prevent it.

On the other hand less than less than 50 percent of the surveyed population in the United Kingdom, United States, and Netherlands agree with this sentiment. Furthermore, with the exception of Brazil and Mexico, between approximately 25 percent and 35 percent of survey respondents choose the answer category 'undecided', indicating that at least 1 out of 4 people are not familiar with their government's position on reducing GCC. Nevertheless, the data suggest that in all nine countries the majority of people seem to perceive the lack of involvement by their government as a reason to worry about GCC.

Threat and risk. The survey instrument first asked participants several questions regarding the risks and potential threats of a list of negative environmental events, such as GCC. The way the public perceives the risk and threats of GCC is important information for successful communication efforts. It allows risk communicators to better understand their audience in terms of their perceptions and experiences regarding GCC and its impact and develop effective communication tools. Thus, increasing the likelihood that GCC communication programs will enhance the public's level of awareness and sense of urgency as well as increasing their policy support through behavioral changes. The following presents the frequency distributions among the nine countries of questions which focus on determining how concerned the public is about GCC and how they perceive its levels of threat and risk.

The first question in the survey instrument's risk and threat section addresses the perceived level of consequences or effects of different environmental changes expected over the next 20 years.

Table 5

Ranking of Environmental Changes based on the Public's Perceived Level of Risk

Rank	Environmental Changes	Mean
1	Extensive loss of forest and/or wetlands	4.43
2	Deterioration of ozone layer	4.34
3	Increasing frequency of droughts	4.30
4	Increasing frequency of major hurricanes and/or floods	4.29
5	Substantial increase in global warming resulting in global climate change	4.26
6	Worsening of urban air pollution	4.24
7	Further extinction of endangered animals and plants	4.21

One of the environmental changes listed was 'Substantial increase in global warming resulting in global climate change'. The participants determined the level of consequences of each environmental change based on a 5 point scale, ranging from 'not likely at all to happen' to 'serious negative consequences'. The responses provided a first indication on whether or not the participants believed in the reality of GCC and how they perceive the level of consequences or relative risk compared to other environmental impacts.

On the global scale, the data show that only 3.6 percent of the total global sample holds the belief that global warming will not result in climate change. However, over 55 percent of those surveyed indicated that climate change will have 'very serious negative consequences'; another 24.9 percent expect 'moderate negative consequences' over the next 20 years. Together, this percentage of the global survey represents a significant result related to peoples' beliefs about climate change and the level of negative consequences they expect on the global scale. In total, this question listed seven environmental changes for which responses in levels of perceived risk was asked for.

As shown in Table 5, with a mean score of 4.26 'substantial increase in global warming resulting in global climate change' only ranks 5th in terms of the public's perceived level of risk or consequence. A higher percentage of participants expect greater negative consequences from events such as the extensive loss of forests and/or wetlands, the deterioration of the ozone layer, the increasing frequency of droughts, and the rising number of major hurricanes and /or floods. The two environmental changes ranked 6th and 7th on the risk scale were 'worsening of urban air pollution' and 'further extinction of endangered animals and plants'.

As illustrated in Table 6, examining the frequency distribution for every country individually reveals significant differences among the surveyed populations specifically on the impacts of global warming.

With the exception of Netherlands, United Kingdom, and United States the majority of the public seems to expect serious negative consequences from global warming and climate change. The data indicates that populations of Mexico and Brazil are most concerned among the nine countries with over 80 percent of the participants believing that here will be serious negative consequences.

On the other end of the spectrum over 10 percent of the survey participants in the United States do not believe that global climate change will be happening at all. The data suggest that the reality of climate change is much more challenged by the public in the U.S. than in any other surveyed country. Overall, based on the mean values, several countries seem to perceive the future level of consequences quite similar. As mentioned before, Mexico and Brazil show a very similar frequency distribution and their mean values are also close to each other.

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Table 6

Public's Perceived Level of Consequences, if any, from Future GCC

Country	1 not likely at all to happen	2 no negative consequences	3 slight negative consequences	4 moderate negative consequences	5 serious negative consequences
MEX	0.2%	0,2%	1,9%	14.4%	83.2%
BRA	1.4%	1.4%	3.5%	13.0%	80.8%
ESP	3.4%	2.4%	8.5%	27.0%	58.6%
JP	1.1%	3.0%	11.6%	29.2%	55.1%
GER	3.2%	1.6%	13.6%	27.4%	54.2%
CAN	2.4%	2.0%	13.4%	30.6%	51.6%
NET	3.7%	6.0%	21.5%	28.1%	40.8%
UK	4.4%	5.6%	21.1%	29.7%	39.2%
USA	10.8%	6.4%	16.9%	26.3%	39.6%

Another group of countries with similar percentages and means consists of Spain, Japan, Germany, and Canada. Their means range from 4.27 to 4.35 indicating that the overall populations of these countries expect moderate to serious consequences. The third group includes countries that have a mean score below 4.0 such as the Netherlands, the United Kingdom, and the United States. For these countries the data suggest that the majority of people expect slight to moderate negative consequences from global climate change.

In the same segment of the questionnaire another question asked participant's how they perceive the level of threat from GCC over the next 50 years. The previous question asked responders about their concern with a time period of 20 years. Participants were asked to determine the level of threat for four different groups; 'plants and animals', 'people in other countries', people in your country' and 'you and your family'. The level of threat was measured using a 4 point Likert-scale ranging from 1 representing 'no threat at

all' to 4 being 'a high threat'. In total over 50 percent of the 7,261 survey participants recognize GCC as a high threat for plants and animals as well as for people living in other countries than themselves. However, when asked about the level of threat GCC poses for people in their respective countries, to their family, and to themselves the percentage of people answering with ' high threat' is significantly lower. The data show that only 36.8 percent of surveyed population believes that GCC presents a high threat for other people in their country. In terms of the perceived level of threat for their family and themselves only 33.4 percent chose the 'a high threat' response category'. Only 9.5 percent of the surveyed publics feel that GCC does not pose any danger to themselves or their families over the next 50 years. Although, the frequency distributions vary among the nine countries the results suggest that people tend to believe that GCC is in general a serious threat but not necessarily to themselves, but to plants and animals as well as to people in other countries.

This observation is further supported by the results of two survey questions that asked participants to indicate how long it will take until dangerous impacts of GCC will be experienced 'somewhere on earth' and 'in their region'. Asking the public to determine a timeframe until they expect GCC impacts to become visible also adds another perspective in terms of the perceived saliency of the issue and level of urgency among the population. The participants were asked to choose from six different answer categories; 'impacts are already experienced', 'in 10 years', 'in 25 years', in 50 years', 'in 100 years', or 'never'. The results for each country individually are displayed in Table 7.

Table 7

Timeframe until the Public Believes GCC Impacts will be Experienced Somewhere on

Earth and in their Region

Somewhere on Earth								
Country	1 impacts are already experienced	2 in 10 years	3 in 25 years	4 in 50 years	5 in 100 years	6 never	*Mean*	*Std. Dev.*
MEX	81.0%	9.4%	4.7%	3.1%	1.3%	0.4%	1.35	.86
BRA	83.0%	5.6%	5.9%	3.1%	1.9%	0.5%	1.37	.93
GER	65.5%	10.4%	11.3%	5.9%	3.5%	3.3%	1.81	1.35
JP	59.7%	14.1%	12.5%	7.8%	3.7%	2.1%	1.88	1.30
CAN	64.4%	9.8%	10.2%	5.8%	6.3%	3.5%	1.90	1.45
ESP	53.0%	9.1%	14.3%	12.4%	7.6%	3.7%	2.23	1.54
UK	48.1%	10.4%	14.0%	11.0%	8.5%	8.0%	2.46	1.71
USA	50.5%	8.4%	12.5%	7.3%	7.1%	14.3%	2.55	1.88
NET	45.0%	8.4%	13.3%	13.3%	11.8%	8.2%	2.63	1.76
In Your Region								
Country	1 impacts are already experienced	2 in 10 years	3 in 25 years	4 In 50 years	5 in 100 years	6 never	*Mean*	*Std. Dev.*
MEX	72.0%	17.1%	5.8%	3.1%	1.5%	0.5%	1.46	.91
BRA	70.4%	15.1%	8.0%	4.0%	1.9%	0.6%	1.54	1.00
GER	46.5%	22.0%	14.3%	8.7%	4.2%	4.2%	2.15	1.41
CAN	39.9%	24.5%	15.8%	9.3%	6.7%	3.9%	2.30	1.44
ESP	44.9%	16.4%	14.3%	10.8%	9.4%	4.1%	2.36	1.55
JP	34.0%	26.7%	18.6%	11.8%	6.0%	2.9%	2.38	1.37
USA	34.7%	19.9%	13.7%	9.2%	7.4%	15.1%	2.80	1.82
NET	24.6%	20.3%	15.5%	15.1%	15.0%	9.5%	3.04	1.67
UK	20.0%	20.6%	19.4%	17.3%	12.9%	9.8%	3.12	1.60

With the exception of the United Kingdom and the Netherlands the data suggest

that the majority of the nine-country public believes that GCC impacts are already being

experienced somewhere on earth. In all nine countries no answer category was chosen

more often than the one stating that impacts are already being experienced. On the other hand, the answer category 'never' received the least level of agreement from eight of the nine surveyed countries. In this case, the outlier is the Unites states where 14.3 percent of the participants indicated that they believe that no impacts will be experienced anywhere on the planet. When asked about a timeframe until GCC impacts will become apparent locally, a smaller percentage of people believe that dangerous impacts of climate change are occurring within their own region than somewhere on earth. A majority of over 70 percent in Brazil and Mexico believe that they are personally already experiencing GCC impacts. This statistic is much more than the country with the third highest rating Germany, where 46.5 percent of the participants indicate that they already experience GCC impacts. Based on the total sample size, 42.8 percent of the nine-country population believes that dangerous impacts are being experienced today in the region they live in. In addition just over 20 percent of the global surveyed population believes that they will experience effects from GCC within 10 years.

However, the data also suggests that most of the population in the United Kingdom does not believe that they are already experiencing GCC impacts. Only 1 out of 5 participants believe that GCC impacts are already occurring on the local scale. This is the lowest rate among all nine countries. Moreover, the United Kingdom, the Netherlands, and the United States are the only countries where over 50% of the surveyed populations believe that GCC impacts are neither already occurring locally nor will be in the next 10 years. In the remaining six countries at least 60% of the public either seems to experience impacts of GCC already or at least expects them to take place locally within the next 10 years.

Overall, the results suggest that the overwhelming majority of the public either already experiences impacts or expects GCC impacts to occur globally and locally over the next 25 years. In total, 60.7 percent of the 7,261 survey participants hold the belief that dangerous impacts of GCC somewhere in the world are already being experienced today. In addition 9.5 percent indicate that they expect impacts to be experienced somewhere on the planet within the next 10 years and another 11 percent thinks within 25 years. Still, in the Unites States 15.3 percent and close to 10 percent of the populations in the United Kingdom and in the Netherlands do not think that they will ever experience any impacts of GCC in their own region.

Another question was asked specifically about their level of concern regarding the possible impacts of GCC in the nine countries on a 5 point Likert-scale. Responses were categorized from 'not at all concerned' to 'highly concerned'. On the global scale with all participants combined, 31.3 percent are highly concerned, 33.1 percent concerned, and 19.3 percent somewhat concerned. Only 6.1 percent of the 7,261 people participating in this study indicated that they are not concerned at all. The data suggest that on the global level, represented by the nine countries in this study, the majority of the public is concerned about global climate change and its potential impacts. This becomes even more apparent when the frequencies of the three answer categories 'highly concerned', 'concerned', and 'somewhat concerned' are combined. As an aggregate, 83.7 percent of the participants state at least some concern regarding the possible impacts of GCC.

Table 8

Public's Level of Concern regarding the Possible Impacts of GCC by Country

Country	1 not at all concerned	2 slightly concerned	3 somewhat concerned	4 concerned	5 highly concerned	*Mean*	*Std. Dev.*
MEX	1.0%	0.8%	6.3%	35.0%	56.9%	4.46	.74
BRA	1.4%	1.8%	7.6%	28.5%	60.8%	4.46	.82
CAN	4.3%	7.2%	17.8%	39.7%	31.0%	3.86	1.07
ESP	4.3%	7.7%	20.3%	39.5%	28.3%	3.80	1.07
GER	4.4%	6.6%	25.4%	37.3%	26.5%	3.75	1.05
JP	3.0%	20.7%	21.8%	26.2%	28.2%	3.56	1.19
UK	9.3%	15.6%	24.4%	31.4%	19.4%	3.36	1.22
USA	14.9%	11.8%	20.1%	30.5%	22.7%	3.34	1.35
NET	10.4%	16.9%	28.9%	32.9%	11.0%	3.17	1.15

As shown in Table 8, the data suggest that Mexico with 56.9 percent and Brazil with 60.8 percent have the largest percentage of people who are highly concerned. In the case of Mexico 91.9 percent of the participants indicated that they are either 'concerned' or 'highly concerned, closely followed by Brazil with 89.3 percent. The results also show that the populations in Canada, Spain, and Germany express a very similar level of concern. In these four countries the percentage of participants who are 'concerned' or 'highly concerned' ranges between 63.8 (Germany) and 67.8 percent (Spain). In the case of Japan, the percentage of people that are 'slightly concerned' (20,7 percent) is larger compared to all other countries. The 14.9 percent of the participants from the United States stating that they are 'not at all concerned' is significantly different compared to all other country specific samples.

Table 9

Possible Reasons for the Public's Concern about GCC

'I worry about GCC because at some point we will not be able to reverse it'				
Country	1	2	3	4	5
	strongly disagree	disagree	undecided	agree	strongly agree
MEX	1.7%	2.5%	5.6%	22.3%	67.9%
BRA	1.8%	3.6%	7.4%	34.5%	52.8%
ESP	4.3%	3.4%	22.3%	36.4%	33.6%
CAN	5.8%	8.9%	20.6%	34.7%	30.1%
GER	4.9%	6.8%	25.6%	39.2%	23.5%
JP	2.1%	6.2%	30.5%	46.0%	15.3%
USA	13.5%	7.8%	21.5%	30.9%	26.2%
UK	8.3%	10.1%	28.3%	34.7%	18.5%
NET	5.4%	18.4%	25.2%	35.0%	16.1%

'I worry about GCC because there is no strong political will to prevent it'				
Country	1	2	3	4	5
	strongly disagree	disagree	undecided	agree	strongly agree
MEX	2.7%	5.4%	11.1%	35.0%	45.8%
BRA	2.4%	5.0%	10.0%	42.3%	40.4%
ESP	3.4%	6.6%	25.7%	38.9%	25.5%
GER	3.9%	10.3%	25.5%	36.7%	23.7%
JP	2.2%	7.2%	34.1%	43.1%	13.4%
CAN	5.8%	10.0%	26.7%	35.1%	22.4%
UK	7.9%	11.7%	35.1%	32.1%	13.1%
USA	14.4%	9.9%	28.3%	30.4%	17.0%
NET	5.4%	22.5%	27.4%	33.1%	11.5%

'I do not worry much about GCC for me, but I worry for future generations'				
Country	1	2	3	4	5
	strongly disagree	disagree	undecided	agree	strongly agree
GER	4.5%	7.8%	22.2%	38.8%	26.7%
CAN	10.0%	18.4%	17.6%	35.6%	18.4%
NET	7.4%	21.8%	18.9%	38.8%	13.0%
UK	8.4%	17.2%	28.6%	35.7%	10.1%
BRA	17.0%	22.0%	9.9%	28.1%	23.0%
USA	14.4%	16.4%	23.4%	30.0%	15.8%
JP	8.1%	22.6%	32.7%	27.7%	8.9%
ESP	17.8%	21.3%	26.6%	22.8%	11.6%
MEX	27.7%	21.9%	11.6%	19.1%	19.6%

According to the data, the countries that are least concerned are the United Kingdom, the United States, and the Netherlands. In these countries about 25 percent of the population is either not at all or only slightly concerned about the possible impacts of GCC. The survey instrument probed about why people are concerned about GCC. To gain insight into public attitudes the survey asked respondents about three possible reasons for their concerns. The responses were measured on a 5-point Likert-scale ranging from 'strongly disagree' to 'strongly agree' and the results are illustrated in Table 9.

Very strong levels of agreement were observed with the rational that at some point GCC cannot be reversed anymore. In total more than 75 percent of the participants agreed or strongly agreed with that sentiment. In Mexico 67.9 and in Brazil 52.8 percent of all participants strongly agreed with that statement. Almost 60 percent of all survey partakers agreed that their worry is based on the lack of political will to prevent GCC. Again, the percentage of people strongly agreeing with that statement is the highest, by a significant margin, in Mexico (45.8 percent) and Brazil (40.4 percent) followed by Spain with 25.5 percent. The lack of political will as a reason to worry about GCC seems to be most strongly contested among the populations of the Netherlands, the United Kingdom, and the United States. In these three countries at least 26 percent disagree or strongly disagree with the statement 'I worry about GCC because there is no strong political will to prevent it'.

In the case of the third justification, approximately 46 percent in total indicated that they worry for future generations and not necessarily for themselves. The data suggest that the German population worries the most relative to the other countries about the impact of GCC for future generations. Over 65 percent of Germans agree or strongly

agree with the notion that GCC is a concern because of impacts to future generations, followed by Canada with 54 percent, Netherlands and Brazil with both 51 percent, United States with 45 percent, Mexico with 38.7 percent, Japan with 37 percent, United Kingdom with 36 percent, and Spain with 34 percent.

Trust in GCC information. Besides building trust through interpersonal relations or ideological values and norms, people can also hold trust in organizations and institutions (Hardin, 2006). The role of trust is an important perceptual dimension that influences the success of policies targeting GCC as well as the public's willingness to commit to behavioral changes. We know from prior studies that when people have a better understanding of GCC science and trust in the information, they tend to be more supportive of mitigation efforts (Read et al, 1994; Bord et al, 1998). Furthermore, research shows that the failures of risk communication are significantly influenced by the public's trust in the communicator and in the ability of certain individuals, industries, or institutions responsible for risk management (Renn & Levine, 1991; Kasperson et al, 1992; Nye, 1997). If there is no trust in the source, any message and policies are likely to be disregarded, no matter how well designed and well delivered. Thus, public trust in organizations whose risk management addresses adaptation and mitigation strategies is vital in order to generate social cooperation to increase their likelihood of success.

Therefore, the survey questionnaire asked about the public's level of trust towards different sources of information that also play a role in the design, communication, and/or implementation of global climate change policies.

Table 10

Public's Trust towards Different Sources of GCC Information

	Level of trust towards different sources of information					
All Countries Combined	1 Strongly distrust	2 Somewhat distrust	3 undecided	4 Somewhat trust	5 Strongly trust	*MEAN*
Television weather reports	5.4%	13.8	19.4%	51.6%	9.7%	3.46
Corporations	14.1%	24.9%	36.0%	22.0%	3.0%	2.75
Family and friends	2.6%	7.8%	33.1%	41.6%	14.9%	3.58
Governmental organizations	16.0%	25.6%	28.8%	25.9%	3.7%	2.76
Environmental organizations	8.9%	12.5%	22.5%	39.1%	17.0%	3.43
Mainstream news media	9.4%	18.1%	30.5%	36.0%	6.0%	3.11
Scientists	3.4%	8.1%	21.7%	45.0%	21.8%	3.74
Religious leaders	33.3%	21.3%	27.3%	13.6%	4.6%	2.35
Teachers	7.8%	13.7%	40.0%	32.2%	6.3%	3.16

The question was measured on a 5-point Likert-scale and asked: "On a scale of 1 to 5, where 1 is 'strongly distrust' and 5 is 'strongly trust' what is your level of trust towards the following sources of information regarding global climate change?". As shown in Table 10, the question included nine different sources of information. In addition, the survey participants were also asked attitude questions, on a 5 point Likert-scale, which tested their level of agreement with two different statements related to trust in the available scientific GCC.

- *We already have enough scientific data and expert knowledge to fully understand all aspects of GCC*

- *The scientific findings on GCC is trustworthy*

As shown in Table 10, the data suggest that corporations, governmental organizations, and religious leaders are trusted the least as sources for GCC information: less than 5 percent of the surveyed population expressed strong trust towards any of them. Instead, the majority of the population trusts scientists the most. The results show that 66.8 percent of the public seems to somewhat or strongly trust scientists, followed by television weather reports (61.3 percent), family and friends (56.5 percent), and environmental organizations (56.1 percent). The results also show that a significant amount of people seem to be undecided in whether or not they should trust certain sources of information. Especially, in regards to teachers, 40 percent of all participants chose the answer category 'undecided' followed by corporations (36 percent), family and friends (33.1 percent), and the mainstream news media (30.5 percent). The groups that the public seems to strongly distrust the most are religious leaders. Over 50 percent of the participants strongly or at least somewhat distrust them as a valid source for GCC information.

The analysis of the survey results by country for the two statements mentioned above indicates a contradiction between the level of trust towards the scientists and the level of agreement with the sufficiency and trustworthiness of scientific data and expert knowledge. Table 11 illustrates the percentage of people for each of the nine surveyed countries who agreed or strongly agreed with the two statements. Whereas 66.8 percent of the total sample size somewhat or strongly trusts scientists as sources for GCC information the data also indicate that many people doubt that the scientific community actually has enough data to fully understand the complexity of the issue.

Table 11

Level of Agreement with Different Statements related to GCC Information

'We already have enough scientific data and expert knowledge to fully understand all aspects of GCC' (agree or strongly agree)								
BRA	CAN	GER	JP	MEX	NET	ESP	UK	USA
55.7%	36.2%	19.9%	15.4%	31%	38.3%	39.3%	26.4%	32.6%
'The scientific findings on GCC is trustworthy' (agree or strongly agree)								
BRA	CAN	GER	JP	MEX	NET	ESP	UK	USA
63.9%	47.3%	31.8%	32.1%	51.7%	26.2%	41.7%	33.2%	39.1%

Especially, the populations of Japan and Germany seem to believe that significantly more research needs to be conducted. In both countries less than 20 percent of the participants agreed with the statement that the existing body of knowledge is sufficient. In fact, 51 percent in Japan and 49 percent in Germany specifically disagreed with that attitude, more than in any other of the surveyed countries. Furthermore, less than 50 percent of the public in seven of the nine countries trust the existing scientific findings. Only in Mexico and Brazil did more than 50 percent of survey respondents consider the scientific findings as trustworthy.

Acceptable public strategies. As discussed in the introduction of this study, a multitude of different planning approaches and climate change policies already exist to mitigate and adapt to GCC. However, without the public support these strategies will not be successful nor will decision-makers have the political capital to implement them in the first place. Many climate change policies and strategies need to be supported by the public though often additional financial burdens or behavioral changes. As a result the survey

questionnaire included several questions to determine the public's attitudes towards various national climate change policies.

The participants were asked on a 5-point Likert-scale how much they support or oppose each of several policies. The 5-point Likert-scale consists of the answers 'strongly oppose', 'moderately oppose', 'undecided', 'moderately support', and 'strongly support'. For this first basic analysis, additive indexes were created to aggregate the different strategies into the two different groups, 'Overall support for mitigation policies' and 'Overall support for adaptation policies'. Mitigation addresses the core cause of human induced climate change namely the large amount of energy consumption and the resulting of greenhouse gas emissions. The concept of mitigation is clearly understood by scientists and decision makers.

Adaptation strategies focus on avoiding negative impacts caused by global climate change. They are essentially adjustments with the aim to increase resilience or decrease vulnerability to current or expected impacts of climate change. The indexes were calculated based on the degree the participants supported the following policies:

- *Index1: Overall support for mitigation policies*
    - *require higher fuel efficiency for automobiles*
    - *require higher energy efficiency standards for buildings, household appliances, material production, and building methods*
    - *require higher taxes on electricity*
    - *require electric utilities to produce at least 20% of their electricity from renewable energy sources by the year 2020*

- *provide subsidies to industries to invest in alternative energy development*

- *require higher road taxes and tolls*

- *require installation of solar panels or photovoltaics on buildings*

- *require more compacts, higher density, mixed use, and transit oriented development*

- *Index 2: Overall support for adaptation policies*

  - *require cities over the next 220 years to invest in coastal flood protection and barriers*

  - *the national/federal government should mandate that I personally take action to respond to undesirable impacts of GCC*

  - *the national/federal government should mandate that local governments take action to respond to undesirable impacts of GCC*

  - *the national/federal government should encourage action to respond to undesirable impacts of GCC*

  - *the national/federal government should make me aware of how climate change may affect me*

Compared to mitigation, adaptation is a local challenge since GCC impacts can vary between regions. As a result, the adaption questions were designed in a more general way to ensure they can be answered by people in different countries facing different impacts. Moreover the public's level of support for the different policies, the willingness to commit to behavioral changes, and/or motivation to spend additional money were analyzed in great detail using regression analyses and the results are discussed in the next chapter.

Table 12

Global Support for GCC Policies

All Countries Combined	1 strongly oppose	2 moderately oppose	3 undecided	4 moderately support	5 strongly support	*Mean*
Overall support for mitigation policies	2.2%	5.0%	35.3%	42.6%	14.9%	3.63
Overall support for adaptation policies	3.1%	4.1%	26.8%	40.4%	25.6%	3.81

       Table 12 shows the frequency distribution for the complete survey sample of the nine countries combined and indicates the global trends in terms of public support for GCC policies and strategies. The data suggest that only a small percentage of people oppose any actions against the causes or impacts of GCC. Only 7.2 percent of all survey participants oppose mitigation policies, 35.3 percent are undecided and the majority of 57.5 percent moderately to strongly support mitigation policies in general. On the national scale the strongest opposition to mitigation policies is among the Dutch public and among the citizens of the United States with 16 percent of the participants from these two countries moderately or strongly opposing such policies in general. In the remaining seven countries the percentage of people opposing policies to address the causes of GCC is less than 8 percent. There are a high percentage of people who are undecided among all survey participants with 35.3 percent experienced among all nine countries. In Germany; Japan, the Netherlands and the United Kingdom 40% and more of the survey participants indicated they are undecided whether they should support mitigation policies or not. In the remaining surveyed countries the percentage of people being undecided is less but still substantial and ranges from 21 percent in Mexico to 36 percent in the United States.

At least 45 percent of the public among all nine countries generally supports mitigation policies. The data suggest that the public in Brazil, Canada, Germany, Japan, Mexico, and Spain support mitigation policies with over 50 percent.

In terms of adaptation policies the results are very similar compared to mitigation, both on the global and national level. When combining all survey participants 7.2 percent oppose supporting adaptation strategies, 26.8% percent are undecided, and 65 percent at least moderately support the idea that adapting to GCC through policies and strategies is necessary. Nevertheless the results indicate a relative strong opposition to GCC adaptation in the United States compared to all the other countries. About 20 percent of the survey participants in the United States indicated that they are not planning on supporting adaptation policies. In addition the United States and the United Kingdom are the only cases where fewer than 50 percent of the survey participants seem to moderately or strongly support GCC adaption policies.

Summary

The underlying hypothesis of the basic frequency analysis was that the public perception of GCC in terms of threat and risk, saliency of the issue, trust in GCC information, and acceptable public strategies vary among countries. The data does confirm differences between some countries but also show similarities between others. The populations of Mexico and Brazil seem to be the most concerned about GCC, perceive it as a high risk, and want their respective governments to take stronger action against the impacts and causes of GCC. Whereas the survey participants of the Netherlands, United Kingdom, and the Unites States always were among the countries with the lowest amount of concern for GCC impacts, threats, and risks.

The data also show that more survey participants in these three countries challenge the reality and/or danger of GCC than in any other country. A third group of countries consisting of Japan, Canada, Germany and Spain also showed similar frequency distributions in regards to the political saliency, risks, and threats of GCC. According to the data, the public of these four countries are not as concerned as people living in Brazil and Mexico, but still perceives GCC as a significant issue, supports government involvement and only a very small percentage of people doubts the existence of GCC and its potential negative impacts. Despite difference between the nine countries in terms of the perceived political saliency and the risks and threats of GCC the result show similar trends among all nine countries. For example, in all nine countries a significant amount of participants indicated that they worry about GCC, are concerned about its possible impacts, and perceive it as a politically salient issue.

Furthermore, a substantial percentage of people believe climate change impacts are already or soon will be experienced somewhere on earth. Simultaneously less people, nut still a substantial percentage believe that their own regions are experiencing dangerous impacts or will within the next 10 years. Generally, the survey shows that harms from GCC are usually seen as impacting other places more severely, more often and sooner than in one's own region. In regards to the public's level of trust towards different sources of information, scientists seem to be most trusted in all nine countries, followed by family and friends. On the contrary, the public in all nine countries seem to share high levels of distrust towards religious leaders, governmental organizations, and corporations. Another significant finding is that the high percentages of people in all nine countries who indicated that they are undecided or uncertain towards all the listed sources of information.

This indicates a high level of general uncertainty towards the issue of GCC. This notion is further supported by seemingly contradicting survey results from similar questions or rather statements. Although scientists are highly trusted and the most trusted source in all nine countries results also indicates a significant amount of people doubting the validity and sufficiency of the existing body of knowledge. This contradiction is another indication for the uncertainty the public seems to experience when being confronted with the issue of GCC.

The last segment of questions discussed in this chapter focused on the public's support for adaptation and mitigation policies in general without looking at specific strategies. Based on the data, the majority of the public seems to support efforts to reduce the causes and impacts of GCC. In fact, among the nine countries the Netherlands were the only country were less than 50 percent, but still a significant amount supported mitigation policies. However, similar to the public's level of trust towards sources of GCC information a large number of people indicated that they are undecided to whether or not support any GCC strategy. With GCC being still a controversial topic in the political arena and among some groups of the population, the people who are undecided today could make the difference in the future success of various GCC policies.

Therefore, it is crucial to gain a better understanding what factors influence the public in their decision process. At this point the public's attitudes towards GCC policies was only analyzed and discussed in a preliminary form to illustrate basic trends among the total sample size and among the nine countries separately. The interrelationships between socio-demographic characteristics, perceptions and attitudes towards GCC, and support for general and specific GCC policies among the survey participants in the nine

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countries is the focus of the next two chapters. The next chapter discusses the results of different regression analyses with the aim to answer the following research question.

- *What importance do GCC risk perceptions and attitudes play in the public's willingness to support mitigation and adaptation strategies?*

Chapter 5

THE RELATIONSHIP BETWEEN GCC RISK PERCEPTIONS, POLICY SUPPORT, AND BEHAVIOR

The following section addresses one research question underlying this study, which focuses on the relationships between GCC perceptions and attitudes towards GGC policies (adaptation and mitigation) among the nine countries. The central research question of this chapter is:

- *What importance do GCC risk perceptions and attitudes play in the public's willingness to support mitigation and adaptation strategies?*

In order to answer the research questions hypotheses were tested using various statistical methods. Four different analytical tools were applied to the data, such as frequency distributions, crosstabs, standard multiple regressions, and stepwise regressions. Frequency distributions were used to show differences between countries for key variables used in the regression analyses and to provide a basis for interpreting the regression results. Crosstabs were used to explore relationships between different categorical indexes or relevant to the first research question. Similar to the analysis of frequencies, the crosstabs also provide helpful insights to interpret the results of different regression analyses. For each crosstab two tests were performed to ensure statistical significant relationships between the variables and between particular cells of the crosstab table. In particular, the chi square test is used to determine if there is a relationship between the two categorical variables. This study only considered a relationship between variables if the chi square test resulted in at least $p < .05$ because the value of .05 is the conventionally considered threshold of statistical significance (Field, 2009).

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Standard linear regressions were used, for example, to explicate the relationships between independent variables such as risk perceptions, attitudes, and socio-economic characteristics and dependent variables such as the public's level of support for GCC policies and their willingness to commit to behavioral changes. Regression analysis not only allows the confirmation of relationship between predictor variables (independent variable) and an outcome variable (dependent variable), but also enables the determination of the strength of the relationship and the amount of variability in one variable that is shared by the other.

Three outputs of the regression analysis are important in this research. First, the multiple correlation coefficient (R) measures the strength of the correlation between the predictor variables and the outcome variables. In general an R score of 0.5 and higher indicates that the independent variables have strong effects on the dependent variables, whereas a value of less than 0.3 suggests a weak relationship (Field, 2009). Second, the coefficient of determination (R^2) illustrates how much the independent variables can explain variation in the dependent variables. Since multiple independent variables per regression can raise the R^2 and be a potential source for error, this study reports on the adjusted R^2 in cases with more than two predictor variables in a regression model. The adjusted R^2 compensates for the use of more predictors and adjusts the value downwards (Field, 2009). Third, the analysis of variance (ANOVA) test has two important purposes. First, ANOVA test was used to determine whether or not a regression model predicts an outcome variable well and secondly, confirms that the results are statistically significant and can be generalized for the countries' entire population. This was considered the case

when the calculated F-ratio was significant at p>.001, which means that there is less than a 0.1% chance that the particular F-ratio would happen if the null hypothesis were true.

Stepwise regressions were conducted in cases where the standard multiple regressions showed a large effect between predictor variables and outcome variables. The aim of the stepwise regression was to determine the subset of independent variables that have the strongest relationship to a dependent variable. In stepwise regressions the predictor variables are entered into the model based on their statistical contribution in explaining the variance in the dependent variable. First, the predictor that has the highest simple correlation with the outcome variable is entered into the model. If this predictor significantly improves the ability of the model to predict the outcome, then this predictor is retained in the model and the computer searches for a second predictor. The criterion used for selecting this second predictor is that it is the variable that explains most of the remaining variation of the outcome variable. Each time a predictor is added to the equation, a removal test is made of the least useful predictor, thus identifying the single independent variable that has the strongest relationship to the dependent variable

Risk Perception, Attitudes, & Support for GCC Policies

The following discussion explores the role GCC risk perceptions and attitudes play in the public's willingness to support mitigation and adaptation policies.

- *What importance do GCC risk perceptions and attitudes play in the public's willingness to support mitigation and adaptation policies?*

In this analysis two hypotheses were tested to structure the analysis and to discover the insights necessary to answer the research question. The hypotheses were tested through frequency distributions, crosstabs and regression analyses and are as follows;

- *The public's general support for mitigation and adaptation policies is linked to the way the public perceives 1) the level of consequences from possible environmental consequences and 2) the level of threat resulting from global climate change*

- *The public's position towards climate change is the main reason for the 1) low policy support, 2) willingness to pay for GCC policies, and 3) willingness to change their behavior related to mitigation and adaptation.*

Relationships between perceived GCC threats, consequences from environmental changes & public policy support. Discussed in the previous chapter, the frequency distribution of the survey data suggest that the majority of people moderately to strongly support adaptation and mitigation policies in general. However, a considerable number of people still seem to be undecided. The data show that 35.3 percent of all survey participants are undecided on whether to oppose or support mitigation policies. In regards to adaptation policies 26.8 percent are still undecided.

The survey instrument asked participants what would be the severity of consequences they would expect over the next 20 years from different environmental changes. The surveyed population was asked to respond to seven potential environmental changes which included: further extinction of endangered animals and plants, deterioration of the ozone layer, worsening of urban air pollution, extensive loss of forests and/or wetlands,

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increasing frequency of major hurricanes and/or floods, increasing frequency of droughts, and substantial increase in global warming resulting in global climate change. Based on these results, an additive and categorical index for the overall perceived level of consequences was developed for these environmental changes. In turn this index was used to test the relationships between the public's perceived level of consequences from environmental changes in general and the degree of support for mitigation and adaptation policies. These relationships are the focus of the next section. As shown in Table 13, the majority of the population in every country expects 'serious negative consequences' from environmental changes over the next 20 years.

However, in the Netherlands with 55.5 percent, in the UK with 53 percent, and in the United States with 54.3%, the majorities are rather narrow compared to the remaining six countries, such as Canada with 70.5 percent, Brazil with 87.8 percent, or Mexico with 94.7 percent. If you combine the two answer categories 'moderate negative consequences' and 'serious negative consequences', at least 80 percent of the population in each of the nine countries expect moderate to serious negative consequences from changes in the environment within the next 20 years.

Only very small percentages of the survey participants question whether that environmental changes will happen or that they won't result in negative consequences. The data indicate that is the U.S. population that expresses the most skepticism regarding GCC. In the case of U.S. close to 8 percent of the surveyed population either does not believe that any environmental changes will occur or these will not have any negative consequences over the next 20 years.

Table 13

Perceived Level of Consequences, if any, from Environmental Changes over the Next 20

Years

Country	1 not likely at all to happen	2 no negative consequences	3 slight negative consequences	4 moderate negative consequences	5 serious negative consequences
MEX	0.1%	0.1%	1.0%	4.1%	94.7%
BRA	0.6%	0.8%	2.9%	8.0%	87.8%
ESP	1.2%	1.1%	7.1%	14.7%	75.9%
CAN	0.9%	2.0%	4.8%	21.7%	70.5%
JP	0.1%	1.0%	6.4%	29.3%	63.2%
GER	1.8%	1.0%	6.9%	22.7%	67.6%
NET	0.9%	2.7%	11.2%	29.7%	55.5%
UK	0.7%	2.8%	15.3%	28.1%	53.0%
USA	2.6%	5.3%	13.1%	24.7%	54.3%

Another categorical index created specifically from responses to the survey is based on how the public perceives the level of threat of global climate change over the next 50 years for 'plants and animals', 'people in other countries', 'people in your country', and 'you and your family'. The participants were asked to rank the level of treat for each area on a 4-point Likert-scale ranging from to 'no threat at all' to 'a very high threat'. Table 14 illustrates the results of this index for each of the nine countries. The mean values and frequencies suggest that the public perceives GCC as a potential threat over the next 50 years. In terms of posing a high threat the data show significant differences among the countries. In Mexico and Brazil over 80 percent indicate that they believe GCC will be a high threat over the next 50 years. In contrast only 19.2 percent in the Netherlands agreed with that sentiment.

Table 14

Public's Perception of Threat resulting from GCC over the Next 50 Years

Country	1 no threat at all	2 a slight threat	3 Some threat	4 a high threat	*Mean*	*Std. Dev.*
MEX	0.2%	0.8%	11.0%	87.9%	3.87	.38
BRA	0.3%	1.4%	14.3%	84.1%	3.82	.43
GER	1.8%	4.5%	33.5%	60.2%	3.52	.67
CAN	1.5%	5.4%	32.8%	60.3%	3.52	.67
ESP	2.7%	8.6%	32.0%	56.6%	3.43	.76
JP	1.0%	9.8%	42.5%	46.8%	3.35	.69
UK	3.5%	11.7%	43.3%	41.5%	3.23	.79
USA	8.2%	12.5%	30.0%	49.3%	3.20	.95
NET	2.8%	20.1%	58.0%	19.2%	2.94	.71

On the other end of the spectrum, over 15 percent of the participants in the United Kingdom (15.2 percent), the United States (20.7 percent), and the Netherlands (22.9 percent) perceive GCC as not a threat or a slight threat. Nevertheless, the overwhelming *majority* in each country acknowledges that GCC will pose at least some threat if not a high threat over the next 50 years.

Policy support & perceived levels of consequences from future environmental changes. Table 15 shows the results of the first cross tabulation that tests the relationships between degree of support for GCC mitigation and adaption policies and perceive level of consequences from environmental changes for all nine countries combined. On the global scale with the data of all nine countries combined, the chi-square test was found to be p<0.0005. This suggests a statistical significant relationship between support for mitigation and adaptation strategies and perceived level of consequences from future environmental changes. For example, 49.2 percent of the people who strongly oppose mitigation policies and 44.6 percent who strongly oppose adaptation policies also believe

that GCC and other environmental changes are either not happening at all or do not result in any negative consequences. Furthermore, 48.8 percent of the participants who strongly or moderately oppose mitigation policies and 57.9 percent who strongly or moderately oppose adaptation policies also expect slight negative consequences from environmental changes over the next 20 years. On the other end of the scale, 91.7 percent of the people who strongly support mitigation policies and 92.1 percent who strongly support adaptation polices also expect serious negative consequences. This means that if people believe that future changes to the environment have serious negative consequences they are more likely to support mitigation and adaption strategies. This global trend is supported by the data for the individual nine countries as well. Over 80 percent of the participants in Brazil, Canada, Germany, Japan, Mexico the Netherlands, Spain, the United Kingdom, and the United States who strongly support mitigation or adaptation policies also expect serious negative consequences from environment changes.

For Canada, Germany, and the United Kingdom the data indicate approximately 70% of the public moderately supporting mitigation or adaptation policies also expects serious negative consequences from GCC and other environmental changes. In addition, in the cases of the public in Germany, the Netherlands, and the United States the data show strong relationships between opposing any type of GCC policy and not expecting any environmental changes in the foreseeable future. For example, in Germany 46.2 percent, in the Netherlands, 15.4 percent, and in the United States 22.5 percent who strongly opposed mitigation policies also do not expect any environmental changes, including GCC, to occur within the next 20 years.

Table 15

Relationship between Public Support of GCC Policies and the Perceived Level of Conse-

quences from Environmental Changes

All Countries Combined	Index of support for mitigation policies				
	strongly oppose	*moderately oppose*	*undecided*	*moderately support*	*strongly support*
not likely at all to happen Column%	23.5%	2.5%	0.8%	0.1%	0.5%
no neg. cons. Column %	25.9%	9.6%	2.1%	0.1%	0.4%
slightly neg. cons. Column %	23.5%	25.3%	13.8%	2.5%	1.0%
moderate neg. cons. Column %	18.5%	36.3%	28.5%	16.9%	6.5%
serious neg. cons. Column %	8.6%	26.4%	54.9%	80.4%	91.7%
	Index of support for adaptation policies				
	strongly oppose	*moderately oppose*	*undecided*	*moderately support*	*strongly support*
not likely at all to happen Column%	18.9%	1.4%	1.0%	0.1%	0.4%
no neg. cons. Column %	25.7%	9.5%	2.3%	0.2%	0.2%
slightly neg. cons. Column %	26.1%	31.8%	16.4%	2.6%	1.3%
moderate neg. cons. Column %	20.3%	35.5%	33.3%	19.5%	6.1%
serious neg. cons. Column %	9.0%	22.0%	47.0%	77.6%	92.1%

Public's perceived level of consequences from environmental changes

Furthermore, 42.9 percent of the respondents in Germany and 18.2 percent in the United

States who strongly oppose adaption policies do not anticipate any environmental chang-

es at all.

Overall, the analysis identified several significant relationships for the nine surveyed countries. The data finds strong correlations between the public's support for GCC mitigation and adaptation policies and their perceived level of consequences from environmental changes. People who strongly oppose GCC policies are also less likely to believe in negative consequences from environmental changes, whereas someone who is very supportive of mitigation and adaptation measures also tends to take changes to the environment very serious.

   Policy support & perceived levels of GCC threat. Using the same methodology a second crosstabulation was performed to test the relationship between mitigation/ adaption policy support and perceived level of threat resulting from climate change and further test the underlying hypotheses:

- *The public's general support for mitigation and adaptation policies is linked to 1) the way the public perceives the level of consequences from possible environmental consequences and 2) the level of threat resulting from global climate change*

Table 16 illustrates the relationships on the global scale using data from all nine countries combined into one sample. Similar to the contingency table discussed above, the chi-square test with p<0.0005 suggests a statistical significant relationship between the two. The data show that about 46 percent of the population who strongly opposes mitigation and adaptation policies also perceives GCC as no threat at all. Also, over 60 percent who strongly or moderately oppose GCC policies also stated that they only few GCC as a slight threat. In terms of the people who are undecided in whether or not to support mitigation and adaptation polices, 43.2 percent perceive GCC as some threat.

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Table 16

Relationship between Public Support of GCC Policies and the Perceived Level of Threat

from GCC

All Countries Combined	Index of support for mitigation policies				
	strongly oppose	*moderately oppose*	*undecided*	*moderately support*	*strongly support*
no threat at all Column%	46.3%	11.3%	2.5%	0.2%	0.1%
a slight threat Column %	30.2%	31.6%	13.5%	3.4%	0.7%
some threat Column %	13.0%	34.3%	43.2%	31.8%	15.9%
a high threat Column %	10.5%	22.8%	40.8%	64.6%	83.2%
	Index of support for adaptation policies				
	strongly oppose	*moderately oppose*	*undecided*	*moderately support*	*strongly support*
no threat at all Column%	46.4%	11.5%	2.1%	0.2%	0.2%
a slight threat Column %	31.1%	29.4%	17.2%	3.8%	1.0%
some threat Column %	13.1%	42.6%	46.7%	35.5%	16.3%
a high threat Column %	9.5%	16.6%	34.0%	60.5%	82.5%

(Row label, vertical: Public's perceived level of threat resulting from global climate change)

Another significant relationship that was observed was between level of support for GCC policies and the belief that GCC poses a high level of threat. For this case, 83.2 percent of people who strongly support mitigation policies and 82.5% that strongly support adaptation polices perceive GCC as a high threat. On the international scale five out of the nine countries show significant relationships between strong public support for mitigation policies and perceptions of GGC as a high threat. For Canada the data found

that over 90 percent of the people who strongly support mitigation policies also perceive GCC as a high threat to plants and animals, people in other countries, people in their own country, or to themselves and their family. This is followed by the United States with 85.4 percent, Spain with 84.3 percent, and Germany with 82.6 percent. The fifth and last country where this relationship was statistical significant was the Netherlands where 45 percent of the participants strongly supporting mitigation policies perceived GCC as a high threat. As shown in chapter 4, within these five countries between 45 percent (Netherlands) to 65 percent (Spain) of the populations moderately or strongly support mitigation policies in general. Furthermore, 20 percent of the Spanish, 18 percent of the Canadian, 13 percent of United States, 12 percent of the Dutch, and 11 percent of the German population in general strongly supports mitigation policies.

All nine countries confirm significant relationships between strong support for the study's adaptation policies and perceiving GCC as a large threat. The data suggest that in Mexico 93.7 percent, in Brazil 91.1 percent, in the United States 86.6 percent, in Germany 85.9 percent, in Canada 84.7 percent, in Japan 80.8 percent, in Spain 79.6 percent, in the United Kingdom 75.3 percent, and in the Netherlands 38.1 percent of the public who strongly support adaptation policies also perceive GCC as a high threat. According to the frequency distributions between 48 percent (United States) and 86 percent (Mexico) of the public 'moderately' or 'strongly' support adaption policies in general. Moreover, over 40 percent in Brazil (45%) and Mexico (42%) show strong support for adaptation policies, compared to less than 30 percent in Canada (29%), Germany (25%), and Spain (23%). In the Netherlands, the United Kingdom and the United States less than 20 percent of the public seems to strongly support adaptation policies.

Furthermore, the performed tests for statistical significance also showed that in Germany 61.5 percent of the participants who strongly opposed mitigation policies and 50 percent who strongly opposed adaptation policies also do not perceive GCC as a threat at all. The survey data from the Netherlands also shows similar relationships. Within the Dutch population results indicate that 33.3 percent who strongly oppose mitigation policies and 40.6 percent who strongly oppose adaptation policies do not feel threatened by GCC. For the populations in Spain, the United Kingdom, and the United States the data only show a relationship between strong opposition to adaptation policies and perceiving GCC as no threat at all. In Spain 70 percent who strongly opposed adaptation policies also perceived GCC as no threat followed by the United Stated with 49.1 percent and the United Kingdom with 48 percent.

The data finds strong positive correlations between the public's support for GCC mitigation and adaptation policies and their perceived overall level of threat from GCC. People who strongly oppose GCC policies are also very likely to perceive GCC as 'no threat' or only 'slight threat', whereas someone who is very supportive of mitigation and adaptation measures also tends to view GCC as a significant threat. This suggests as more people support mitigation and adaption policies more people will also consider GCC a significant threat. Overall, the analysis confirmed the hypotheses and identified several significant relationships for the nine surveyed countries between the public's general support for adaption and mitigation polices on the one hand and the perceived level of consequences from environmental changes and the level of threat resulting from GCC on the other.

Relationships between attitude, levels of concern, public support for GCC policies, & willingness to commit to behavioral changes. The following discussion of the regression analysis is divided into different parts based on three groups of dependent variables which were all tested with the same dependent variables presenting public's attitudes towards climate change and levels of concern. In particular, the second hypothesis underlying the above research question (see 5.2) tested to what degree the public's lack of policy support, unwillingness to pay and commitment to behavioral changes can be explained by public attitudes and levels of concern towards global climate change. The public's preference towards four general climate change strategies and the level of belief in the reality of global climate change were used to describe a person's attitude towards GCC. The remaining independent variables focused on the public's level of concern regarding possible dangerous impacts of GCC on different geographical and personal levels as well as timescales.

For the first attitude variable the survey respondents were asked to choose one out of four possible general strategies on global climate change that comes closest to their opinion. These strategies and the frequency distribution by country are displayed in Table 17. By asking the participants to choose one particular basic strategy the person's attitude in terms of the general long-term policy approach become apparent. Together with the public's level of belief in the reality of GCC (Table 18) it is possible to draw conclusions regarding someone's general attitude towards GCC. With the exception of Japan the strategy chosen most often by the participants was that 'GCC is a serious problem and we should begin taking steps now even if this involves significant costs'.

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Table 17

Public's Attitude towards taking Political Action against GCC

a) we should not take any steps that would have economic costs until we are certain that GCC is really a problem								
BRA	CAN	GER	JP	MEX	NET	ESP	UK	USA
1.4%	11.9%	6.8%	5.1%	1.2%	12.2%	7.1%	14.2%	23.5%
b) we should take some steps just in case GCC is real								
BRA	CAN	GER	JP	MEX	NET	ESP	UK	USA
9.0%	19.3%	10.7%	51.5%	4.7%	25.6%	16.1%	28.8%	22.0%
c) we only should take steps to address GCC which are low in costs								
BRA	CAN	GER	JP	MEX	NET	ESP	UK	USA
1.6%	8.2%	14.3%	3.9%	4.1%	14.7%	7.2%	13.7%	10.7%
d) GCC is a serious problem and we should begin taking steps now even if this involves significant costs								
BRA	CAN	GER	JP	MEX	NET	ESP	UK	USA
88.0%	60.7%	68.2%	39.6%	90.0%	47.5%	69.7%	43.3%	43.8%

With regards to Japan the data indicate that the majority of the population prefers the option of taking 'some steps just in case GCC is real'. However, when combining two answer categories, the data generally indicate that a significant number of people in Canada (21.1 percent), Germany (21.3 percent), the Netherlands (26.9 percent), the United Kingdom (27.9 percent), and in the United States (34.3 percent) either oppose any policies that might hurt the economy or only support policies which are low in costs. The second attitudinal variable is an index which was created from the responses of several questions, based on level of belief in the reality of global climate change. As shown in Table 18, the overwhelming majority of the population strongly believes that GCC is real. Nevertheless, a small percentage of 10.2 percent in the United States are still not convinced that GCC is occurring. The participant's answers to the following survey questions provided the remaining four independent variables focusing on concern towards GCC:

- *How long, if ever, will it take until dangerous impacts of GCC will be experienced somewhere on Earth?*

- *How long, if ever, will it take until dangerous impacts of GCC will be experienced in your region?*

- *How concerned are you about the possible impacts of GCC?*

- *How concerned are you about the level of threat resulting from GCC to you and your family?*

As already discussed in the previous chapter, the data suggest that the majority of the population believes that GCC is already happening somewhere on Earth, but is less convinced that it is already occurring in their own region. Based on the frequency distribution for all nine countries combined 60.7 percent believe that GCC is already being experienced somewhere, but only 42.8 percent stated that they already experienced dangerous impacts. About 37 percent of the respondents believe that it will take at least 25 years, if ever, until they personally will experience any negative impacts linked to GCC.

Nevertheless, the majority of the public is concerned about global climate change and its potential impacts. In total, 83.7 percent of the participants stated at least some concern regarding the possible impacts of GCC. However, only 33.4 percent of the respondents perceive GCC as a high threat to their family and to themselves. Instead, close to 10 percent feels that GCC does not pose any danger to themselves or their families over the next 50 years. This supports the argument that the public perceives GCC as an issue removed in space and time only effecting future generations in less developed countries (Leiserowitz, 2005; Ockwell et al, 2009).

Table 18

Public's Level of Belief regarding the Reality of GCC

	Public's level of belief in the reality of global climate change					
Country	0 strong believer	1 believer	2 moderate believer	3 non-believer	*Mean*	*Std. Dev.*
MEX	98.5%	1.1%	0.4%	0.0%	0.02	0.16
BRA	98.4%	1.1%	0.1%	0.4%	0.03	0.22
JP	95.3%	2.7%	0.8%	1.2%	0.08	0.40
ESP	94.0%	2.3%	1.2%	2.4%	0.12	0.53
GER	93.6%	3.0%	1.3%	2.1%	0.12	0.51
CAN	93.5%	3.2%	1.5%	1.9%	0.12	0.49
UK	86.7%	4.9%	3.1%	5.3%	0.27	0.76
NET	85.0%	6.9%	3.1%	5.0%	0.28	0.75
USA	80.7%	4.6%	4.4%	10.2%	0.44	0.98

Furthermore, the data suggest that people who already experienced GCC or believe they will experience GCC soon are more concerned compared to people who believe they will not experience impacts from GCC in the near future. The dependent variables used for the regressions included different additive indexes, based on survey answers from various survey questions, as well as single survey questions addressing the public's level of support for mitigation and adaption policies as well as their willingness to pay more or commit to behavioral changes in order to reduce GCC. The dependent variables were the following:

- *Overall indexes of the public's support for mitigation policies, adaptation policies, and public's willingness to pay more for mitigation and changes in behavior*

- *Specific indexes of the public's support for energy efficiency policies, economic incentives, planning or adaptation strategies*

- *Specific indexes of the public's willingness to pay more for renewable energy/energy efficiency and for taxes to reduce GCC*

- *Specific survey questions addressing the public's willingness to use public transit for most of their travel, install solar panels on their home, buy mainly locally produced goods, use mainly recycled paper, purchase only energy saving appliances, and insulate their home and apartment*

General support for GCC policies. For six out of the nine countries, the results of the regression analysis show a strong and statistical significant relationship between the independent variables capturing the public's attitude and levels of concern towards climate change and the dependent variable presenting the public's support for mitigation policies in general. As already discussed in the previous chapter, the dependent variable was created from survey questions which asked the survey participants for their level of support for different mitigation policies on a 5 point scale ranging from strongly oppose to strongly support. As illustrated in Table 19, the results show a strong relationship with $R > 0.5$ between the independent and dependent variable for the United States, Netherlands, Spain, United Kingdom, Germany, and Canada. Between 25.4 percent (Canada) and 44.7 percent (United States) of the variation in the public's overall support for mitigation can be explained by the independent variables. The stepwise regressions show that the level of concern regarding possible impacts of GCC is the strongest of the different independent or predictor variables for all six countries.

Table 19

Strong Relationships between the Predictor Variables and Overall Support for Mitigation

Policies

Countries	Standard Regression				Stepwise Regression		
	Model		ANOVA		strongest	Model	
	R	Adj. R^2	F	Sig.	two variables	R	Adj. R^2
USA	.671	.447	128.633	.000	concern of pos. impacts & level of belief in GCC	.626 .653	.392 .426
NET	.636	.401	97.486	.000	concern of pos. impacts & pref. general strategy	.566 .613	.319 .374
ESP	.596	.350	74.610	.000	concern of pos. impacts & pref. general strategy	.530 .575	.280 .329
UK	.570	.320	64.461	.000	concern of pos. impacts & impacts exp. on Earth	.534 .554	.284 .305
GER	.523	.268	51.280	.000	concern of pos. impacts & pref. general strategy	.478 .508	.228 .256
CAN	.512	.254	31.528	.000	concern of pos. impacts & concern for family	.469 .490	.219 .237

However, when looking at the second strongest dependent variable the stepwise

regressions identified country specific differences. In the cases of the Netherlands, Spain,

and Germany the second most influential independent variable is one of the attitudinal

variables which asked the participants to choose between four general climate strategies.

For the participants in the United Kingdom the data shows that the survey question ask-

ing how long it will take until GCC will be experienced somewhere on Earth is the sec-

ond strongest independent variable. For Canada the stepwise regressions demonstrate that

the perceived level of threat of GCC over the next 50 years for oneself and family is the

second strongest predictor variable for mitigation support, whereas in the United States

the level of believe in the reality of GCC has the second strongest impact.

Table 20

Strong Relationships between the Predictor Variables and Overall Support for Adaptation Policies

Countries	Standard Regression				Stepwise Regression		
	Model		ANOVA		strongest	Model	
	R	Adj. R^2	F	Sig.	two variables	R	Adj. R^2
USA	.757	.570	209.927	.000	concern of pos. impacts	.706	.498
					& pref. general strategy	.731	.534
UK	.675	.451	111.669	.000	concern of pos. impacts	.616	.379
					& pref. general strategy	.646	.416
GER	.634	.398	91.709	.000	concern of pos. impacts	.598	.357
					& pref. general strategy	.617	.379
ESP	.632	.395	90.148	.000	concern of pos. impacts	.568	.321
					& pref. general strategy	.611	.372
NET	.619	.379	88.856	.000	concern of pos. impacts	.562	.315
					& pref. general strategy	.602	.361
CAN	.570	.317	42.686	.000	concern of pos. impacts	.519	.268
					& pref. general strategy	.547	.297
JP	.524	.274	51.750	.000	concern of pos. impacts	.421	.176
					& concern for family	.470	.219

For the three remaining three countries Japan, Mexico, and Brazil the R score is less than .5 indicating no large effect between the independent variables and the level of support for mitigation policies.

In terms of the relationship between the attitude and levels of concern towards GCC and support for adaptation policies the standard regressions identified strong relationships for seven of the nine surveyed countries. The dependent variable, the index for the public's overall support for adaptation policies, is based on single survey questions which asked the survey participants for their level of support for different specific adaptation policies on a 5 point scale ranging from strongly oppose to strongly support. The frequency distribution and a more detailed discussion of the creation of this index were pro-

vided in the previous chapter. As shown in Table 20, the results of the country specific

standard regressions confirmed significant and strong relationships with R>.5 between

the predictor and outcome variables for the samples from the United States (R=.757 &

Adj. R^2=.570), the United Kingdom (R=.675 & Adj. R^2=.451), Germany (R=.634 & Adj.

R^2=.398), Spain (R=.632 & Adj. R^2=.395), the Netherlands (R=.619 & Adj. R^2=.379),

Canada (R=.570 & Adj.R^2=.317), and Japan (R=.524 & Adj. R^2=.274).

As a result, the variation in the public's overall support for adaptation policies can

be explained to 57 percent in United States, to 45.1 percent in the United Kingdom, to

39.8 percent in Germany, to 39.5 percent in Spain, to 33.7 percent in the Netherlands, to

31.7 percent in Canada, and to 27.4 percent in Japan by the predictor variables. Again, the

ensuing stepwise regression identified the level of concern variable as the predictor vari-

able with the strongest relationship to the dependent variable, in this case the public's

overall support for adaptation policies. Furthermore, for six of the seven countries who

showed a strong relationship between the attitude and levels of concern towards GCC and

support for adaptation policies the attitudinal variable asking the participants to choose

between four general climate strategies is the second strongest predictor variable. Only

the Japanese sample identified the perceived level of threat of GCC over the next 50

years for oneself and family as the second strongest predictor variable for adaptation pol-

icy support.

Due to the identified strong relationships the previous two overall indexes of mit-

igation and adaptation support were further broken into three more specific thematic in-

dexes. This allowed testing the relationship between the independent variables and the

public's support for energy efficiency policies, economic incentives, and for planning and

adaptation strategies. All three sub-indexes are based on survey questions also used for the creation of the indexes of the public's support for mitigation and adaptation policies. The data found a strong relationship between the predictor variables and the sub-index of the public's support for energy efficiency policies for four of the nine countries. Based on the results of the standard regression analysis the answers provided by the participants show a strong relationship between the predictor and outcome variable in the United States (R=.627 & Adj. R^2=.390), in the Netherlands (R=593 & Adj. R^2=.347), in Spain (R=539 & Adj. R^2=.286) and in Germany (R=.530 and Adj. R^2=.276). Unfortunately, the standard regression does not show a strong relationship for the remaining five countries the United Kingdom, Canada, Japan, Mexico, and Brazil.

On the global scale, however, the regression analyses show a large effect of R=.545 and R^2= .297 of the predictor variables on the outcome variable with the level of concern variable and the attitudinal variable capturing the public's preference of 4 different general GCC strategies having the strongest impact on the public's level of support for energy efficiency policies. In the cases of the United States, the Netherlands, Spain, Germany the stepwise regressions also identified the level of concern variable as the most influential variable. In addition, with the exception of the United States, the public's choice regarding the four general GCC policies is the second strongest independent variable. The data from the United States show that the level of belief in the reality of GCC is the second strongest variable after the public's level of concern regarding possible impacts of GCC.

Furthermore, the data from the United States and the Netherlands also indicate a strong relationship between the predictor variables and the second sub-index capturing

the public's support for economic incentives. The data indicates that among the public in the United States 29.8 percent (R=.550 & Adj. R^2=.298) and in the Netherlands 30.9 percent (R=.560 & Adj. R^2=.309) of the variation in the public's support for economic incentives can be explained trough the predictor variables. In addition, at least the United Kingdom (R=.485 & Adj. R^2=.229) Spain (R=.480 & Adj. R^2=.229), Canada (R=.420 & Adj. R^2=.167), and Germany (R=.385 & Adj. R^2=.142) show a medium relationship between the attitude and levels of concern towards GCC and support for economic incentives. For both countries, United States and Netherlands, the performed stepwise regressions confirm the level of concern variable as the predictor variables with the strongest relationship to the dependent variable. The second strongest variable is for the Netherlands the public's attitude towards four general policies listed in Table 17 and for United States the level of believe regarding the reality of GCC shown in Table 18.

For the third sub-index, the public's support for planning and adaptation policies, the predictor variables showed a strong effect with R>.5 for the data collected from the United States, the United Kingdom, the Netherlands, Germany, Spain, and Canada. As displayed in Table 21 the predictor variables seem to have the strongest effect among the public in the United States (R=.756 & Adj. R^2=.568), followed by the United Kingdom (R=.662 & Adj. R^2=.434), Spain =.633 & Adj. R^2=.396), the Netherlands (R=.632 & Adj. R^2=.395)), Germany (R=.601 & Adj. R^2=.357, Canada (R=.567 & Adj. R^2=.314), and Japan (R=.511 & Adj. R^2=.256).

Table 21

Strong Relationships between the Predictor Variables and Public Support for Planning

and Adaptation Policies

Countries	Standard Regression				Stepwise Regression		
	Model		ANOVA		strongest		Model
	R	Adj. R^2	F	Sig.	two variables	R	Adj. R^2
USA	.756	.568	208.708	.000	concern of pos. impacts	.704	.495
					& concern for family	.729	.531
UK	.662	.434	104.127	.000	concern of pos. impacts	.613	.375
					& level of belief in GCC	.634	.400
ESP	.633	.396	90.496	.000	concern of pos. impacts	.562	.315
					& pref. general strategy	.615	.376
NET	.632	.395	95.141	.000	concern of pos. impacts	.580	.335
					& pref. general strategy	.612	.373
GER	.601	.357	77.168	.000	concern of pos. impacts	.567	.320
					& impacts exp. on Earth	.584	.340
CAN	.567	.314	41.995	.000	concern of pos. impacts	.515	.264
					& pref. general strategy	.537	.288
JP	.511	.256	48.328	.000	concern of pos. impacts	.400	.159
					& concern for family	.459	.209

Thus, among the public in the United States 56.8 percent, in the United Kingdom 43.4 percent, in Spain 39.6 percent, in the Netherlands 39.5 per-cent, in Germany 35.7 percent, in Canada 31.4 percent, and in Japan 25.6 percent of the variation in the public's overall support for planning and adaptation strategies can be explained by the six independent variables addressing the attitude and level of concern regarding possible negative impacts of GCC. The stepwise regression suggests that for all of these six countries the level of concern variable has the strongest relationship with the dependent variable. Ranging from R=.704 and Adj. R^2=.495 in the case of the United States to R=.400 and Adj. R^2=.159 for Japan.

Based on the second strongest independent variable the seven countries can be organized into four different groups. The largest group consists of Spain, the Netherlands, and Canada for which the stepwise regressions identified the attitudinal variable asking the participants to choose between four general climate strategies as the second strongest independent variable. The second group includes the United States and Japan. In both cases the variable capturing the participants level of concern for themselves and their family was the second strongest predictor variable. The third and fourth groups only consist of one country. The second strongest independent variable in the United Kingdom is the level of believe regarding the reality of GCC whereas for Germany the data shows that the survey question asking how long it will take until GCC will be experienced somewhere on Earth is the second strongest independent variable.

Similar to the precious indexes neither the regressions for Mexico nor Brazil shows a strong relationship (R>.5) between the independent variables and the outcome variable. This suggests that neither attitudes nor levels of concern seem to be major aspects during the public's decision process of supporting or opposing mitigation and adaptation policies.

Willingness to pay more for GCC abatement. The standard regression analyses between the predictor variables and the overall index of the public's willingness to pay more for climate strategies did not identify any large effects for any of the nine countries. As illustrated in Table 22, the conducted standard regressions only confirmed, at best, a medium relationship with R>.3between the predictor and the outcome variables for the United States, the Netherlands, the United Kingdom, Canada, and Japan.

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Table 22

Relationship between the Public's Attitude and Levels of Concern towards GCC and Willingness to Pay More for GCC Strategies

Countries	Standard Regression			
	Model		ANOVA	
	R	Adj.R^2	F	Sig.
United States	.429	.184	35.318	.000
Netherlands	.398	.153	26.943	.000
United Kingdom	.393	.148	24.446	.000
Canada	.382	.137	15.191	.000
Japan	.300	.083	13.502	.000
Spain	.259	.060	9.770	.000
Germany	.248	.055	8.956	.000
Mexico	.190	.029	5.101	.000
Brazil	.112	.013	1.682	.122

Among these five countries the public's attitudes and levels of concern can account for between 9.3 percent (Japan) and 18.4 percent (United States) of the variation in the public's willingness to pay more for climate strategies.

Thus, the data indicates that the independent variables do influence the public's willingness to pay more for GCC strategies, but are not the main or most important criteria the decision is based on. The public's preference towards four fundamental GCC strategies, the level of believe in the realty of GCC, the perception of how long it will take until dangerous impacts of GCC will be experienced on earth and in their region, the level of concern regarding the possible impacts of GCC, and the perceived the level of threat resulting from GCC for themselves and their families does not largely influence the public's willingness to pay more for GCC mitigation or adaptation policies. Instead, other factors may explain the public's willingness to pay more for GCC policies which were

not captured by the survey instrument. Subsequently, the regression analyses between the six predictor variables and all the sub-indexes such as the willingness to pay more for public transit, renewable energy, or taxes did also not show any large effects among the nine countries.

Willingness to change behavior. Another strong relationship was established between the predictor variables and the overall index for the public's willingness to change their behavior to reduce the causes and impacts of GCC. The outcome or dependent variable is based on the responses to single survey questions which asked the participants for their level of willingness to change their behavior in such areas as to use public transit for most of their travel, install solar panels on their home, buy mainly locally produced goods, use mainly recycled paper, purchase only energy saving appliances, and insulate their home or apartment. The global frequency distribution of this index suggests that close to 80 percent of all survey participants are in principle willing to strongly willing to change their behavior and thus live a more sustainable lifestyle.

The standard regression analysis indicates a strong relationship of R>0.5 among the participants from the United States (R=.573 & Adj. R^2=.324), the United Kingdom (R=.557 & Adj. R^2=.305), Germany (R=.538 & Adj. R^2=.284), and Spain (R=.524 & Adj. R^2=.269). Among the public in the United States 32.4 percent, in the United Kingdom 30.5 percent, in Germany 28 percent, and in Spain 26.9 percent of the variation in the public's willingness to change their behavior can be explained by the predictor variables.

As shown in Table 23, the stepwise regressions once again suggest that for all four countries the level of concern variable has the strongest relationship with the dependent variable.

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Table 23

Strong Relationships between the Predictor Variables and Willingness to Commit to Behavioral Changes

Countries	Standard Regression				Stepwise Regression		
	Model		ANOVA		strongest		Model
	R	Adj. R^2	F	Sig.	two variables	R	Adj. R^2
USA	.573	.324	76.447	.000	concern of pos. impacts & concern for family	.547 .561	.298 .314
UK	.557	.305	60.098	.000	concern of pos. impacts & pref. general strategy	.516 .546	.265 .297
GER	.538	.284	55.481	.000	concern of pos. impacts & pref. general strategy	.516 .530	.265 .279
ESP	.524	.269	51.334	.000	concern of pos. impacts & pref. general strategy	.469 .517	.219 .266

This independent variable is followed by the attitudinal variable asking the participants to choose between four general climate strategies the in the cases of the United Kingdom, Germany and Spain. For the United States the variable capturing the participants level of concern for themselves and their family was the second strongest predictor variable.

The regression analyses for the remaining five countries Canada, Netherlands, Japan, Brazil, and Mexico showed an R score of less than 0.5 indicating no large effect between attitude and levels of concern towards GCC and the public's willingness to change their behavior. However, the regressions of the remaining five countries all show a R score of R>.3 indicating at the least a medium relationship between the public's attitudes and levels of concern towards GCC on the one hand and their willingness to commit to behavioral changes on the other. Despite only four individual countries showing strong relationships the standard regressions for the global scale with all nine countries combined show an R score of R>0.5.This means that the global sample does show a strong

relationship (R=.543 & Adj. R^2= .295) between the independent variables and the public's willingness to change their behavior. Therefore, the data suggests that on the global scale 29.5 percent of the variation in the dependent variable can be explained by the dependent variables. In particular, the answers provided to the two survey questions measuring the public's general level of concern and preferences regarding four fundamentally different GCC strategies seem to have the strongest impact on whether or not someone is willing to commit to behavioral changes.

Similar to the discussion in section 5.2.2.2 the regressions analyses focusing on the relationship between the predictor variables and all the individual survey questions making up the index for the public's willingness to change their behavior in general did not show a strong relationship of R>0.5. Thus, the results suggest that the predictor variables can make a large effect on the public's general willingness to change its behavior to reduce the main causes of GCC but not on specific behavioral changes.

Summary

By applying different analytical tools and testing specific hypotheses this chapter addressed one of the central research questions to this study focusing on the interrelationships between perceptions, attitudes, policy support, and behavior regarding GCC in nine countries. The data support the argument that the lay public perceives GCC as a future threat. The results of the analysis also indicate significant differences in the perceived level of threat among the nine countries. About 85 percent of the respondents from Mexico and Brazil labeled GCC as a 'high threat', more often than any other surveyed national population. In contrast, Japan, the United Kingdom, United States, and the Netherlands less than 50 percent of their populations perceive GCC as a high threat. Moreover, people

who already have experienced GCC or believe they will experience GCC soon are more concerned about it compared to people who believe they will not experience impacts from GCC in the future. In terms of the role GCC risk perceptions and attitudes play in the public's willingness to support mitigation and adaptation policies, the analysis identified several significant relationships for the nine surveyed countries. The data finds strong correlations between the public's support for GCC mitigation and adaptation policies and their perceived level of consequences from environmental change as well as perceived level of threat from GCC. The data received from multiple countries also indicates that if people strongly oppose GCC policies, they also do not expect environmental changes such as GCC, worsening of urban air pollution, or an increasing frequency of major hurricanes and/or floods to occur over the next 20 years, and generally perceive GCC as no threat at all.

Numerous multiple regressions were conducted focusing on the relationship between attitudes and levels of concern over GCC and willingness to support GCC mitigation and adaptation policies, to pay more for climate abatement, and to commit to behavioral changes such as using public transit for most of their travel, installing solar panels on their home, buying mainly locally produced goods, using mainly recycled paper, purchasing only energy saving appliances, and insulating their home and apartment. With the exception of Japan, Mexico, and Brazil the results of the regression analysis show a strong and statistical significant relationship (R>0.5) between the independent variables capturing the public's attitude and levels of concern towards climate change and the dependent variable presenting the public's support for mitigation policies in general. In terms of the relationship between the attitude and levels of concern towards GCC and

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support for adaptation policies the standard regressions identified strong relationships for seven of the nine surveyed countries. Only for the samples of Brazil and Mexico was the R value below .5, indicating no strong correlation between the dependent and independent variables. This suggests that only in the cases of Brazil and Mexico neither attitudes nor levels of concern seem to be major aspects during the public's decision process of supporting or opposing mitigation and adaptation policies. The standard regression analyses between the predictor variables and the overall index of the public's willingness to pay more for climate abatement did not identify any large effects for any of the nine countries. A strong relationship was established between the predictor variables and the overall index for the public's willingness to change their behavior to reduce the causes and impacts of GCC. In particular the standard regression analysis indicates a strong relationship of R>.5 among the participants from the United States, the United Kingdom, and Spain. In addition for all of the remaining five countries Canada, Netherlands, Japan, Brazil, and Mexico showed an R score of R>.3 indicating at the least a medium relationship between the public's attitudes as well as levels of concern towards GCC and their willingness to commit to behavioral changes.

Furthermore, the ensuing stepwise regressions identified the level of concern regarding possible impacts of GCC as the strongest of the independent or predictor variables for all countries and regressions. However, when looking at the second strongest dependent variable the stepwise regressions identified country specific differences. The data identify, in most cases, the one of the attitudinal variables which asked the participant's to choose between four general strategies as the second most influential independent variable. Other less common independent variables which were identified by the stepwise re-

gressions as second strongest predictor variables were the perceived level of threat of GCC over the next 50 years for oneself and family, the level of believe in the reality of GCC, and the survey question asking how long it will take until GCC will be experienced somewhere on Earth.

Chapter 6

IMPACT OF SOCIO-ECONOMIC, KNOWLEDGE, TRUST, AND RESPONSI-

BILITY FACTORS ON GCC PERCEPTIONS AND POLICY SUPPORT

This chapter's focus is on the effects of socio-economic variables as well as the trust factors on climate change risk perceptions. It also looks at the role of public trust in the communication of GCC risks and information. The overarching research questions addressed in this chapter are the following:

- *How do the public perceptions regarding climate change and attitudes toward mitigation and adaptation strategies vary by socio-economic factors?*

- *What role do level of knowledge and perceptions of trust and responsibility play in the public's level of support for adaptation and mitigation policies?*

This chapter is divided into three parts. The first presents the results of frequency distributions and regression analyses examining the relationships between the socio-economic characteristics and perceptions of GCC as well as their willingness to commit to behavioral changes. The second part addresses the relationships between public trust in the science of GGC and the different sources of information and risk perceptions of GCC on the global scale. This is an important relationship to consider since, as shown in Chapter 5, the public's level of concern has the strongest effect on the level of support for mitigation and adaptation policies. The third part examines the relationships between the public perceptions of how responsible different groups are for reducing GCC, the level of trust towards different sources of information, and policy support.

The Role of Socio-Economic Characteristics

This section focuses on whether socio-economic characteristics of the survey participants have impacts on GCC perception as well as willingness to commit to behavioral changes. In order to identify differences and similarities among the nine countries a frequency distribution analysis was conducted for survey questions relevant to the research question stated above (see 6.2.1). Furthermore, to examine the role of socio-economic variables the following two hypotheses were tested through regression analyses following the same methodology applied in the previous chapter.

- *The general attitude towards GCC is impacted by socio-economic variables.*

- *Public risk perceptions of GCC are significantly impacted by socio-economic variables.*

The results of the regression analyses are discussed in the two following subsections. First, however, the frequency distributions of the key survey questions are discussed which were used as dependent variables for the regressions and were not discussed in previous chapters.

Frequencies of key risk perception questions. As discussed in Chapter 4, the data show that the majority of people view GCC as a serious threat to 'people in other countries', but not necessarily to themselves. Another principal question asked about the risk of global climate change possibly causing various negative impacts of GCC over 50 years. Respondents were given thirteen consequences of GCC and were asked to evaluate their level of risk on a five-point Likert-scale. Table 24 shows the results for all nine countries combined. Among the possible consequences of GCC, for example are 'more

frequent and serious hurricanes', 'coastal damage', 'negative impacts on the global economy', or 'more people living in poverty'. Responses in the 'very high' risk category show that the survey participants are most concerned about GCC causing 'droughts and water shortage' (42.4 percent), 'more frequent and serious floods' (42.4 percent), 'forest fires' (40 percent), and 'severe heat waves' (39.7 percent).

Overall, at least 30 percent of the survey participants stated that there is a very high risk for GCC causing each of the thirteen negative events listed in Table 24. Moreover when the answer categories 'high risk' and 'very high risk' are combined the data show not much variation between the risk perceptions of the different negative GCC impacts. Instead, between 66.5 percent and 76.9 percent of the surveyed population perceive the risk of GCC causing any of the listed impacts as high or very high. On the other hand, only a small percentage of the public seems to believe that there is no risk of global climate change causing any of the different negative events. For example, only 3.1 percent stated that they do not expect any negative impacts from GCC on the global economy in the near future. In addition, less than 3 percent of the participants do not anticipate an increase in poverty, refugee problems, or loss of farmland due to GCC. As a result, the data suggest *that on average for all nine countries 71.2 percent of the public perceives the risk of global climate change causing one of the thirteen negative events as high or very high.* Compared to only an average of approximately 8 percent who see 'no to little risk' of GCC increasing the frequency or severity of environmental hazards.

Table 24

Perceived Level of Risk over the Next 50 Years for GCC causing Negative Impacts

All Countries Combined	1 no risk	2 little risk	3 moderate risk	4 high risk	5 very high risk	Mean
More frequent and serious hurricanes	2.7%	5.9%	23.7%	37.5%	30.2%	3.87
Greater extinction of plant and animal species	2.3%	5.7%	21.2%	33.7%	37.0%	3.97
Famines and food shortage	2.4%	5.3%	20.8%	34.3%	37.2%	3.99
Droughts and water shortages	2.1%	4.5%	17.0%	33.9%	42.4%	4.10
More people living in poverty	2.9%	5.6%	21.7%	34.4%	35.5%	3.94
More refugee problems in parts of the world	2.8%	6.6%	24.0%	35.1%	31.4%	3.86
Severe heat waves	2.4%	4.8%	19.3%	33.8%	39.7%	4.04
Forest fires	2.4%	4.8%	18.6%	34.2%	40.0%	4.05
Diseases/epidemics	2.8%	6.6%	23.2%	30.9%	36.5%	3.92
More frequent and serious floods	2.4%	4.1%	16.6%	34.5%	42.4%	4.10
Coastal damage	2.5%	5.2%	20.8%	34.7%	36.8%	3.98
Extensive loss of farmland	2.8%	5.9%	21.4%	33.3%	36.6%	3.95
Negative impacts of the global economy	3.1%	5.6%	21.7%	32.6%	37.1%	3.95

On the national scale the mean scores for the perceived level of risk of GCC causing any of the thirteen environmental impacts suggests country-specific differences. As illustrated in Table 25 and based on the five-point Likert-scale ranging from no to very high risk (5 on the scale), the average mean scores were the highest for Mexico and Brazil. For these two countries, the average mean score was above 4.5 demonstrating that the populations from Mexico and Brazil perceive high risk levels of GCC. The lowest mean scores were from the United States, the Netherland, and the United Kingdom. The average mean score was below 3.7 indicating that a large number of people in these countries perceive GCC as a moderate risk for causing future environmental impacts.

Table 25

Country Specific Mean Scores for the Public's Risk Perceptions of GCC causing Future

Environmental Impacts

Mean scores by country for the public's perception of the risk of GCC causing various environmental impacts over the next 50 years									
	BRA	CAN	GER	JP	MEX	NET	ESP	UK	USA
More frequent and serious hurricanes	4.28	3.91	4.00	3.79	4.53	3.54	3.92	3.51	3.42
Greater extinction of plant and animal species	4.49	4.02	3.97	3.83	4.57	3.59	4.05	3.76	3.59
Famines and food shortage	4.34	4.00	3.84	4.14	4.56	3.80	3.95	3.77	3.56
Droughts and water shortages	4.57	4.06	4.00	4.17	4.69	3.85	4.18	3.80	3.65
More people living in poverty	4.27	3.96	4.05	3.90	4.49	3.64	4.07	3.62	3.57
More refugee problems in parts of the world	4.14	3.91	4.00	3.77	4.27	3.64	3.85	3.66	3.56
Severe heat waves	4.62	4.13	4.05	3.98	4.66	3.64	4.08	3.63	3.66
Forest fires	4.64	4.08	4.02	3.91	4.62	3.77	4.19	3.65	3.62
Diseases/epidemics	4.47	3.99	3.79	4.04	4.61	3.57	3.93	3.50	3.48
More frequent and serious floods	4.55	4.14	4.14	4.02	4.70	3.90	4.18	3.82	3.58
Coastal damage	4.43	4.03	4.04	3.87	4.54	3.65	4.01	3.77	3.61
Extensive loss of farmland	4.39	4.03	3.92	4.03	4.64	3.48	4.02	3.56	3.59
Negative impacts of the global economy	4.40	4.08	3.88	3.98	4.55	3.51	4.03	3.59	3.67
AVERAGE	**4.43**	**4.03**	**3.98**	**3.96**	**4.57**	**3.66**	**4.04**	**3.66**	**3.58**

Several survey questions addressed the public's perceived level of threat from

global climate change. As mentioned earlier many people perceive GCC as an issue far

removed in time and space only impacting people in less developed countries. Neverthe-

less the frequency distribution of the index for the overall perceived level of threat result-

ing from climate change over the next 50 years showed significant differences among the

nine countries. As discussed in chapter 5 over 80 percent of the populations in Mexico and Brazil seem to perceive GCC as a high threat. For Japan, the United Kingdom, the United States, and the Netherlands people identifying GCC as a high threat is below 50 percent. Of interest, is the fact that in the Netherlands the data indicate that only 20 percent of its population acknowledges GCC as a high threat. However, 58% of the Dutch participants did identify GCC as a source of some threat. Thus, more than 50% of the population in each country agrees that GCC will pose at least some threat over the next 50 years.

In terms of the public's willingness to change its behavior (such as in support for mitigation policies) the data show that most people are willing or even strongly willing to do so. Table 26 shows the frequency distribution for the six behavioral options for all nine countries combined. With close to 80 percent of the participants indicating a willingness or even strong willingness, the survey results demonstrate that the public is most willing to use more recycled paper and purchase energy saving appliances. However, on the national scale, only 25.1 percent of the participants from Japan indicated a strong willingness to mainly use recycled paper. This is significantly less compared to the top two countries Mexico with 68.5 percent and Canada with 54.7. Japan also ranked last for the three behavioral questions addressing energy consumption at home. When asked about the level of willingness to purchase only energy saving appliances, install solar panels, or insulate their home or apartment less than 11 percent of the survey participant in Japan answered with 'strongly willing'.

Table 26

Frequency Distribution for Behavioral Questions for all Countries Combined

All Countries Combined	1 not willing at all	2 slightly willing	3 undecided	4 willing	5 strongly willing	Mean
Use public transit for moist of my travel	15.1%	15.7%	14.3%	29.4%	25.5%	3.35
Install solar panels	9.8%	10.0%	17.3%	33.8%	29.0%	3.62
Buy mainly locally produced goods	5.3%	9.3%	16.0%	39.5%	29.8%	3.79
Use mainly recycled paper	3.6%	6.7%	10.0%	38.4%	41.3%	4.07
Purchase only energy saving appliance	3.3%	6.3%	12.3%	37.1%	40.9%	4.06
Insulate your home or apartment	5.6%	6.5%	18.3%	36.3%	33.2%	3.85

Overall the data indicate that the public is the least willing to change their travel behavior. Over 30 percent of the survey participants stated that they are not willing or only slightly willing to increase their use of public transit systems. In the United States and the Netherlands the amount of people stating that they are not willing at all to use public transit for most of their travel is significantly higher compared to the other seven surveyed countries. In the United States over 33 percent and in the Netherlands almost 25 percent did not show any willingness to use public transit more often. In addition, a relatively large number of people seem to be undecided in terms of their willingness to install solar panels (17.3 percent), buy mainly locally produced goods (16 percent), and improve the insulation of their homes or apartments (18.3 percent). The mean scores suggest that people are most willing to change their behavior in areas that do not impact their daily routine or cost extra money such as using mainly recycled paper and purchasing only energy saving appliances.

Table 27

Frequency Distribution for the Public's Overall Willingness to Change their Behavior to

Reduce the Causes of GCC

Country	1 not willing at all	2 slightly willing	3 undecided	4 willing	5 strongly willing	*Mean*
MEX	0.4%	0.6%	2.3%	31.1%	65.6%	4.61
BRA	0.1%	2.4%	5.4%	33.9%	58.3%	4.48
CAN	0.9%	2.2%	11.1%	34.9%	50.8%	4.32
ESP	1.5%	2.8%	13.0%	39.2%	43.5%	4.20
GER	2.9%	4.1%	17.5%	39.3%	36.2%	4.02
UK	2.1%	5.7%	15.2%	42.3%	34.7%	4.02
NET	2.0%	6.6%	19.2%	44.6%	27.7%	3.89
USA	4.0%	7.0%	16.6%	41.5%	30.9%	3.88
JP	0.7%	8.1%	27.7%	45.4%	18.1%	3.72

On the other hand insulating the home and installing solar panels will save money in the long run but requires an upfront capital investment first. Changing travel habits is a significant change of someone's daily routine and locally produced goods are often more expansive than mass produced products sold by the big-box supermarkets.

The behavioral questions listed in the previous table were also combined into an index capturing the public's overall willingness to change its behavior to reduce the causes of GCC (mitigation). The results of this index for each country are shown in Table 27. Based on the country-specific frequency distribution and mean scores, the populations of Mexico and Brazil are the most willing to commit to behavioral change. Among the nine countries, the survey results for Japan show the least amount willing to change their behavior (63.5 percent),but the highest numbers for people that are undecided (27.7 percent). In terms of similarities, the mean scores and frequency distributions of Germany and the United Kingdom suggest similar behavioral attitudes among the populations of

both countries. In Germany 75.5 percent and in the United Kingdom 77 percent of the survey respondents seem to be willing or strongly willing to make behavioral changes. In general the population of Mexico, Brazil, and Canada seem to be the most willing to adjust their behavior in order to mitigate GCC.

Socio-economic variables & general GCC attitudes. Can differences in general attitudes towards GCC among the nine countries be explained to a large degree by socio-economic characteristics? As discussed earlier, the public's general attitude towards GCC was measured through level of believe in the reality of GCC and their preference regarding the following four fundamental GCC policies.

- *'We should not take any steps that would have economic costs until we are certain that GCC is really a problem*
- *'We should take some steps just in case GCC is real'*
- *'We only should take steps to address GCC which are low in costs'*
- *'GCC is a serious problem and we should begin taking steps now even if this involves significant cost'*

Standard and stepwise regressions were conducted to determine the effect of independent socio-economic variables such as age, gender, household income, and education on the two dependent variables presenting the public's attitude towards GCC. The country specific frequency distribution for both outcome variables were already discussed in previous sections and displayed in the Tables 17 and 18.

Table 28

Regression Results for Relationships between Socio-Economic Characteristics and Attitude towards GCC Policies

Relationship between socio-economic characteristics and preference towards four general GCC strategies				
Countries	Model		ANOVA	
	R	Adj. R^2	F	Sig.
Brazil	.188	.030	6.423	.000
United Kingdom	.187	.030	6.438	.000
Mexico	.159	.018	3.544	.007
United States	.157	.020	5.550	.000
Germany	.155	.018	4.145	.003
Japan	.145	.016	3.906	.004
Spain	.134	.012	2.937	.020
Netherlands	.104	.005	1.789	.129
Canada	.095	.002	1.216	.303
Relationship between socio-economic characteristics and level of belief in the reality of GCC				
Countries	Model		ANOVA	
	R	Adj. R^2	F	Sig.
United Kingdom	.228	.047	9.683	.000
United States	.199	.035	9.045	.000
Netherlands	.174	.024	5.101	.000
Spain	.148	.016	3.628	.006
Japan	.145	.016	3.908	.004
Mexico	.143	.013	2.853	.023
Brazil	.123	.010	2.701	.030
Germany	.109	.006	2.030	.089
Canada	.103	.003	1.421	.226

The regression analysis did not indicate any large effects between the socio-economic variables and the two dependent attitudinal variables. As shown in Table 28, the statistical tests of the standard regressions only, at best, showed weak significant relationships between the variables with R >.2 and $R^2 \geq$ .03. That is, the results suggest that

gender, household income, level of education, or age only account for a small percentage of the variation in the public's level of believe and preference towards general GCC strategies.

Socio-economic variables & GCC risk perceptions. The second hypothesis is also not confirmed by the results of different regression analyses. Compared to the hypothesis discussed in the previous section, regression analyses were performed to examine to what degree the four socio-economic variables (age, gender, level of education, and household income) can explain differences in the public's risk perception of GCC among the nine countries. The results show that socio-economic variables are not a strong predictor of perceived risks of global climate change. Instead, the calculated R and R^2 scores showed only a small correlation between the independent and dependent variables. At no point does the R score reach .3 indicating at least a medium relationship between the predictor and outcome variables. Instead, the data show that the socio-economic characteristics do not have a significant impact on the way GCC risks are perceived.

Trust Factors & Public GCC Risk Perceptions

Studies show that public distrust in individuals, industries, governmental departments, and other institutions of organizations involved in risk and hazard management is strongly linked to risk perceptions (Bord & O'Connor, 1990; Flynn et al, 1992; Jenkins-Smith, 1992; Mushkatel & Pijawka, 1992). Typically, the more the public distrusts risk management and communicators information the more concern they have about adverse impacts and potential threats for their own wellbeing (Slovic et al, 1991).

Research also shows that the failures in risk communication is significantly influenced by the public's trust in the communicator and in the ability of individuals, industries, or institutions responsible for risk management (Renn & Levine, 1991; Kasperson et al, 1992; Nye, 1997). Where risks are characterized by high uncertainties, as in GCC, trust may play a critical role in the success of risk communication and implementation of policies. Moreover, trust is not only a necessary precondition for successful GCC communication but it can also be improved by well-developed communication strategies (Misztal, 1996). Trust is vital in organizations whose risk management policies impact communities and the environment in order to reduce complexity and generate social cooperation (Cvetkovich & Loefstedt, 1999).

However, much of this research was not conducted for hazards with high levels of uncertainties such as GCC, but in the context of technological risks such as nuclear power. Being important, this led to the question if such relationship between trust factors and public risk perceptions also exist in the context of GCC.

Therefore, two different groups of regression analyses were conducted. The first group of regressions focused on the relationship between public trust in the science of GGC, as well as towards different sources of GCC information, and the level of concern over the impacts of GCC. This relationship is of great importance for communication efforts in order to improve public policy decision-making.

As shown in Chapter 5, the public's level of concern over possible GCC impacts has the strongest effect on the level of support for mitigation and adaptation policies among all tested GCC risk perceptions. Moreover, as discussed earlier, success of commutation efforts is significantly impacted by the public's trust in the communicator such

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as family and friends, mainstream media, governmental and environmental organizations, scientists and teachers, and corporations. The results of the regressions are discussed in the next section.

The second group of regressions focused on the effect of GCC threat and risk perceptions on trust perceptions in the federal government as a potential communicator and risk manager. Due to the government's capability to implement the needed, comprehensive GCC policies, trust in the government is of significant importance to successfully mitigate and adapt to GCC. Furthermore, the survey data show that the public perceives the national or federal government as the primary institution responsible to reduce or mitigate GCC. The public's perceived level of responsibility of the federal government to reduce GCC was used as a surrogate variable for the public's level of trust in the GCC risk management capabilities of the government. This is based on the rational that the public would not perceive the government as responsible to reduce GCC without acknowledging its capability to do so in the first place.

In addition, two additive indexes were created to present the public's perceived risks:1) general level of threat from GCC, and 2) risk of GCC causing negative impacts over the next 50 years. The additive index of the public's perceived level of threat resulting from climate change is based on how the survey participants rated the threat level of GCC for plants and animals, people in other countries, people in their country, and for themselves and their family over the next 50 years. The additive risk index is based on how the respondents rated the risk of GCC causing different environmental and societal impacts over the next 50 years.

Table 29

Standard Regression Results for the Relationship between Trust in Science as well as to-wards Different Sources of Information and Level of Concern for all Countries Combined

Model				Coefficients				
R	*Adj.R²*	*F*	*Sig.*	*Ind. Var.*	*Unstand. B*	*Stand. Beta*	*t*	*Sig.*
.569	.322	314.913	.000	enough scientific data	-.051	-.050	-4.380	.000
				scientific data are trustworthy	.276	.245	18.215	.000
				trust TV weather reports	.028	.024	1.954	.000
				trust corporation	-.017	-.015	-1.171	.241
				trust family and friends	.102	.080	7.588	.000
				trust governmental organizations	-.113	-.106	-7.887	.000
				trust environmental organizations	.345	.342	23.465	.000
				trust mainstream news media	-.013	-.012	-.840	.401
				trust scientists	.134	.113	8.002	.000
				trust religious leaders	-.016	-.016	-1.391	.164
				trust teachers	.032	.027	2.089	.037

Trust factors & level of concern over GCC impacts. As mentioned above, regressions were used to test the relationships between the public's trust in the science of GGC, as well as towards different sources of GCC information, and the level of concern over the possible impacts of GCC. Table 29 summarizes the results of the standard regressions on the global scale with all nine countries combined into one sample. The results show a strong relationship (R=.569 & Adj. R^2=.322) between the independent trust variables and the public's level of concern over GCC. The data show that 32.2 percent of the variation in the public's level of concern can be explained by their level of trust to-

wards GCC science and different sources of information. The results also show that the relationship between the different independent variables and the one dependent variable are not always positive. For example, the data indicate that the more people consider the GCC scientific data as trustworthy, or trust environmental organizations the more they are concerned about GCC. On the other hand, the more the public trusts the information from corporations or governmental organizations the less concerned are they about GCC.

As already discussed in Chapter 4, the majority of the public is concerned about global climate change and its potential impacts; 83.7 percent stated at least some concern regarding the possible impacts of GCC. Regarding the independent trust variables, corporations, governmental organizations, and religious leaders are trusted the least as a source for GCC information. Instead, the majority of the public somewhat or strongly trusts scientists (66.8 percent), television weather reports (61.3 percent), family and friends (56.5 percent), and environmental organizations (56.1 percent) as sources of GCC information. The results also show that a large numbers of people are undecided in whether or not they should trust certain sources of information. Especially, in regards to teachers, 40 percent of all participants chose the answer category 'undecided' followed by corporations (36 percent), family and friends (33.1 percent), and the mainstream news media (30.5 percent). The frequency distributions among the nine countries also indicate an inconsistency between the level of trust towards of scientists and the level of agreement with the sufficiency and trustworthiness of scientific data and expert knowledge. 66.8 percent of the total sample 'somewhat' or 'strongly' trusts scientists as sources for GCC information. However, the data also indicate that 40.2 percent of the total sample doubts that the scientific community actually has enough data to fully understand GCC.

Table 30

Countries with Strong Relationships between Trust towards GCC Science & Communicators as well as Level of Concern

Countries	Standard Regression				Stepwise Regression		
	Model		ANOVA		Strongest variable	Model	
	R	Adj. R^2	F	Sig.		R	R^2
USA	.738	.540	101.925	.000	trustworth. of gcc science	.671	.339
					& trust environ org.	.723	.522
UK	.640	.402	50.317	.000	trust environ org	.578	.334
					& trustworth. of gcc science	.613	.374
NET	.590	.340	41.422	.000	trust environ org	.547	.298
					& trustworth. of gcc science	.574	.328
CAN	.550	.288	20.829	.000	trust environ org	.434	.187
					& trustworth. of gcc science	.486	.233

On the international scale, the regression analysis shows a strong and statistical significant relationship between the independent variables capturing the public's trust towards GCC science as well as potential communicators and the level of concern about possible impacts of GCC. Table 30 shows a strong relationship of R>0.5 between the independent and dependent variables for the United States, United Kingdom, Netherlands, and Canada. According to the adjusted R^2 scores between 28.8 percent (Canada) and 54 percent (United Stated) of the variation in the public's level of concern can be explained by the independent variables.

According to the stepwise regressions the two strongest independent variables are the level of trust in environmental organizations and perceived trustworthiness of GCC science. Both variables have a positive relationship to the dependent variable. Thus, the higher the trust in environmental organizations and the scientific data the more concerned is the public about the possible impacts of GCC.

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Impact of GCC risk & threat perceptions on trust in government as source of information & risk manager. The second group of regressions focused on the impact of risk and threat perceptions on the public's trust in the federal government as source of GCC information and as risk manager capable of implementing successful mitigation and adaptation strategies. On the global scale, the regressions show only a weak relationship (R<.3) between the public's perceived level of threat from GCC as well as risks of GCC causing negative impacts over the next 50 years and the level of trust in government as a source of GCC information. This shows that how the public perceives the threat of GCC and the risks of potential negative impacts does not have a strong influence on the level of trust towards the government as a source of GCC information and potential speaker of communication programs. Regressions on the national scale for each of the nine countries also show no strong relationships of R>0.5.

As shown in Table 31, the regression testing the strength of the relationship between the two risk and threat indexes and the public's trust in the government as risk manger also did not show a strong relationship (R <0.5). However with an R score of R=.427 the regression shows a moderate relationship on the global scale. Furthermore, the analysis shows a positive relationship for both indexes and the public's level of trust in the government's capability as GCC risk manager. This indicates that the stronger the public believes in GCC risks and threats the more they trust the government to be capable of implementing successful mitigation and adaption policies.

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Table 31

Impacts of GCC Risk and Threat Perceptions on the Public's Level of Trust in the Government as a GCC Risk Manager

Model			ANOVA		Coefficients				
R	*R²*	*Adj.R²*	*F*	*Sig.*	*Ind. Var.*	*Unstand. B*	*Stand. Beta*	*t*	*Sig.*
.427	.183	.182	810.319	.000	GCC threat index	.289	.232	15.731	.000
					GCC risk index	.255	..232	15.755	.000

On the international scale, the regression analysis shows a strong relationship only for the data from the United States. With an R score of R=.553 and a R² score .306. The result shows that the two indexes explain 30.6 percent of the public's variation of trust towards the government as a GCC risk manager. For Japan and Germany the regressions showed moderate relationships as well. For the remaining countries the R is below 0.3 indicating only a weak relationship between GCC risk and threat perceptions and trust in the GCC risk management capability of the government.

Impact of Knowledge, Trust & Responsibility Factors on Public Support for GCC Policies & Strategies

This section focuses on the final research question of this dissertation.

- *What role do level of knowledge and perceptions of trust and responsibility play in the public's level of support towards adaptation and mitigation policies?*

The literature shows that when people have a better understanding of GCC science, they tend to be more supportive of mitigation efforts (Read et al., 1994). Table 32

Table 32

Perceived Level of Knowledge about Key Aspects of GCC

All Countries Combined	1 not informed	2 Somewhat informed	3 informed	4 very informed	*MEAN*
The causes of GCC	7.1%	36.7%	41.0%	15.2%	2.64
The impacts of GCC	6.3%	33.9%	43.1%	16.7%	2.70
The ways in which we can reduce GCC	10.5%	37.7%	37.7%	14.2%	2.56
The various national and inter-national policies to prevent GCC	22.7%	46.5%	23.3%	7.5%	2.16

 shows the frequency distribution for all countries combined for their perceived level of knowledge regarding different aspects of GCC. Less than 60 percent of the public feels 'informed' or 'very informed' about the impacts, causes, and ways to reduce GCC. On a 1 to 4 scale where 1 is 'not informed' and 4 is 'very informed' the public's perceived knowledge averages between 2.0 and 3. 0. Moreover, less than one- third (23.3 percent) of the surveyed population feel at least informed about the various national and interna-tional policies to prevent GCC. Another 22.7 percent indicated that they do not feel in-formed at all about existing GCC policies. Also noteworthy are the fairly high numbers of people who indicated that they only are somewhat informed about these four important aspects of GCC. This indicates high levels of uncertainty among the public which can lead or enforce already existing misconceptions. The second group of independent varia-bles, presenting the public's trust in the science of GGC as well as towards different sources of information, was already discussed in detail in chapter 4. The frequency distri-bution of the last group of relevant independent variables is shown in Table 33 and deals with how people perceive responsibilities of different sectors to reduce GCC.

Table 33

Public's Perceived Level of Responsibility towards different Groups to Mitigate the Main

Causes of GCC

All Countries Combined	1 not responsible	2 somewhat responsible	3 responsible	4 very responsible	MEAN
National/Federal Government	6.7%	23.5%	31.8%	38.0%	3.01
Environmental Protection Agency	6.8%	22.8%	35.0%	35.4%	2.99
The United Nations	6.7%	23.1%	32.7%	37.5%	3.01
Environmental Groups	10.6%	26.6%	34.8%	27.9%	2.80
Corporations	7.2%	25.5%	33.7%	33.7%	2.94
State Government	7.8%	26.1%	34.0%	32.1%	2.90
Local Government	8.8%	28.1%	33.9%	29.2%	2.84
Your Community	8.5%	29.7%	33.8%	28.1%	2.81
You Personally	8.0%	29.3%	33.5%	29.2%	2.84

For many hazards the public feels that applicable strategies exist in which they

can be engaged in (Rotter, 1966). However, GCC is characterized by high uncertainties,

unfamiliar risks, and other characteristics of hazards which make personal connections,

responsibility and engagement difficult. Many hope that effective communication efforts

can foster a personal connection to GCC, raise the level of concern, and thus increase the

level of support for mitigation and adaptation policies. The data show that the majority of

people feel personal responsibility to take action to reduce the causes of GCC.

However, the mean score identifies several groups, agencies, or institutions for

which the public believes that are more responsible than themselves to mitigate GCC.

Although, differences are very small, on the global scale the public seems to perceive the

national or federal government the primary institution responsible to reduce GCC, fol-

lowed by the United Nations, the country's environmental protection agency, and corporations. Among the nine possible groups responsible for reducing GCC, personal responsibility ranks 6th. Thus, the public seems to perceive GCC as an issue that has to be solved to large part by the government and other institutions. This poses a significant barrier to the success of mitigation and adaptation strategies, since many of these policies require the public's support and cooperation.

Following the same structure and methodology discussed in chapter 5, the following paragraphs address the regression analysis focusing on the impact of level of knowledge, level of trust towards sources of information, and perceived levels of responsibilities of different groups for reducing the main causes of GCC on the public's policy support for mitigation and adaption. In particular, the different regressions analyzed the impact of the independent variables on the public's level of support for adaptation and mitigation policies, willingness to pay more for climate change abatement, and willingness to commit to different behavioral changes.

Support for mitigation and adaptation policies. The results of the regression analysis show strong and statistical significant relationships between the independent variables -knowledge, trust, and responsibility- and the dependent variable, the public's support for mitigation policies in general (for at least seven out of the nine countries). As illustrated in Table 34, the results show a strong relationship (with R>0.5) between the independent and dependent variables for the United States, Netherlands, Spain, United Kingdom, Canada, Japan, and Germany. Between 28.4 percent (Germany) and 54.2 percent (United States) of the variation in the public's overall support for mitigation can be explained by the independent variables.

Table 34

Strong Relationships between the Independent Variables and the Overall Support for Mitigation Policies

| Countries | Standard Regression | | | | | Stepwise Regression | |
| | Model | | ANOVA | | Strongest Variable | Model | |
	R	Adj. R^2	F	Sig.		R	R^2
USA	.736	.542	43.512	.000	trust environ. org.	.626	.391
NET	.653	.426	24.935	.000	trust environ. org.	.549	.301
ESP	.646	.417	22.755	.000	trust environ. org.	.471	.221
UK	.601	.341	17.692	.000	trust environ. org.	.482	.231
CAN	.599	.359	11.990	.000	personal resp.	.449	.200
JP	.559	.312	14.579	.000	personal resp.	.392	.152
GER	.533	.284	12.657	.000	trust environ. org.	.383	.146

The stepwise regressions identified two independent variables as the strongest: the level of trust towards environmental organizations as sources of information and the perceived level of personal responsibility to reduce GCC, especially in Japan and Germany. For Mexico and Brazil the R score is less than 0.5 indicating there is no large effect between the independent variables and the level of support for mitigation policies. In terms of the relationship between the same independent variables and adaptation policies, the standard regressions identified strong relationships for the same seven countries as in the previous regression. Thus, the results show a strong relationship for the United States (R=.799 & Adj. R^2=.542), United Kingdom (R=.653 & Adj. R^2=.449). Spain (R=.661 & Adj. R^2= .419), Germany (R=.651 & Adj. R^2=.405), Netherlands (R=.643 & Adj. R^2=.396), Canada (R=.611 & Adj. R^2=.344), and Japan (R=.594 & Adj. R^2=333). Between 54.2 percent (United States) and 33.3 percent (Japan) of the variation in the public's overall support for adaptation policies can be explained by the predictor variables.

Table 35

Strong Relationships between the Independent Variables and Overall Support for Adaptation Policies

| Countries | Standard Regression | | | | Stepwise Regression | | |
| | Model | | ANOVA | | | Model | |
	R	Adj. R^2	F	Sig.	Strongest Variable	R	R^2
USA	.799	.628	65.004	.000	trust environ. org.	.692	.478
UK	.683	.449	27.351	.000	trust environ. org.	.534	.285
ESP	.661	.419	24.668	.000	UN resp.	.450	.202
GER	.651	.405	23.440	.000	personal resp.	.448	.200
NET	.643	.396	23.687	.000	trust environ. org	.488	.237
CAN	.611	.344	12.766	.000	EPA resp.	.435	.188
JP	.594	.333	17.518	.000	local govern. resp.	.421	.176

As shown in Table 35 the ensuing stepwise regression identified differences among the countries in terms of the independent variable with the strongest effect on the public's level of support for adaptation policies in general. Again, in the cases of the United States, United Kingdom, and Netherlands the level of trust towards environmental organizations is the predictor variable with the strongest relationship to the dependent variable, in this case the public's overall support for adaptation policies. However, for the remaining four countries Spain - Germany - Canada and Japan, the perceived levels of responsibility of the United Nations (Spain), Environmental Protection Agency (Canada), local government (Japan), and personally (Germany) are the strongest independent variables for adaptation policy support.

The previous two overall indexes of mitigation and adaptation support were further broken into three more specific thematic indexes: public's support for energy efficiency policies, economic incentives, and for planning and adaptation strategies. The re-

gression analyses identified strong relationships for all three thematic indexes among the nine countries.

For the first sub-index, the public's support for energy efficiency policies, the regression analyses show a strong relationship between the predictor variables and the dependent variables for eight of the nine countries. Only the R score for Brazil is below 0.5 indicating no large effect between the independent variables and the level of support for energy efficiency policies. As shown in Table 36, for the remaining eight countries the R scores range from .514 (Mexico) to .681 (United States). The adjusted R^2 scores suggest that the independent variables account for between 24.1 percent and 45 percent of the variation in the dependent variable.

The stepwise regressions identified the level of trust towards environmental organizations for the United States and Netherlands and the level of trust towards family and friends for Spain as the most influential variables. In the cases of Germany, Canada, Japan, United Kingdom, and Mexico the perceived level of responsibility of corporations, personally, the Environmental Protection Agency, or the federal government have the strongest impact on the public's level of support for energy efficiency policies.

In the case of the second sub-index the public's support for economic incentives, the regression analyses show strong relationships between the predictor variables and the dependent variables for five of the nine countries. The survey included economic incentives such as the government requiring higher utility rates from using non-renewable energy sources or higher taxes on electricity.

Table 36

Strong Relationships between the Independent Variables and Support for Energy Efficiency Policies

Countries	Standard Regression				Stepwise Regression		
	Model		ANOVA		Strongest Variable	Model	
	R	Adj. R^2	F	Sig.		R	R^2
USA	.681	.450	31.919	.000	trust environ. org.	.548	.299
ESP	.611	.353	18.894	.000	trust family and friends	.420	.175
NET	.597	.338	18.654	.000	trust environ. org.	.470	.220
GER	.581	.317	16.284	.000	corporate resp.	.383	.146
CAN	.580	.305	10.850	.000	personal resp.	.414	.170
JP	.563	.296	14.928	.000	EPA resp.	.405	.163
UK	.517	.244	11.450	.000	fed. govern. resp.	.362	.130
MEX	.514	.241	11.504	.000	personal resp.	.325	.104

The data indicates that among the public in the United State 42.8 percent (R=.555 & Adj. R^2=.428), in the Netherlands 34.8 percent (R=.605 & Adj. R^2=.348), in the United Kingdom 31.6 percent (R=.581 & Adj. R^2=.316), in Spain 31.5 percent (R=.579 & Adj. R^2=.315), and in Canada 23.4 percent (R=.518 & Adj. R^2=.234) of the variation in the public's support for economic incentives can be explained trough the independent variables defined at the beginning of section 6.4. According to the stepwise regressions aspects such as the perceived trustworthiness of the scientific GCC data, trust in environmental organizations, as well as perceived corporate and personal responsibility are the strongest independent variables among the five countries.

For the third sub-index, the public's support for planning and adaptation policies, the predictor variables showed a strong effect with R>.5 for the data collected from the United States, Spain, United Kingdom, Netherlands, Canada Germany, Japan, and Mexico. Again, Brazil is the only country with an R score below 0.5.

Table 37

Strong Relationships between the Predictor Variables and Public Support for Planning

and Adaptation Policies

Countries	Standard Regression				Stepwise Regression		
	Model		ANOVA			Model	
	R	Adj. R^2	F	Sig.	Strongest Variable	R	R^2
USA	.804	.637	67.461	.000	trust environm. org.	.695	.482
ESP	.677	.442	26.953	.000	UN resp.	.467	.217
UK	.677	.441	26.508	.000	trust environ. org.	.519	.269
NET	.649	.404	24.433	.000	trust environ. org	.505	.255
CAN	.625	.362	13.696	.000	EPA resp.	.433	.186
GER	.610	.352	18.911	.000	personal resp.	.431	.185
JP	.600	.340	18.052	.000	loc. govern. resp.	.420	.175
MEX	.506	.232	10.996	.000	personal resp.	.317	.099

As displayed in Table 37 the independent variables combined seem to have the strongest effect among the public in the United States (R=.804 & Adj. R^2=.637),followed by Spain (R=.677 & Adj. R^2=.441),United Kingdom (R=.677 & Adj. R^2=.441), Netherlands (R=.649 & Adj. R^2=.404), Canada (R=.625 & Adj. R^2=.362), Germany (R=.610 & R^2=.352), Japan (R=.600 & Adj. R^2=.340), and Mexico(R=.506 & R^2=.232). Thus, between 23.2 percent (Mexico) and 63.7 percent (United States) of the variation in the public's overall support for planning and adaptation strategies can be explained by the public's level of knowledge, level of trust towards GCC information as well as potential sources, and perceived levels of responsibilities of different groups for engaging in mitegative actions.

Table 38

Relationship between Perceived Levels of Knowledge, Trust, as well as Responsibility

and the Public's Willingness to Pay More for Climate Abatement in General

| Countries | Standard Regression | | | |
| | Model | | ANOVA | |
	R	Adj.R^2	F	Sig.
United States	.507	.232	12.777	.000
Canada	.499	.214	7.111	.000
United Kingdom	.488	.214	9.795	.000
Netherlands	.476	.204	9.865	.000
Japan	.400	.134	6.111	.000
Germany	.394	.128	5.851	.000
Spain	.367	.107	4.950	.000
Brazil	.302	.062	3.111	.000
Mexico	.266	.042	2.444	.000

Willingness to pay more for GCC abatement. The standard regression analyses

between the predictor variables and the overall index of the public's willingness to pay

more for climate change abatement did only show a large relationship for the data col-

lected form United States with R=.507 and Adj. R2=.232. As shown in Table 38 the re-

gressions only confirmed, at best, a medium relationship with R>.3 between the predictor

and the outcome variables for Canada, United Kingdom, Netherlands, Japan, Germany,

Spain, and Brazil. In the case of the United States the independent variables can account

for 23.2 percent of the variation in the public's willingness to pay more for climate strate-

gies in general. Furthermore the different regression analyses also show that the per-

ceived trustworthiness of the scientific GCC data is the most influential independent vari-

able for the United States. With the exception of the United States the independent varia-

bles presenting the public's level of knowledge, level of trust towards sources of infor-

mation, and perceived levels of responsibilities of different groups for reducing the main causes of GCC do not largely influence the public's willingness to pay more for GCC mitigation or adaptation policies.

Willingness to change behavior. Another strong relationship was established between the predictor variables and the overall index for the public's willingness to change their behavior to reduce the causes and impacts of GCC. As already discussed in chapter 5, the outcome or dependent variable is based on the responses to six single survey questions which asked the participants for their level of willingness to change their behavior in such areas as to use public transit for most of their travel, install solar panels on their home, buy mainly locally produced goods, use mainly recycled paper, purchase only energy saving appliances, and insulate their home or apartment. The global frequency distribution of this index suggests that close to 80 percent of all survey participants are in principle willing to strongly willing to change their behavior and thus live a more sustainable lifestyle**.**

The standard regression analysis indicates a strong relationship of R>0.5 among the participants from the United States (R=.619 & Adj. R^2=.366), Spain (R=.581 & Adj. R^2=.317), United Kingdom (R=.577 & Adj. R^2=.311), Germany (R=.572 & Adj. R^2=.306), Canada (R=.536 & Adj. R^2=.254), Netherlands (R=.506 & Adj. R^2= .234), and Japan (R=.501 & Adj. R^2=.228). Thus, among these seven countries with R>0.5, between 22.8 percent (Japan) and 36.6 percent (United States) of the variation in the public's willingness to change their behavior can be explained by the independent variables.

Table 39

Strong Relationships between the Predictor Variables and Overall Willingness to Commit

to Behavioral Changes

Countries	Standard Regression				Stepwise Regression		
	Model		ANOVA		Strongest Variable	Model	
	R	Adj. R^2	F	Sig.		R	R^2
USA	.619	.366	22.871	.000	personal resp.	.491	.240
ESP	.581	.317	16.200	.000	community resp.	.380	.143
UK	.577	.311	15.611	.000	personal resp.	.434	.188
GER	.572	.306	15.529	.000	personal resp.	.368	.135
CAN	.536	.254	8.635	.000	trust scientists	.333	.109
NET	.506	.234	11.570	.000	personal resp.	.367	.134
JP	.501	.228	10.778	.000	corporate resp.	.349	.120

As shown in Table 39, the stepwise regressions shows level of perceived personal responsibility has the strongest relationship with the dependent variable in the cases of the United States, United Kingdom, Germany, and the Netherlands. For Spain the data suggests the perceived level of community responsibility and for Japan corporate responsibility as the independent variables with the strongest impact on the public's overall willingness to commit to behavioral changes. In the case of Canada, however, the level of trust towards scientists as sources of information is the most influential singe independent variable. The regression analyses for the remaining two countries Brazil, and Mexico showed an R score of less than 0.5 indicating no large effect between the twenty-five independent variables and the public's willingness to change their behavior. However, the regressions show an R score of R>.3 indicating at the least a medium relationship.

The ensuing regression analyses between the independent variables and the single survey questions comprising the overall index show strong relationships for some of the individual survey questions and countries. Altogether the index was created based on the

responses to six single survey questions which asked the participants for their level of willingness to change their behavior in such areas as to use public transit for most of their travel, install solar panels on their home, buy mainly locally produced goods, use mainly recycled paper, purchase only energy saving appliances, and insulate their home or apartment. The regression analysis show strong relationships between the independent variables and the willingness to install solar panels on their home, use mainly locally produced goods, and to purchase only energy saving appliances.

Table 40 summarizes the significant result and displays the countries for which the regression analysis established a strong relationship between the independent variables and the particular survey questions function as dependent variables. As the table shows the regression analysis only established strong relationships between the independent variables and three out of the six individual survey questions. In case of the United States, the data shows a strong relationships between the predictor variables and all three individual survey questions with R scores ranging from R=.522 (willingness to install solar panels on home) to R=.581 (willingness to use mainly locally produced goods). Data from Spain confirms a strong relationships between the independent variables capturing the public's level of knowledge, level of trust towards GCC information as well as potential sources, and perceived levels of responsibilities of different groups for engaging in mitegative actions and the two answers provided to the two survey questions assessing the public's willingness to use mainly locally produced goods (R=.547 & Adj. R^2=.277) as well as to purchase only energy saving appliances (R=.516 & Adj. R^2=.244).

Table 40

Strong Relationships between the Predictor Variables and Specific Behavioral Survey Questions

		'Willingness to install solar panels on home'					
	Standard Regression				Stepwise Regression		
Countries	Model		ANOVA		Strongest Variable	Model	
	R	Adj. R^2	F	Sig.		R	R^2
USA	.522	.252	13.766	.000	personal resp.	.393	.153

		'Willingness to use mainly locally produced goods'					
	Standard Regression				Stepwise Regression		
Countries	Model		ANOVA		Strongest Variable	Model	
	R	Adj. R^2	F	Sig.		R	R^2
USA	.581	.320	18.783	.000	trust scientists	.441	.194
ESP	.547	.277	13.573	.000	trust scientists	.349	.121
CAN	.511	.227	7.582	.000	trust scientists	.327	.105

		'Willingness to purchase only energy saving appliances'					
	Standard Regression				Stepwise Regression		
Countries	Model		ANOVA		Strongest Variable	Model	
	R	Adj. R^2	F	Sig.		R	R^2
USA	.560	.295	16.804	.000	state govern. resp.	.425	.179
GER	.553	.284	14.088	.000	trust scientists	.352	.123
UK	.522	.249	11.709	.000	personal resp.	.366	.133
ESP	.516	.244	11.569	.000	trust scientists	.340	.114

For Germany and the United Kingdom, the regressions only identified a strong relationship between the independent variables and the survey question addressing the public's willingness to purchase only energy saving appliances. In particular, the analysis shows a relationship for Germany with R=.553 and for the United Kingdom with R=.522. Canada's data confirmed a relationship between the predictor variables and the answers provide to the survey question focusing on the public's willingness to use mainly locally produced goods with R=.511.

Overall, the calculated R^2 scores suggest that the independent variables can account between 22.7 percent and 32 percent of the variation of the answers provided to the three survey questions. Moreover, the stepwise regressions identify the level of trust in scientists as source of GCC information as the independent variable having most often the strongest impact on the dependent variables, followed by perceived personal responsibility to reduce GCC and perceived responsibility for the state government to engage in mitegative actions.

Summary

Several relationships between survey based independent and dependent variables were explored in this chapter. Furthermore the following two research questions were directly addressed using frequency distributions, standard as well as stepwise regressions as analytical tools.

- *How do the public perceptions regarding climate change and attitudes toward mitigation and adaptation strategies vary by socio-economic factors?*

- *What role do level of knowledge and perceptions of trust and responsibility play in the public's level of support towards adaptation and mitigation policies?*

The data show that characteristics such as age gender, household income, or education are do not influence someone's attitude or risk perception significantly towards GCC in any of the nine countries surveyed. Nevertheless, approximately one-third or more of the surveyed population believes that GCC poses a high risk for causing numerous negative environmental impacts. Furthermore, the data suggest that most people in the surveys are generally willing to support GCC mitigation through behavioral changes.

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Regressions demonstrate a strong relationship between the independent trust variables and the public's level of concern over GCC. Roughly one third of the variation in the public's level of concern can be explained by their level of trust towards GCC science and different sources of information. However, the regressions failed to show a strong relationship, on the global scale, between risk and threat perceptions on the public's trust in the federal government as source of GCC information and as risk manager. On the international scale the data only show a strong relationship for the United States between the two risk and threat indexes and the public's trust in the government as risk manger

Such factors as knowledge, trust, and responsibility show several strong relationships with GCC policy support for the nine countries. Strong relationship are seen between the independent variables and the public's support for mitigation and adaptation policies as well as their willingness to commit to behavioral change for seven out of the nine countries with Mexico and Brazil being the exception.

The ensuing regression analyses between the independent variables and the single survey questions comprising the overall index for the public's willingness to change their behavior show strong relationships for some of the individual survey questions and countries. The regression analysis showed only strong relationships related to the willingness to install solar panels on their home, use mainly locally produced goods, and to purchase only energy saving appliances. Moreover, with the exception of the United States the independent variables do not largely influence the public's willingness to pay more for GCC mitigation or adaptation policies.

The stepwise regressions did not identify any one single independent variable as the strongest for all seven countries. Instead the independent variable with the strongest

impact on the dependent variable varies by country. However the variables presenting the perceived level of personal responsibility to reduce GCC and level of trust towards environmental organizations as a source of information seem to be the most influential.

Chapter 7

DISCUSSION AND CONCLUSIONS

The following presents a discussion of the research results that places the insights gained from the dissertation into the context of existing literature developed in the early chapters as well as with the underlying theories, hypothesis, and research questions of this study. The final part of this chapter address the meaning and implication of the knowledge gained for future communication efforts, emphasize country-specific differences in the findings, and points to future research questions.

Public Perceptions of Global Climate Change

The public is concerned about GCC, but considers it a low priority. The data show that on the global level, represented by the nine countries as a whole, the majority of the public expressed concern about GCC causing potential adverse impacts. In total, over 80 percent of the participants stated at least some concern regarding the possible impacts of GCC and close to 32 percent indicated high levels of concern.

This leads to the question, why are people concerned about GCC? Very strong levels of agreement were observed regarding the rationale that at some point GCC will not be able to be reversed anymore. In total, more than three-quarters of the participants agreed or strongly agreed with that sentiment. In addition, almost two-thirds of the public seemed to be concerned due to the lack of political will to do something about it, and close to 50 percent are concerned because of the potential impacts f future generations (intergenerational equity).

However, the literature, especially for the United States, shows that GCC is considered a low priority in terms of political saliency. Studies show that the American pub-

lic regards both the environment and climate change as relatively low national priorities (Dunlap & Scarcce, 1991; Bord et al., 1998; Leiserowitz et al., 2005, 2010, Ockwell et al, 2009). The data collected in this study support the existing body of knowledge on the global scale and for different countries in regards to GCC as a low saliency issue. We found that on the global scale, GCC ranks last among societal issues that government needs to deal with. For the nine countries individually, GCC consistently ranks in the bottom third compared to higher priority issues such as increasing employment or improving education.

The low priority awarded to GCC on the global scale is reinforced by its perceived level of risk compared to other negative environmental impacts that can occur in society. Out of seven adverse environmental impacts such as worsening of urban air pollution, increasing frequency of droughts, or deterioration of the ozone layer, global climate change ranks 5th in terms of the public's perceived level of risk occurring over the next 20 years. Despite these comparatively low perceived risk levels, the public still wants the government to engage in efforts to reduce GCC and tends to be concerned about the lack of political will to do so.

Little difference between public risk perceptions of various adverse negative GCC impacts. Another aspect important for understanding the public's stand on GCC issue involves risk perceptions regarding GCC's negative impacts. On the global scale the data does not show much variation in perceptions of different types of potential negative effects over the next 50 years. The survey participants were asked to rate the risk of GCC causing different harmful impacts. Respondents were given thirteen consequences of GCC and were asked to evaluate their level of risk on a five-point Likert-scale. At least

two-thirds of the surveyed populations believe that there are high or very high risks for GCC causing any of thirteen harmful effects identified in the survey instrument. Nevertheless, responses in the 'very high' risk category show that the public is most concerned about GCC causing 'droughts and water shortage', 'more frequent and serious floods', 'forest fires,' and 'severe heat waves.' On the other hand, only a small percentage of the public seems to believe that there is 'no or little' risk of global climate change increasing the frequency or severity of environmental hazards in general.

Results indicate high levels of public uncertainty. As pointed out in the literature (Renn & Levine, 1991; Kasperson et al, 1992; Nye, 1997), the public is more likely to support GCC policies if they trust the science behind it and the source of information. The data show that scientists are the most trusted source for GCC information, followed by television weather reports, family and friends, and environmental organizations. However past studies in the Unites States also suggest that public GCC perceptions are influenced by various uncertainties which are critical in our understanding of GCC perceptions (Seacrest et al., 2000; Leiserowitz, 2005; Smith, 2005; Moser 2006; Kempton, 1991; Lorenzoni et al, 2005). This study identified several contradictions and hesitations among the surveyed population that indicate major uncertainties not only among the public in the United States, but also in other countries.

Although scientists are highly trusted and the most trusted source in all nine countries, the results also indicate that there is a large number of people who doubt the validity and sufficiency of the existing body of knowledge. The uncertainty is further emphasized by the high percentage of survey respondents who indicated that they are undecided on whether or not to trust any of the listed sources of GCC information in the survey instru-

ment. Especially, in regards to teachers, 40 percent of all participants chose the answer category 'undecided' followed by corporations (36 percent), family and friends (33.1 percent), and the mainstream news media (30.5 percent). In addition, the public perceives GCC as an issue that has to be solved to a large degree by the government and other institution, but also ranks governmental organizations among the least trusted sources of GCC information. In terms of the public's level of support for adaptation and mitigation strategies, data show strong public support for efforts to reduce the causes and impacts of GCC. However, similar to the public's level of trust toward sources of GCC information, between a quarter and one-third of the people indicated that they are undecided to whether or not to support any GCC strategy. With GCC being still a controversial topic in the political arena and among some groups of the population, the people who are undecided today could make the difference in the future success of various GCC policies.

Public supports GCC policies in principle, but is less supportive of policies that directly affect them. Past studies in the United States show that the public largely supports policy action in general the national and international scale, but resists tax policies that directly affect it (Rosenstone et al., 1997; O'Connor, 1999; Moser, 2006; Leiserowitz et al., 2010). This study supports these findings on a global scale and for different countries. The results from the survey show ambiguity between the non-binding relatively strong support for adaptation and mitigation policies in general and the public's support for specific policies, willingness to pay more money for climate change abatement, and willingness to engage in behavioral changes to reduce GCC. The data show that less than a quarter of the total sample supports tax hikes as economic incentives to reduce the

use of electricity or the use of automobiles. No more than one-third of the public supports tax hikes among any of the nine countries for mitigative policies.

Moreover, compared to past studies this research shows that the public not only refuses tax hikes but also hesitates to support any policies that require an initial investment on their part or changes to their daily routine or consumer practices. The analysis shows that the public strongly supports higher investments in public transit systems or transit oriented developments, but more than one-third of the surveyed population also stated that they are not willing, or only slightly willing to change their travel behavior and use public transit systems more often. The hesitation is also supported by the fact that a relatively large number of survey participants stated that they are undecided in terms of their willingness to install solar panels or insulate their home which would save money in the long-run but require initial upfront capital investment.

GCC is perceived as a general threat & not as a personal threat. the literature (Leiserowitz, 2005; Ockwell et al, 2009), especially based on studies from the United States, argues that the low political saliency of GCC reflects a widespread public perception that the issue is removed in time and space. The data show that people recognize GCC as a high threat in general but not necessarily for themselves. Instead, high levels of threat are perceived predominantly for plants, animals, and people in other countries, which are rarely seen as personal threats. Thus, the percentage of people characterizing GCC as a high threat for people in their respective countries, to their family, and to themselves is significantly lower in all nine countries compared to the amount of people perceiving GCC as a high threat for people in other countries. When asked how long it will take until dangerous impacts of GCC will be experienced 'somewhere on earth' or 'in their

region', the majority of the total study sample does believe that impacts are already occurring somewhere on earth, *but not in their own region*. As a result, this study not only confirms the argument that among the public in the United Stated GCC is not perceived as pressing or as a personal threat, but also shows similar perceptions among the populations in the other eight countries.

Perceptual Factors & Public Support for GGC Mitigation and Adaptation Policies

The impact of socio-economic variables. In order to identify potential factors that impact public's risk perception and policy support, one of the research objectives of this study was to see how socio-economic characteristics impact the public's perceptions towards GCC. Therefore, regressions were used to test the following hypothesis: "The general attitude and public risk perceptions of GCC can be largely explained by socio-economic variables". However, the regression analyses do not show any strong relationships between socio-economic characteristics and GCC perceptions in any of the nine countries. Thus, the data collected does not confirm the hypothesis and shows that characteristics such as age, gender, household income, or education are not strong predictors for some-one's attitude or risk perceptions towards GCC. This is also seen in numerous studies in hazard research using social science methodology.

Perception factors impact public support for GCC policies & willingness to commit to behavioral changes. Based on the third underlying hypothesis of this study, - the public's position towards climate change is the main reason for 1) low policy support, 2) willingness to pay for GCC policies, and 3) willingness to change their behavior as related to mitigation and adaptation- the impact of different perceptual factors on public

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policy support were tested through regressions. The first group of perceptual factors consisted of various risk perceptions of GCC and the second group included factors of trust, responsibility, and knowledge related to GCC.

On the global scale, the data confirms a strong and significant relationship between perception factors and the public's level of support for GCC mitigation and adaptation policies. The regressions also show significant relationships between the perception factors and support for specific policies such as energy efficiency strategies and urban planning strategies. In contrast, the regressions do not show any strong links between GCC perceptions and the public's willingness to pay more for GCC reduction among any of the nine countries. Thus, even high perceived risk and threat levels, as in the cases of Mexico, Brazil, or Germany, do not seem to impact the public's level of disposition toward supporting GCC mitigation with more private funds, but support for governmental policies in general. In contrast, in terms of how well the perception factors can predict the public's willingness to change their behavior towards a more sustainable lifestyle, the data established strong relationships.

Perceived level of concern & personal responsibility have strongest impact on policy support & willingness to change behavior. The literature does demonstrate that perceptions have significant impacts on individual and group behavior and needs to be considered when developing global climate change policies and strategies (Slovic, 2000). Furthermore, in order to design, implement, and generate sufficient public support for policies and planning interventions at the national and international level, it is necessary to have a solid understanding of GCC perceptions (Read, 1994; Bord et al., 1998; Moser, 2006, Moench, 2007).

Overall, the findings from regressions indicate that the predictor variables - trust, responsibility, and knowledge- have stronger impact on the public's support for GCC policies compared to the different independent risk perception variables - concern, attitude, and threat-. However, to determine which perceptual factors within the two groups has the strongest impact on public behavior and policy support related to GGC additional stepwise regressions were conducted. In stepwise regressions the predictor variables are entered into the model based on their statistical contribution in explaining the variance in the dependent variable. Each time a predictor is added to the equation, a removal test is made of the least useful predictor, thus identifying the single independent variable that has the strongest relationship to the dependent variable. Among the different GCC risk perceptions captured by the survey instrument the stepwise regressions identified the 'level of concern' over the impacts of GCC as the strongest of the independent or predictor variables for all countries. Varying by country, other perception factors with a strong impact on policy support are the perceived level of personal responsibility to reduce GCC and level of trust towards environmental organizations as a source of information.

Trust factors impact the general concern over GCC. As shown in chapter 5, the public's level of concern over GCC impacts has the strongest effect on the level of support for mitigation and adaptation policies among all tested GCC risk perceptions. Typically, the more the public distrusts risk management and communicators information the more concern they have about adverse impacts and potential threats for their own wellbeing (Slovic et al, 1991). However, much of this research was not conducted for hazards with such high levels of uncertainties as GCC. This led to the question of the role of trust factors impacting public concern in the context of GCC.

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Regression results reveal that, on the global scale, approximately one-third of the variation in the public's level of concern can be explained by their level of trust toward climate change science and sources of information on GCC. Furthermore, the results show that the relationships between level of trust for the science and in different sources of information are not always positively correlated with level of concern. For example, the data indicate that the more people consider the GCC scientific data as trustworthy or trust environmental organizations, the more they are concerned about GCC. This is due to the fact that the scientific data and environmental organizations show major adverse or catastrophic impacts. In turn, the more the public trusts the information from corporations or governmental organizations, the less concerned they are about GCC. Although past studies often focused on technological risks, such as nuclear power (Bord & O'Connor, 1990; Slovic et al., 1991; Mushkatel & Pijawka, 1992), this study confirms similar relations for GCC trust and concern relationships.

Differences & Similarities between the Nine Countries

Currently international studies on public risk perceptions are limited. Thus, very little is known about international perceptions on GCC threats and the perceptions that influence support for mitigation and adaptation policies (Leiserowitz, 2010, Schneider et al. 2010). Nevertheless, the existing literature does point out that perceptions are socially constructed and can vary by culture, human development, affluence, national experience with risks, and demographics (Slovic, 2001) Thus, we should expect widespread national differences

Differences in GCC perceptions. Given that risk perceptions are culturally divided, a key hypothesis was that public perceptions of GCC in terms of threat and risk, saliency of the issue, trust in GCC information, and support for public mitigation strategies vary among countries. Approximately 90 percent of the populations of Mexico and Brazil seem to be concerned about GCC, perceive it as a high risk, and want their governments to take stronger action against the impacts and causes of GCC. In contrast, the Netherlands, United Kingdom, and the Unites States always place among the countries with the lowest amount of concern for GCC impacts, threats, and risks. In these three countries only about 45 to 50 percent of the survey participant are concerned or highly concerned about the possible impacts of GCC. Furthermore, the populations of Mexico, Brazil, and Canada seem to be most willing to adjust their behavior to reduce GCC impacts. Still, the large number of people in all countries who indicated willingness to change behavior is very compelling.

In the United States and the Netherlands over 24 percent of the people seem not at all willing to use public transit for most of their travel. This is significantly higher compared to the other seven surveyed countries. Japan, on the other hand, is last in terms of the willingness to purchase only energy saving appliances, install solar panels, or insulate their home or apartment. Together with Germany, Japan is also among the countries most skeptical regarding the sufficiency and trustworthiness of the scientific GCC data and the expert knowledge. Whereas, in the United States with over 10 percent, almost twice as many compared to any other of the nine countries do not believe in the reality of GCC.
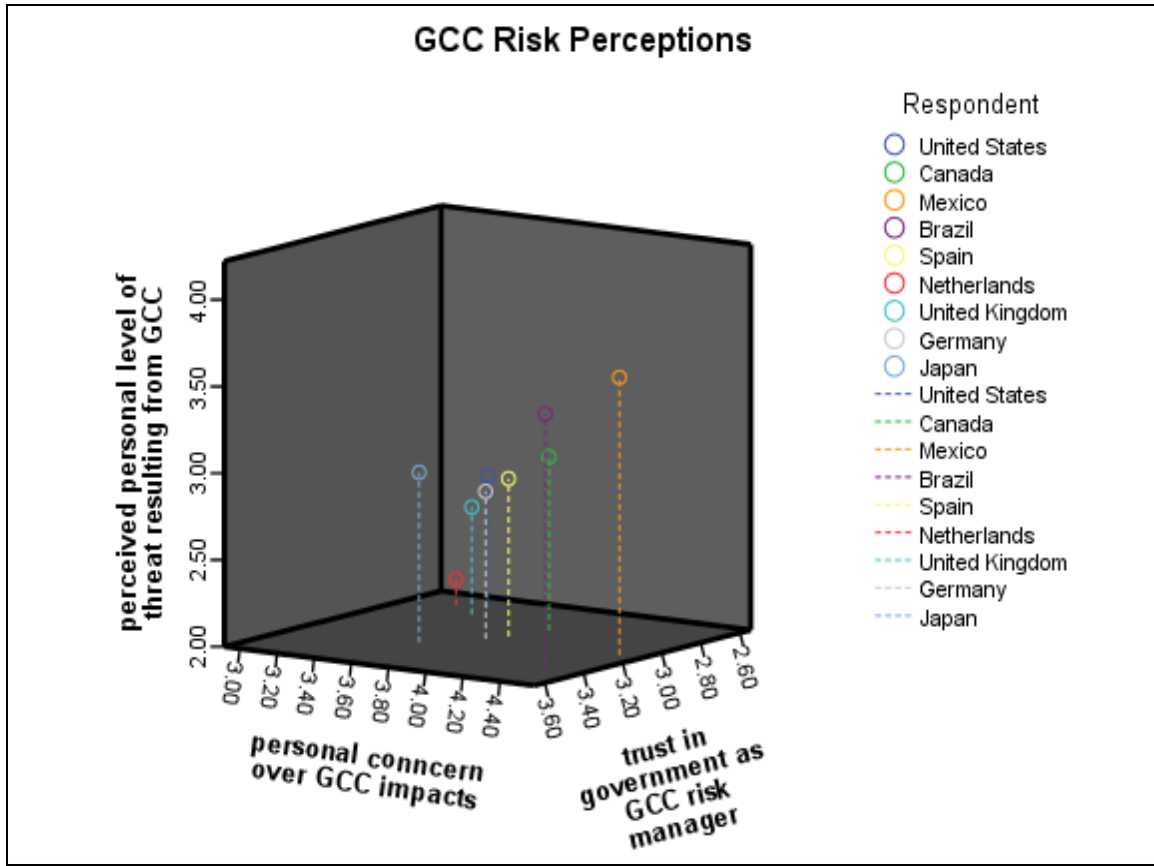
Figure 4. 3D Scatter Plot of public GCC Risk Perceptions among the Nine Surveyed Countries   Own Illustration

Despite these differences in GCC perceptions the analysis also shows that some countries' perceptions are quite similar and the differences are only marginal. For example, Figure 5 shows a country's position with respect to the three principle perception factors - perceived personal level of threat, level of concern, and level of trust in the government's capability as risk manager in regards to GCC-. As illustrated by the scales of the X, Y, and Z axis the country differences among the mean scores of all three factors are small. Nevertheless, the differences are sufficient to cluster the countries into factor space. The data suggest that the United States, Germany, Japan, Spain, and the United Kingdom have more in common in terms of these critical risk perceptions than the differences. A second group consists of Mexico, Brazil and Canada which perceive the person-

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al threat from GCC higher than any other countries. The Netherlands does not belong to any grouping. Although the Netherlands is very similar to the first group of countries in terms of personal concern and trust in government, the perceived level of personal threat from GCC is significantly lower compared to any other country. The low level of perceived personal threat among the Dutch public can be explained by the fact that the country is already strongly engaged in adaptation measurements such as levies and flood gates due to its geographical circumstances. Most of the country is below sea level and the public is used to living with the constant threat of floods and the resulting negative impacts.

The country groupings are different when based on the public's perceived level of personal responsibility, knowledge, and overall trust towards GCC information sources. This can be viewed as the 'trust factor'. As illustrated in Figure 6 the countries can be divided into four groups. Brazil and Mexico have the highest mean scores for all three factors and thus can be clustered. The second group consists of Spain, United States, Japan, and Canada, which are very close together in terms of perceived level of knowledge as well as personal responsibility to reduce GCC and only vary slightly regarding the general level of trust towards different sources of GCC information. The United Kingdom and Germany can be grouped together based on their sense of personal responsibility and general GCC knowledge. In addition the difference in the mean scores for overall trust in GCC information is only 0.11 between the two countries. Again, the Netherlands is the outlier with a low perceived personal responsibility to reduce GCC compared to the eight other countries.
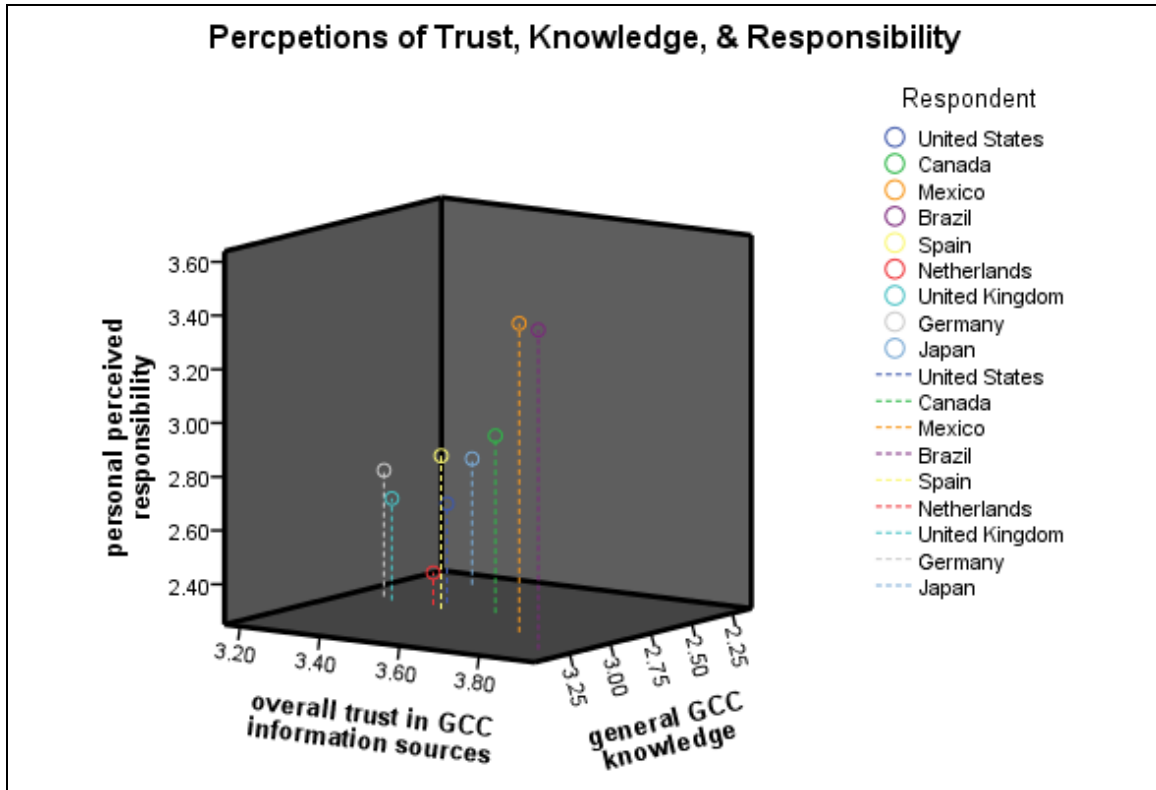
Figure 5. 3D Scatter Plot of Public Perceptions of Factors of Trust, Knowledge, and Responsibility   Own Illustration

With respect to level of support for adaptation and mitigation policies and the willingness to commit to behavioral changes Figure 7 shows the positioning of the nine countries. Again, Mexico and Brazil are the most supportive of GCC policies in general as well as most willing to change behavior to reduce the causes of GCC. Data from Germany, Canada, Spain, and Japan show strong similarities regarding support for mitigation policies as well as willingness to change behavior and only very slight differences in support for mitigation. The United Kingdom and the Netherlands are very close in terms of behavior and among the least supportive countries in terms of support for adaptation policies. The outlier is the United States for which the public is the least supportive of mitigation and adaptation policies.
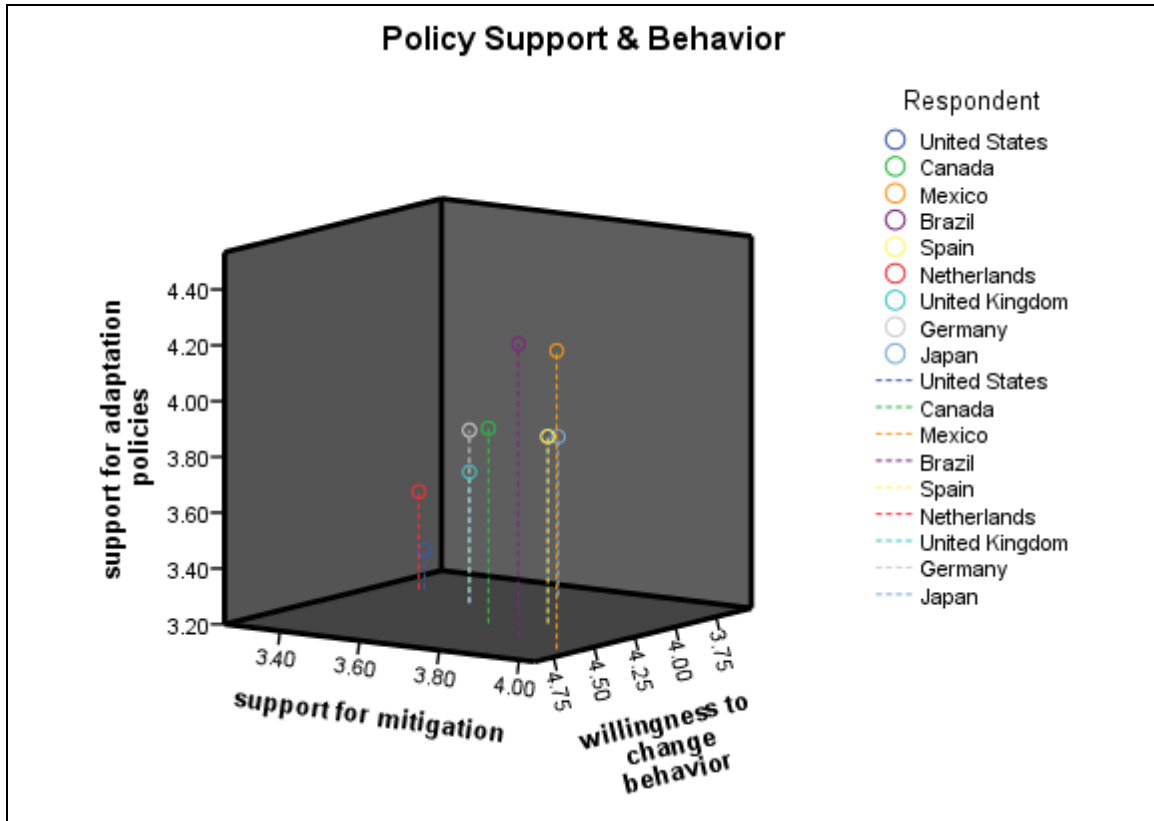
Figure 6. 3D Scatter Plot of Public GCC Policy Support and Willingness to Change Behavior   Own Illustration

Differences in the relationships between perception factors & GCC policy support. Most countries in this study show strong relationships between GCC risk perceptions and mitigation and adaptation policy support. In terms of more specific policies grouped by themes, such as: energy efficiency policies, economic incentives, and planning and adaptation strategies, the country-specific regression results were mixed. That is, the strengths of the relationships between the different perception factors and levels of support for different GCC strategies are not identical among the countries. The data suggest that the relationships are the strongest among the participants from the United States, followed by the United Kingdom, Spain, Netherlands, Germany, Canada, and Japan. In the cases of Brazil and Mexico, neither attitude, levels of concern nor factors of trust, re-

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sponsibility, and knowledge seem to explain any variability in the public's support for or opposition to mitigation and adaptation policies. This is not necessarily surprising, considering that, compared to the other highly industrialized countries in our survey, the perceived levels of risk or concerns regarding GCC are higher, and more people believe that impacts are already occurring in their country.

In terms of the impact of knowledge, as well as factors of trust and responsibility on the public's support for GCC policies, the regressions show significant relationships among all the nine countries. The results show a strong relationship between the independent variables and the public's general support for mitigation and adaptation policies in seven out of the nine countries, with Mexico and Brazil the exceptions again.

Contributions to the Underlying Theories of this Study

As discussed in the opening chapter of this dissertation the research was based on the psychometric paradigm (Fischhoff et al, 1978, & Slovic et al, 1984). Since past perceptual research focused primarily on technological risks and natural hazards (Burton, et al 1978, Kates, 1982; Short 1984. Slovic, 2001), which are quite different from GCC, we do not know very much about the relationship between the different perception factors in the context of GCC. By testing he role of heuristics, trust, values (or worldviews), and social amplification related to GCC risk perceptions among nine identified countries this research contributes to the fundamental theories of of "bounded rationality" (Simon, 1956 & 1959), and "cultural cognition" of natural phenomenon (Douglas & Wildavsky, 1982) from a global climate change perceptive.

In the context of GCC the data indicate that the public applies invalid heuristics resulting in risk assessments and levels of policy support contrary to the scientific find-

ings and recommendations provided by the scientific community. The study shows that the public underrates the personal risks of GCC, compared to scientists who point out that, even in industrialized countries like the USA, GCC is already occurring and posing dangerous impacts (Pittock, 2009). As discussed earlier, the majority of the public believes that GCC is an issue removed in time and space which will primarily impact future generations in other countries. This shows that the public does not have sufficient information or the cognitive skills necessary to make well informed decisions which would confirm the conclusions by the scientific community. Therefore, this study confirms the concept of heuristics and the argument that if heurists are invalid for the risk faced they can lead to or reinforce existing misconceptions (Kahneman et al., 1982; Makofske & Edelstein, 1988). One important reason for this gap between lay models and expert assessment is the public's skepticism and uncertainty of the existing body of GCC knowledge and the low levels of trust towards key risk communicators such as the media and governmental organizations. Furthermore, the low raking of GCC compared to other societal issues and other environmental impacts further dampens the public's missing sense of urgency to take action against GCC. As a result, effective policies to reduce greenhouse gas emissions such as higher taxes related to energy use and behavioral changes to travel behavior are the least supported strategies by the public.

Another theory investigated is that lay people dealing with uncertainties tend to over- or underestimate the risks and threats (Slovic, 2000). In the case of nuclear power risk perception research shows that the public tends to overrate the risks of radiation exposure leading to large social amplification effects and behavior. This study advances the theory of social amplification by examining whether or not current forms of GGC com-

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munication amplify or attenuate the public's risk perception and by discussing the potential of social amplification for GCC compared to other environmental hazards.

The low political saliency and low ranking of GCC compared to other environmental hazards suggests that communication efforts have not amplified the perceptions of risk and their manageability. Instead, the data and literature suggest current communication of GCC, especially by the mass media, has attenuated the public's perceived urgency of dealing with the issue of GCC. According to the data, the majority of the publics do not believe that the media's attention on the effects of GCC is exaggerated which otherwise could lead to an increased risk perception, nor is the media considered a source for GCC information that can be strongly trusted. All current major communicators such as governmental institutions or scientist are either not trusted by the public or not capable to convey the risks and impacts of GCC in a convincing and easy to understand manner (Sheppard, 2012).

Thus, this research suggests that current forms of GCC communication are not very likely to amplify the public's risk perception. However, this might change when impacts of GCC become more obvious to the public, levels of trust towards communicators increase, and reporting links highly publicized negative events, such as droughts, hurricanes or floods more often to global climate change. Existing research also shows a negative relationship between risk or threat perception and trust factors, suggesting that as perceived risks increases as the level of institutional trust decreases (Slovic et al, 1991). Being important, this led to the question if such relationship between trust factors and public risk perceptions also exist in the context of GCC. Therefore, the theory tested in

the context of GCC is that distrust of the government is strongly linked to the level of risk perceived.

In the context of GCC, the data only show , a moderate relationship at best between the public's GCC threat and risk perceptions and their level of trust towards the government. Nevertheless, the study confirms the relationship between trust in government and level of risk perceived in the context of GCC. Moreover, the analysis shows that the stronger the public believes in GCC risk and threat the more they trust the government's capability as GCC risk manager. This marks a significant different compared to the negative relationships between risk or threat perceptions and trust in government for other risks, such as nuclear power. Therefore the results shows that the uniqueness of the GCC issue with its high uncertainties, mostly invisible causes and slow developing impacts also changes the typical type of relationship between risk and treat perceptions and institutional trust.

Cultural theorists argue that our world-views and our values play an important role in public risk perception and behavior (Douglas, 1966 & 1970; Douglas & Wildavsky, 1982; Douglas et al., 1998). This study provided empirical evidence to suppport the argument that we disagree about GCC because we have different belief systems mediated through culture (Hulme, 2009; Kahan et al., 2011) and thus contributes to the theory of cultural cognition. The previously discussed perceptual differences among the nine surveyed countries suggest cultural differences among the survey participants which in turn impact the perceptual factors and behavior. Furthermore, the data show characteristics of intergeneration equity among a large number of participants. Moreover, variables capturing the concern for family members, as well as perceived personal responsibility

for reducing GCC, are confirmed by stepwise regressions to have a significant impact on policy support. Thus, the collected data further confirms to the theory of cultural cognition by showing that cultural background and personal values play a role in public risk perception and behavior in the context of GCC.

Implications for GCC Communication Programs

Communication efforts can foster a personal connection to GCC, raise the level of concern, and thus increase the level of support for mitigation and adaptation policies as well as the willingness among the public to engage in a more sustainable behavior. This study has identified several aspects that need to be considered in future communication programs. GCC is characterized by high uncertainties, unfamiliar risks, and other characteristics of hazards which make personal connections, responsibility and engagement difficult.

However, the high levels of uncertainty among the public also presents an opportunity to increase policy support and foster behavioral changes in the future through well designed communication programs. A large number of people are uncertain about the danger GCC poses today or for future generations, don't know which source of information to trust, and thus are undecided to whether or not support any GCC strategy. With GCC being still a controversial topic in the political arena and among some groups of the population, the people who are undecided today could very well make the difference in the future success of various GCC policies. The comparatively high amount of pubic uncertainty and indecisiveness shows that the public behavior and perceptions can still be influenced by objective GCC coverage if they establish a personal connection to GCC

impacts and thus increase the level of concern and support for mitigation and adaptation policies.

The study also shows that, perceptual factors of trust and responsibility have a great impact on public behavior and policy support and thus need to be acknowledged in communication efforts. The level of success of risk communication is significantly influenced by the public's trust in the communicator and in the ability of individuals, industries, or institutions responsible for risk management. Trust in organizations whose risk management policies impact communities and the environment is vital in order to reduce complexity and generate social cooperation (Cvetkovich & Loefstedt, 1999). On the one hand perceptions of trust have a strong impact on public concern which in turn influences public support for GCC mitigation and adaptation. On the other hand, the results also show that trust also directly influence public behavior and policy support. With respect to the public's level of trust towards different sources of information, scientists seem to be most trusted among potential communicators in all nine countries, followed by family and friends. Analyses also show that the level of trust specifically in environmental organizations and perceived trustworthiness of GCC science have the strongest impacts on perceived levels of concern.

Nevertheless, the data also show significant barriers to successful communication efforts in form of perceptual contradictions among the public regarding trust, responsibility, and behavior. Over one-third of the participants doubt that the scientific community actually has enough data to fully understand the complexity of the issue. This, in turn, further explains the widespread skepticism regarding the trustworthiness of GCC findings. The most significant barrier is probably the fact that on the one hand the public

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views the government as the party most responsible to reduce GCC, but simultaneously highly distrusts it. Communication efforts need to acknowledge these contradictions, build up trust and motivate the public to be more engaged in reducing GCC by emphasizing the multiple benefits of many policies outside of just reducing GCC. Levels of skepticism among the public towards the reality of GCC as well as the trustworthiness and sufficiency of the scientific findings varies by country. Thus, communicators need to be aware of their audience in order to decide how educational their program needs to be.

Future Research

As outlined by the theoretical framework and the feedback loop in particular, GCC risk perceptions, levels of policy support, and its interrelationships need to be constantly reevaluated in order to improve communication programs and to decrease the gap between the recommendations provided by the scientific community and the actual actions by the public and policy makers.

Therefore, this study should function as a benchmark for different follow-up studies adding more countries to the database as well as enabling longitudinal research for the countries addressed in this dissertation. For example, time and money constraints did not allow surveys in China, Africa, or Australia. In addition, research with larger sample sizes per country and more survey questions are needed to further improve the understanding of the perceptual differences between countries and what variables can explain them. In regard for improving GCC communication programs, future research should also incorporate interviews of public officials directly involved with past or ongoing GCC communication efforts. Moreover, the data for this study was collected just weeks before the Tsunami and the nuclear fallout in Japan. Therefore, a fallow up study in Japan would

allow a pre and post disaster analysis examining how risk perceptions and other perceptual factors have changed after a significant negative event.

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BIOGRAPHICAL SKETCH

Bjoern Hagen received his Masters in urban planning from the Technical University Kaiserslautern, Germany focusing on sustainable urban and transportation planning in low density environments. Bjoern Hagen has worked on projects focusing on sustainable urban and regional development with the Development Agency of Rhineland Palatinate (Entwicklungsagentur Rheinland-Pfalz e.V) and the redesign of the UNESCO World Heritage site Völklingen Ironworks towards a sustainable future. For the past three years, he has conducted research in the areas of climate change mitigation and adaptation, public risk perception, and risk communication. By studying the nature of public perceptions of global climate change in different countries and over time, his research contributes to improving climate change communication efforts to reduce greenhouse gas emissions and to increase the adaptive capacity and resiliency of urban environment.