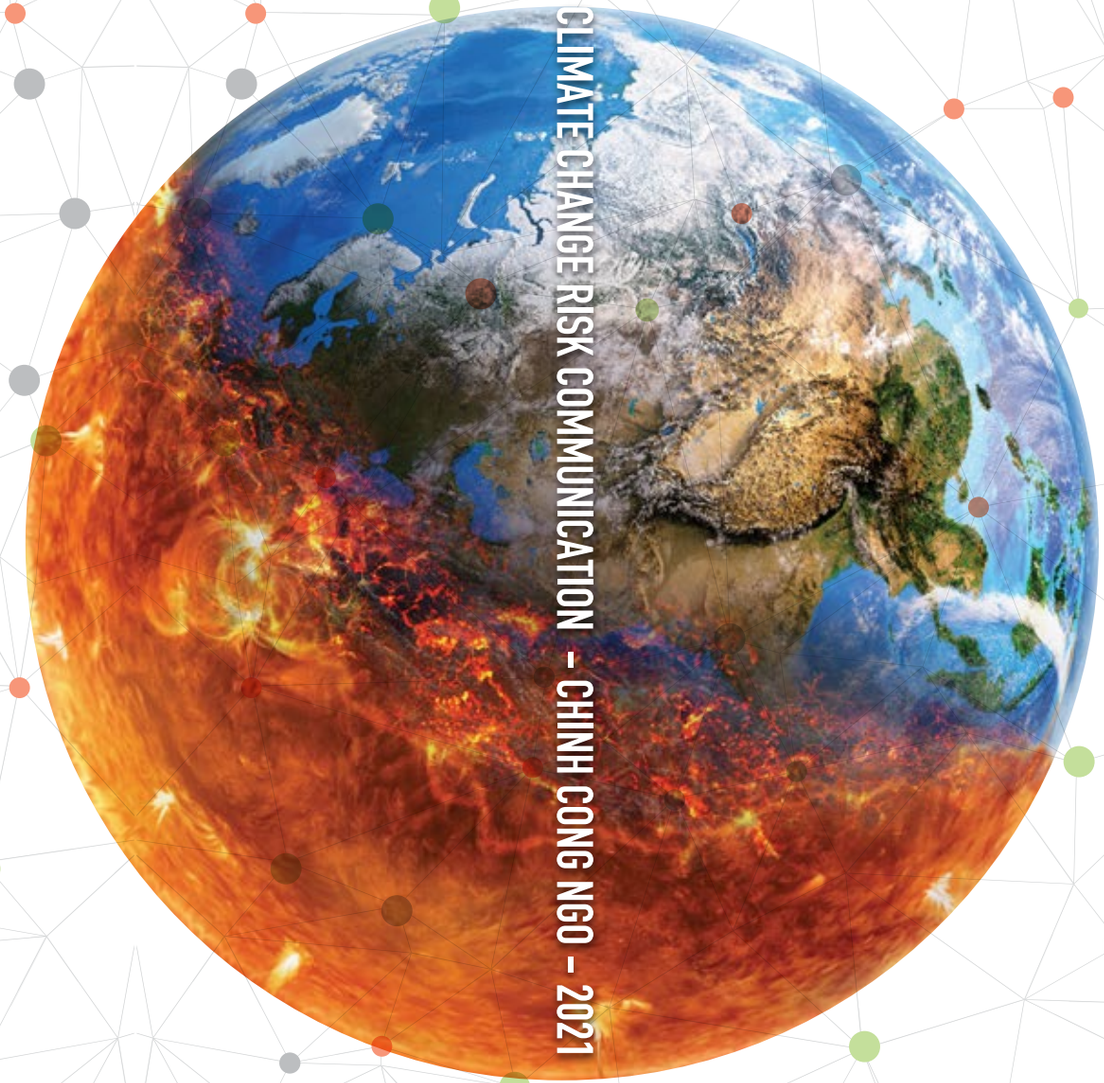

CLIMATE CHANGE RISK COMMUNICATION

HOW MESSAGE FRAMES SHAPE PERCEPTIONS OF RISKS AND EFFICACY, AND INFLUENCE BEHAVIOURAL INTENTIONS TO CLIMATE CHANGE ADAPTATION AND MITIGATION

Chinh Cong Ngo

Propositions

1. Due to the temporal, spatial, social and hypothetical characteristics of climate change, risk communication should be congruently framed to influence behavioural intentions to climate change adaptation and mitigation.

   (this thesis)

2. Understanding the factors that influence risk perceptions has not been practically considered in climate change communication, especially in a developing country like Vietnam.

   (this thesis)

3. For sandwich and external PhD candidates the biggest challenge to complete their degree is to balance work and study.

4. Gender equality is still a neglected issue in Vietnam and in other developing countries.

5. Widespread application of data science will make survey and interview-based methods in social science obsolete in the future.

6. Since the Covid19 pandemic which accelerated the use of online learning environments for children, internet safety must be a higher priority.

7. Even with United States of America rejoining the Paris Agreement, it is highly questionable that the target of "holding the increase in the global temperature to well below 2^{o}C above pre-industrial levels" can be met.

Propositions belonging to the thesis, entitled:

"Climate Change Risk Communication: *How message frames shape perceptions of risks and efficacy, and influence behavioural intentions to climate change adaptation and mitigation*"

Chinh Cong Ngo

Wageningen, 14 December 2021

Climate Change Risk Communication

How message frames shape perceptions of risks and efficacy, and influence behavioural intentions to climate change adaptation and mitigation

Chinh Cong Ngo

Climate Change Risk Communication

How message frames shape perceptions of risks and efficacy, and influence behavioural intentions to climate change adaptation and mitigation

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Thesis

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List of acronyms

CCRPM	climate change risk perception model
CLT	construal level theory
COP	conference of parties
ELT	experiential learning theory
EPPM	extended parallel processing model
FAO	Food and Agriculture Organization
GHG	greenhouse gas
GST	gender schema theory
IPCC	Intergovernmental Panel on Climate Change
MONRE	Ministry of Natural Resources and Environment
NOAA	National Oceanic and Atmospheric Administration
PMT	protection motivation theory
PT	prospect theory
SLR	sea level rise
TPB	theory of planned behaviour
UNFCCC	United Nations Framework Convention on Climate Change
VBN	value-belief-norm theory

Chapter 1: Introduction

"The earth has a rising fever and it will not heal by itself."

Al Gore, Founder and Chairman
The Climate Reality Project

1.1 Introduction

During February to May 2016, millions of inhabitants in the Lower Mekong Region which had been experiencing an unusually long dry season, were longing for rain but it never arrived as it usually does at the time of the traditional water festival. Farmers suffered from water shortages because water sources had dried up or were saline; paddy fields were cracked and abandoned for several months; animals were malnourished and died; fishponds had dried up; fruit gardens were severely water stressed. This was all due to the worst drought in over a hundred years (CGIAR 2016) which started in late 2015 and lasted until mid-2016. The situation was even worse in the Mekong delta and the provinces in the Central Highlands and Southern coastline of Vietnam, in which 52 out of 63 provinces were affected and 18 provinces declared states of emergency. Total economic loss for Vietnam alone was equivalent to at least 671 million US dollars (FAO 2016a; FAO 2016b; CCFSC 2015). Multiple response activities were conducted by both government and international donors to provide emergency and recovery support for affected people. In May 2016, a post-response evaluation was carried out by the World Bank and the Vietnamese government to assess the response impacts and recovery needs (World Bank 2017). The team was shocked at the damage caused by this severe drought to the people and environment, such that experts believed it would take a long time to fully recover. This type of disaster is no longer a rare climate event in Vietnam, as well as in the Greater Mekong region or in other parts of the world.

Most recently, according to the National Oceanic and Atmospheric Administration (NOAA) the month of July 2019 was the hottest month ever recorded globally (NOAA 2019). In many parts of the world from Asia to Europe, from Africa to America, people struggled with the unprecedented heat in that month, as temperatures soared to new heights. NOAA reported that "the average global temperature in July was 1.71 degrees Fahrenheit above the 20th-century average of 60.4 degrees Fahrenheit (or 15.77 degrees Celsius) making it the hottest July in the 140-year record. Moreover, nine out of the ten hottest Julys have occurred since 2005 -- with the last

five years ranking as the five hottest" (NOAA 2019). NOAA also reported that due to the "unusual warmth that shrank Arctic and Antarctic sea ice to historic lows with a record for July 2019 running 19.8% below average – surpassing the previous historic low of July 2012. The average Antarctic sea-ice coverage was 4.3% below the 1981-2010 average, making it the smallest for July in the 41-year record" (NOAA 2019). According to the Intergovernmental Panel on Climate Change's experts, as a consequence of global warming, sea level rise (SLR) is predicted to be more serious in the near future (IPCC 2001; IPCC 2014; IPCC 2018). Furthermore, due to SLR, storms and high tides have amplified coastal flooding and erosion impacts which have been observed recently in many parts of the globe such as the Mexican Gulf and the Pacific countries. In the United States of America alone, under the high climate change scenario (RCP8.5), it is estimated that cumulative damages (in 2015 dollars) will be $3.6 trillion in 2100 if no flood adaptation measures are implemented (USGCRP 2018).

These are just a few examples of climate events and natural disasters worldwide which have been getting more intense and severe, more frequent, and larger in scale (IFRC 2020). In the past decade 2008-2018, total losses caused by natural catastrophes worldwide have tripled, from below 100 billion US dollars in 2008 to more than 300 billion US dollars in 2018 (IIE 2020). What is happening with our planet's climate system and why? Is this just a normal climate pattern changing or is something else unknown happening? The answer can be found in the United Nations Framework Convention on Climate Change (UNFCCC) reports on global warming, climate change and SLR (IPCC 2001; IPCC 2014; IPCC 2018). In recent decades, to communicate about this phenomenon, the media have repeatedly used images of melting icebergs and hungry polar bears. Such images were considered powerful initially, as they highlighted the consequences of global warming to draw public attention. Does such a situation need joint action globally and by everyone? The answer could be simply 'Yes'. But the first thing we must understand are the causes of the phenomenon and how to jointly address its consequences.

Addressing the consequences of global warming has become a pressing need for human society that requires both mitigation and adaptation (IPCC

1995). Climate change adaptation is defined as "the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects" (IPCC 2014). Climate change mitigation is "a human intervention to reduce the sources or enhance the sinks of greenhouses gases" (IPCC 2014). While adaptation deals with the consequences of climate change, mitigation aims to tackle its causes. Both adaptation and mitigation involve joint individual and societal responses. Climate change communication is therefore important to raise awareness, to garner support for collective initiatives and to motivate individual action. Since the IPCC Second Assessment Report in 1995, attention to climate change adaptation is being increased. Adaptation deals with every sector and each individual, and covers a wide range of activities, from policy reform, to livelihood diversification, to behavioural change communication. In Vietnam as well as in many parts of the world, some adaptation initiatives and models have showed initial successes in helping society to adapt to climate change impacts (Shaw 2006; Garschagen 2013; Dang et al. 2014; Gustafson et al. 2018). In conclusion, addressing the causes of global warming and anthropogenic climate change needs joint action and various approaches, from policy advocacy to communication about risk and efficacy. Behavioural changes are vital for responding effectively to climate change, which require collective effort by each individual and the whole of society.

Most recently, the IPCC's Fifth Assessment Report concluded that "it is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century" (IPCC 2014). The main effects of modern global warming that have been recorded by IPCC's scientists include: an increase in global surface temperature, rising sea levels, regional changes in precipitation and more frequent extreme climatic events such as typhoons, heat waves and droughts (IPCC 2014) (see Figure 1.1 and Figure 1.2). Over the past decades, the main drivers of global warming are related to competition for higher gross domestic product per capita (GDP) growth by each country as well as population growth which continuously increases greenhouse gases (GHG) (IPCC 2018). In the

UNFCCC's Conference of the Parties in Paris, France (COP21) in 2015, the world leaders agreed to set a target of keeping global temperature increase to not greater than 2°C in comparison to the pre-industrialized era (UN 2015). This will ensure that the world climate system will not collapse and will keep the earth sustainable at the same time, to ensure food security, human safety, eco-system protection and economic development.

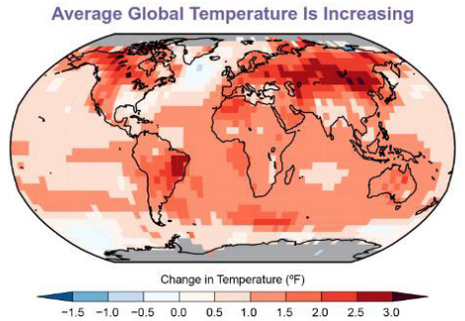


Figure 1.1. Average global temperature is increasing

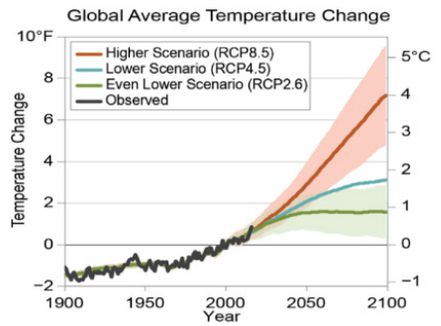


Figure 1.2. Observed and projected changes in global temperature

(Source: Fourth National Climate Assessment, Volume II Impacts, Risks, and Adaptation in the United States, 2018. Reprinted with permission from the U.S. Global Change Research Program)

In the past three decades, IPCC scientists have studied different climate models to project the GHG emission levels and produced a series of Assessment Reports (currently under the Sixth Assessment Cycle to be released in 2021) and a number of Special Reports on global warming and climate change. These technical reports and policy briefs provide scientific evidence about the level of GHG concentrations, global warming and the impacts of climate change including temperature change and SLR scenarios (see Figure 1.3, Figure 1.4). These documents can serve as the foundations for policy makers, researchers, and the public to develop policies and action plans for appropriately mitigating and adapting to climate change consequences. Moreover, these can also be used as policy advocacy and public communication tools for facilitating policy and behavioural changes towards climate change action at local to global levels.

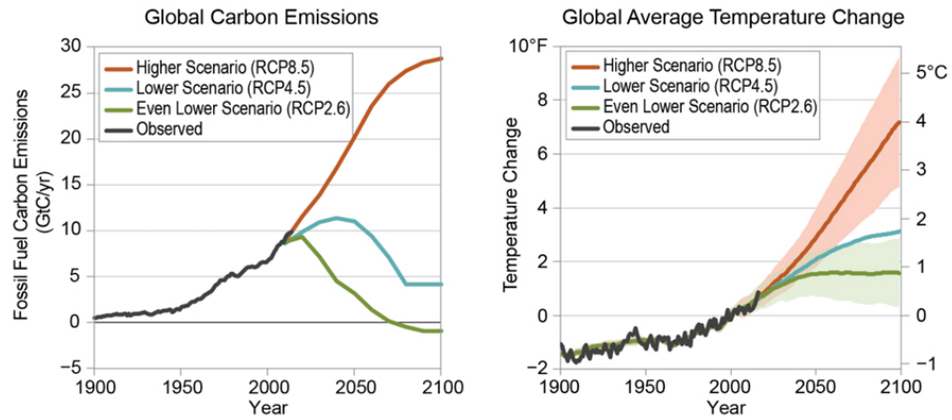


Figure 1.3. Observed and projected changes in carbon emissions and temperature

(Source: Fourth National Climate Assessment, Volume II Impacts, Risks, and Adaptation in the United States, 2018. Reprinted with permission from the U.S. Global Change Research Program)

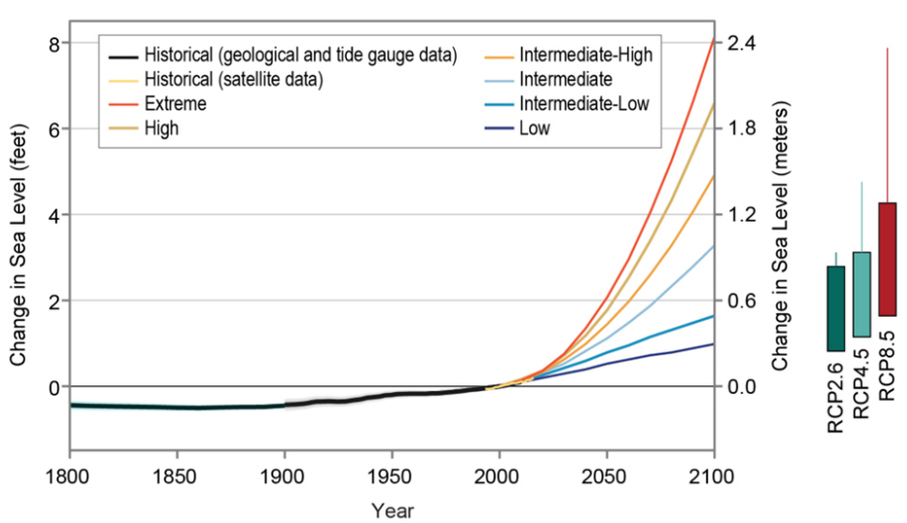


Figure 1.4. Historical and projected global average sea level rise

(Source: Fourth National Climate Assessment, Volume II Impacts, Risks, and Adaptation in the United States, 2018. Reprinted with permission from the U.S. Global Change Research Program)

Inspired by these facts, in this thesis, I address two main topics: 1) Climate risk perceptions; and 2) Climate risk communications. This research focuses on studying perceptions of climate change risks among different stakeholders in order to design risk communication messages through different framing methods; and by analysing how different techniques of communicating climate change risks affect people's perceptions and attitudes towards climate change impacts in Vietnam. By understanding risk perception and analysing the effectiveness of different message framing methods for communicating risks and changing perceptions in the target stakeholder groups, predictors for behaviour change can be developed. Such research is important for developing improved climate change adaptation in Vietnam. Three key aspects will be explored in this study: content and framing of messages; situations; and predictors of behaviour change.

Beyond improving knowledge of risk communication in Vietnam, this thesis also aims to make contributions to the literature of climate risk and communication, in particular the following areas: i) what factors influence people in understanding flood and climate change risks perceptions, efficacy and behavioural intentions to mitigate or adapt; and ii) how message framing influences the risk perception, efficacy and behavioural intentions to adapt or mitigate to flood and climate change risks. In the synthesis chapter, I will also discuss the contributions of this thesis to existing theories around risk perceptions, efficacy, and communication, namely: climate change risk perception model (CCRPM), construal level theory (CLT), extended parallel processing model (EPPM), gender schema theory (GST), theory of planned behaviour (TPB), protection motivation theory (PMT) and prospect theory (PT).

1.2 Problem definition

1.2.1 Climate change risk: A complex concept

Over the past several decades, the concept of risk has been intensively studied within various disciplines such as health, environment, agricultural sciences and engineering. In social science, there are two prevailing risk definitions: (1) risk is a situation or event where something of human value (including humans themselves) is at stake and where the outcome is uncertain; (2) risk is an uncertain consequence of an event or an activity

with respect to something that humans value (Aven and Renn 2009). In this research, I focus on climate-related risk which refers to extreme (negative) natural events such as heavy rainfall, storms, floods, droughts and SLR.

Risk research includes two main fields: risk assessment and risk management (Renn 1998; Renn 2008; IRGC 2017). Risk assessment refers to a scientific process of defining the components of risk in precise, usually quantitative terms (Renn 1998); while risk management refers to the process of reducing the risks to a level deemed tolerable by society and to assure control, monitoring, and public communication. It is commonly agreed that "risk has always been part of human existence and the field of risk research started as early as human beings started to reflect the possibility of their own death and contemplated actions to avoid dangerous situations" (Renn 1998). Understanding how people perceive risks is an important field in risk research to effectively reduce negative consequences at an individual or societal level. Overall, risk perceptions have been theoretically and empirically studied as an important predictor of people's behaviour in coping with natural hazards (Peacock, Brody, and Highfield 2005; Terpstra, Lindell, and Gutteling 2009; Ngo, Poortvliet, and Feindt 2019) and human-caused incidents (Slovic, Fischhoff, and Lichtenstein 1981; Nelkin 1989; Lima, Barnett, and Vala 2005). Various theoretical models have been proposed to understand the determinants of risk perception and risk behaviour (e.g. the psychometric model, the value-belief-norm theory, the theory of planned behaviour, and the protection motivation theory). For example, the psychometric model posits that risk perceptions are mainly influenced by risk characteristics, e.g. knowledgeability, controllability, dread and catastrophic potential (Fischhoff et al. 1978; Slovic, Fischhoff, and Lichtenstein 1982; Fischhoff 1995). It explains why different types of risk are perceived differently rather than why individuals perceive risks differently and focuses on risk characteristics that shape people's risk perceptions and risk assessments (Slimak and Dietz 2006).

Response to climate change requires both mitigation and adaptation (IPCC 1995). Initially, global efforts focused on climate change mitigation that dealt with reducing GHG emissions. Adaptation to climate change has received increasing attention since the IPCC's Fourth Assessment Report (Grothmann

and Patt 2005; IPCC 2007). This includes a wide range of measures from policy making and social-economic development planning to infrastructure improvement, capacity building, education, and communication. Public awareness and understanding of climate change risks are important to secure support for public measures and to encourage and enable spontaneous adaptation by households, community groups and private enterprises (Moser and Dilling 2004; Moser 2016). However, effectively communicating the distant, complex, and uncertain phenomenon of climate change is difficult, in particular when aiming to empower the most vulnerable communities (Lebel et al. 2013). For effective risk communication, understanding the perceptions of target audiences is essential (Rohrmann 1992; Lebel et al. 2013; Chapman, Lickel, and Markowitz 2017; Markowitz and Guckian 2018; Salama and Aboukoura 2018).

Although risk perception is a well-established concept, climate change risk perception has rarely been addressed, especially in developing countries like Vietnam where climate change risks are high and threaten the livelihoods and safety of millions of people. Existing studies have primarily focused on risks in developed countries (e.g. flooding, earthquakes, drought, tornadoes, and hurricanes) (Völker et al. 2011). In Vietnam, residents and local officials in the coastal and delta communities are familiar with seasonality in weather associated with the monsoon and are therefore aware of changes in associated risk (e.g. extreme floods or saline intrusion) – although they might not be able to identify causes (Lebel et al. 2013). Moreover, to date risk assessment seems to have been carried out by technical experts and mostly influenced by politics (Lebel et al. 2013); particularly, there exists a lack of scientific and participatory approaches in risk appraisal, management and communication.

1.2.2 Climate change risk communication: A challenge

In recent decades, climate change communication has gained in theoretical and empirical interest for researchers; however, it still lacks practical evidence to target specific audiences such as policy makers, farmers and adolescents, especially in developing countries (Nerlich, Koteyko, and Brown 2010; Moser 2016; Stevenson et al. 2018; Markowitz and Guckian 2018; Salama

and Aboukoura 2018). In the early stages, climate change communication focused on scientific findings about the global climate and was triggered by extreme weather events or global climate change conferences. The communication was carried out mostly by scientists or environmentalists, with a lack of exchange among those doing the communication work and those who researched the topic, as well as a lack of empirical studies on climate change risk communication (Nerlich, Koteyko, and Brown 2010). Efforts by climate scientists to communicate climate change risks to non-scientific audiences have been largely ineffective (Opitz-Stapleton 2010). The information deficit model (i.e. one way communication) applied in many communication strategies, which simply assumes that the public at risk is lacking knowledge and if provided more or better information will produce more rational responses, is most likely not successful in addressing complicated and highly-uncertain climate-related risks (Irwin 1995; Opitz-Stapleton 2010; Irwin 2014). Despite many studies on communicating climate change and its associated risks in Europe, America, and Australia (Hamilton 2010; Morton et al. 2011; Nerlich, Koteyko, and Brown 2010; Weber 2010; Cook 2016) there are fewer studies into how to effectively communicate climate change risks in the developing world (Völker et al. 2011; Ngo, Poortvliet, and Feindt 2020). Many governments have tried to raise awareness about climate change through top-down and one-way communication campaigns, with limited success (Maibach, Roser-Renouf, and Leiserowitz 2008; Ockwell, Whitmarsh, and O'Neill 2009; Moser 2010). Especially in Vietnam, a number of factors such as a lack of climatologists and prominent meteorologists, media landscape, socio-economic factors, literacy rates, etc. impede the effectiveness of climate change communication (MONRE 2010; Copsey, Nguyen, and Pham 2012; MONRE 2017).

Communicating climate change to the public is a particularly arduous task, but nevertheless, for obvious reasons it is extremely important. Traditionally this topic has been supported mainly by scientists and government officials, however currently it is important to educate almost everyone on the topic, for change surrounding climate change and global warming to be possible and effective. It is widely agreed that communicating climate change risk poses a number of challenges because of its uncertainty, invisible causes,

and distant impacts (Moser 2010). Thus, there is a question of how to effectively communicate a global problem that has less certainty and that does not pose an immediate threat, when compared to problems such as food insecurity, disasters, conflicts, or health epidemics. Should climate change risk communication adopt the same approaches used by other risk communications? Moreover, effective climate change risk communication must address stakeholders' varying perceptions of risk, knowledge about risk reduction and adaptation, levels of motivation, and response capacity (Lebel et al. 2013; Ngo, Poortvliet, and Feindt 2019; Stevenson et al. 2018; Salama and Aboukoura 2018).

There exist several important factors in any risk communication, such as building basic awareness and understanding; selecting the right mode; acknowledging differences in motivation and capacities to act; making sense of experiences; and sharing knowledge (Lebel et al. 2013; Ngo, Poortvliet, and Feindt 2019; Ngo, Poortvliet, and Feindt 2020). Moreover, risk communication aims at understanding risks, acceptance of public policy, adoption of interventions, empowerment, behaviour change and spontaneous adaptation, etc. (Lebel et al. 2013; Chapman, Lickel, and Markowitz 2017; Stevenson et al. 2018; Markowitz and Guckian 2018; Salama and Aboukoura 2018). It is commonly accepted that a risk communication model consists of five components: purpose, target audience, modes, communicator, and messages (especially message framing) (Moser 2010). Specifically, literature in health communications has revealed that message framing affects people's perception of risks and risk taking behaviours (O'Keefe and Jensens 2009). Whereas many disciplines have studied this trend, a literature review showed that the effect of message framing in communicating climate change risks is still limited (Morton et al. 2011; Spence and Pidgeon 2010). Positively framing climate change messages (gains) might make people feel more capable and willing to act in high uncertainty situations; thus, message framing can be considered an important tool for communicating climate change risks (Morton et al. 2011).

Nevertheless, as Sterman (2011) noted, widespread scientifically proven consensus on the detection, attribution and risks of climate change is in

stark contrast to widespread confusion, scepticism, complacency and denial amongst policy makers. Furthermore, social scientists have continued to examine why in communicating climate change to any person, educated on the subject or not, that person would reject scientific fact. Fischhoff (2007) found that when scientific facts conflict with "common sense" (or what is a person's or people's common belief) then people are unlikely to favour or adopt the policies that have been created consistent with scientific fact. Sterman (2011) continues to suggest that political ideology actually has a significant impact and can determine what people believe to be true about the physical world. Therefore, understanding climate change strategies and adaptations to prevent climate change should be examined and created in line with the mental models of complex systems. After the COP21 in 2015 in Paris, France, a media storm was created by none other than the former President of the United States - Donald Trump. Controversially, he tweeted "the concept of global warming was created by the Chinese in order to make US manufacturing non-competitive" ("Climate Change History" n.d.). Unfortunately, influential figures like himself making this kind of comment on a global media platform can prove to influence the minds of those who follow him, and politically support him, as well as those who are not educated enough to know otherwise. In summary, despite the scientific evidence by prominent climate researchers (IPCC), there still exists a hot debate or even controversy about climate change, its causes and consequences. Therefore, it obviously requires more communication, education, and public awareness-raising efforts to change this mindset, including empirical and practical research.

Especially, in Vietnam as a developing country, risk communication efforts currently focus on raising public awareness of natural disasters or environmental protection issues via mass media (MONRE 2010; Copsey, Nguyen, and Pham 2012; MONRE 2017; MONRE 2019). There is a challenge to effectively communicate risks in dealing with disaster responses as well as fostering better urban planning that could reduce risks from the impacts of climate change (Lebel et al. 2013; Stevenson et al. 2018; Markowitz and Guckian 2018; Ngo, Poortvliet, and Feindt 2020). According to the Ministry of Natural Resources and Environment (MONRE), in 2009 only

about five per cent of the Vietnamese population was aware of climate change nationally (MONRE 2010). In addition, the complexity of changes in land and water use combined with dynamic population movements and diverse interests, perceptions, and levels of understanding of water-related hazards in coastal and delta areas already represent a significant challenge for learning about and communicating risks so as to reduce risks associated with disasters. Climate change adds another layer of complexity that requires an even greater consideration of risks. Thus better tools and a thorough understanding of communicating climate change risks as well as sharing knowledge from different sources would provide a shared-learning and decision-making platform for discussing and implementing climate change adaptation in the coastal and delta communities in Vietnam, and could be replicated in the wider region within a similar context.

1.2.3 Climate change context in Vietnam

Vietnam, due to its exposed location and physical characteristics, is one of the most disaster-prone countries in the world. In the period 1990-2010, natural disasters caused economic damage equivalent to 1% of GDP and were responsible for 13,000 deaths (World Bank 2010). Vietnam has been recognized as one of the countries most severely affected by climate change and associated SLR, given the sheer number of people living in coastal and low-lying areas (World Bank 2011). Climate change makes water-related hazards (e.g. typhoons, floods, droughts) more unpredictable and extreme, and thus more dangerous. According to the MONRE's climate change scenarios, temperature is projected to increase in all regions of Vietnam with the highest level of +3.3 to 4^0C in the North and +3.0 to 3.5^0C in the South under the high scenario- RCP8.5 (see Figure 1.5) which will cause serious drought in many provinces. Moreover, SLR is projected to cause serious challenges for low-lying coastal and delta areas of Vietnam (see Figure 1.6) (MONRE 2016). Climate change impacts may be exacerbated by poor urban development decisions that concentrate vulnerable groups in sites that will become increasingly risky. Moreover, climate change will likely result in setbacks to the country's poverty reduction efforts and development growth (MONRE 2016).

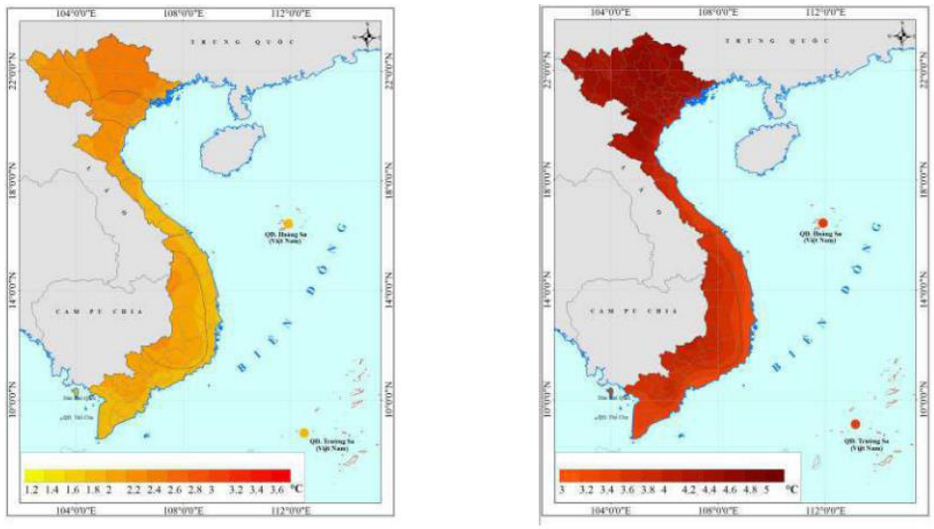


Figure 1.5. Projection of temperature increase in Vietnam under the RCP8.5

(Source: MONRE, Climate Change and Sea Level Rise Scenarios, 2016; High scenarios, the map on the left presents the temperature increase in the middle of the 21st century and the map on right presents the temperature increase at the end of the 21st century)

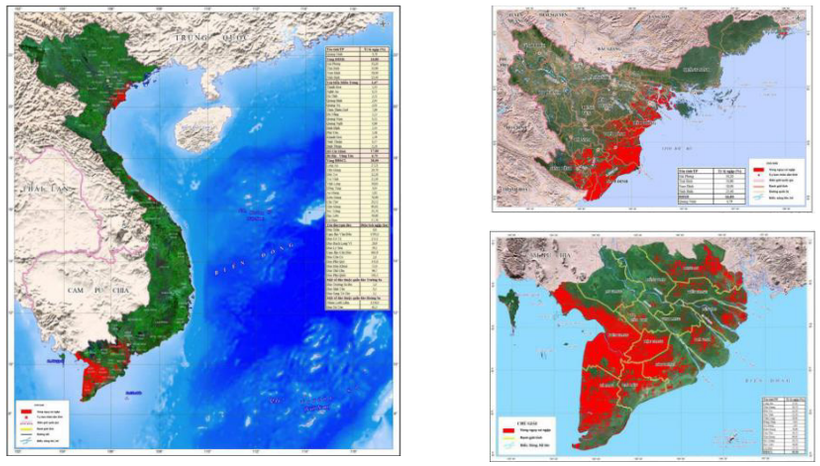


Figure 1.6. Sea level rise scenarios at 100 cm increase and flood projections for Vietnam coastal areas

(Source: MONRE, Climate Change and Sea Level Rise Scenarios, 2016; the map on the left presents the whole coastal provinces of Vietnam; the upper-right map presents the projection for the Red River delta in the North; the lower-right map presents the projection for the Mekong River delta in the South)

1.3 Research objectives

The main objective of this thesis is to understand which factors influence flood and climate change risk perceptions and efficacy towards responding to flood and climate risks among different groups of people living in the coastal and delta communities in Vietnam; and through different experimental studies, the thesis also aims to test message framing methods to effectively communicate flood and climate change risks for behavioural changes toward mitigation and adaptation.

It has been largely argued that the efforts to communicate flood and climate change risks without understanding risk perception are ineffective, because direct experiences influenced individuals' knowledge, attitudes, risk perception and behavioural responses to climate change (Whitmarsh 2008; Poortinga et al. 2011; Ockwell, Whitmarsh, and O'Neill 2009; Ngo, Poortvliet, and Feindt 2020). Therefore, in this thesis I focus on two main objectives: i) understanding what factors influence flood and climate change risk perception, efficacy, and behavioural intentions to mitigate or adapt; ii) exploring how message framing influences the risk communication effectiveness.

1.3.1 Specific objectives

1 To explore what factors (e.g. cognitive; experiential processing; socio-cultural influences: social participation, political ideology, religion; or socio-demographics: age, gender, income source, place of residence) influence people in the coastal and delta communities in Vietnam in understanding flood and climate change risk perceptions, efficacy and behavioural intentions to mitigate or adapt (Chapter 2 and Chapter 3).

2 To study how message framing influences the risk perception, efficacy, and behavioural intentions to adapt or mitigate to flood and climate change risks among selected audiences (e.g. schoolchildren, farmers) (Chapter 4 and Chapter 5).

1.3.2 Key terms employed in this thesis include

(1) Perceived severity refers to an individual's subjective perception of the magnitude of a threat or risk (Smith, Ferrara, and Witte 2007).

(2) Perceived susceptibility to a risk entails the appraisal of one's vulnerability regarding the risk (Smith, Ferrara, and Witte 2007).

(3) Self-efficacy refers to an individual's subjective perception of his or her ability to successfully perform risk adaptation/mitigation practices (Smith, Ferrara, and Witte 2007).

(4) Response efficacy means the perceived effectiveness of the risk adaptation/mitigation behaviours (Smith, Ferrara, and Witte 2007).

(5) Behavioural intention refers to an individual's subjective probability that he or she will perform the behaviour (Fishbein and Ajzen 1975).

1.4 Research questions and methods

1.4.1 Research questions

In this thesis, I built the main research questions around two topics: flood and climate change risk perception and risk communication to explore communication effectiveness. Based on the results from risk studies, I developed the research models to explore how the risk perceptions (severity, susceptibility) and efficacy (self- and response efficacy) influence the behavioural intentions to flood and climate change mitigation/adaptation through different message framing and manipulation. In each Study, a main question is formed around some specific questions as presented in Table 1.1.

Topic 1: Risk perception

- How does an individual's knowledge, past experience, frequency of community participation and socio-demographics influence the perceived severity of flood and climate change risks, the perceived own vulnerability, and the self-ascribed adaptive capacity, which in turn influence the intention to take or support flood or climate change adaptive measures? (Chapter 2)

- How do people perceive flood risks in terms of social, economic, and environmental impacts? How does gender influence the perception of flood risk in terms of social, economic, and environmental impacts? (Chapter 3)

Topic 2: Risk communication

- How do perceptions of risk and efficacy influence the relationship with predictors of behavioural change: perceived responsibility and mitigation intentions regarding climate change? How does message congruency moderate the strength of the relationship between risk and efficacy toward predictors of behavioural change? (Chapter 4)

- How does a gain-framed (/concrete-framed) message influence attitude toward climate change mitigation differently from a loss-framed (/abstract framed) message in comparison with attitude toward climate change adaptation? How does the combination of a gain- and concrete-framed message influence attitude toward climate change mitigation differently from a combination of loss- and abstract-framed message? (Chapter 5)

1.4.2 Major theories reviewed to develop research framework

In this research, I developed or adapted several conceptual frameworks based on existing theories around risk perceptions, efficacy, and communication, namely: climate change risk perception model (CCRPM), construal level theory (CLT), extended parallel processing model (EPPM), gender schema theory (GST), theory of planned behaviour (TPB), protection motivation theory (PMT) and prospect theory (PT).

In Chapter 2, the conceptual framework, inspired by the climate change risk perception model (CCRPM, van der Linden 2014), includes indicators of the four groups of determinants of climate risk perception: cognitive factors, experiential processing, social-cultural and socio-demographic

factors. Considering the available survey dataset, I constructed a simplified set of independent variables compared to the CCRPM model: individual knowledge, past experience, frequency of community participation and socio-demographics. Compared to previous studies, I included a broader set of dependent variables than merely risk perception. The reason is that in the end I am interested in risk perceptions as a determinant of the intention to take measures to adapt to climate change-related risks. Following protection motivation theory (Rogers 1975) and the extended parallel processing model (EPPM, Witte 1992), this intention will be influenced by perceived vulnerability to climate risks, their perceived severity and the perceived capacity to successfully carry out adaptive measures (perceived adaptive capacity). Individual knowledge, past experience, frequency of community participation and socio-demographics influence the perceived severity of climate change risks, the perceived own vulnerability, and the self-ascribed adaptive capacity, which in turn influence the intention to take or support adaptive measures. The ambition in this study is to explore the relative importance of these influences among the population in the case study areas. The research results showed that while pairwise analyses revealed a significant association of flood and climate change risk perceptions with an individual's flood experience, climate change knowledge, frequency of community participation and socio-demographic factors, it did not show the influence of most socio-demographic factors. Therefore, in the next Chapter, I proposed to explore a more concrete variable i.e. how a demographic factor such as gender influences flood risk perception among city residents.

In Chapter 3, a gender-differentiated framework (GST, Ben 1981) was applied to assess risk perceptions on how city flood risks cause social, economic and environmental impacts on residents, local entrepreneurs, visiting street vendors and transport service providers during flood season. Women are one segment of society that is particularly vulnerable and highly affected by flood disasters. Differences in disaster vulnerability and impacts between men and women can be attributed to a variety of factors, including social roles (e.g. care for children, the elderly and the sick; food provision; household duties), education, employment status, income, household finance responsibilities, access to community services and infrastructure

(Rahman 2013; Fakhruddin and Rahman 2015). In addition, female-headed households are typically more vulnerable to income and asset losses, and therefore more severely impacted by disasters, although female-headed household vulnerability also depends on other influencing factors, such as headship type (e.g. widows, never married women or women with a non-resident partner) and country context (Klasen, Lechtenfeld, and Povel 2015; Flatø, Muttarak, and Pelser 2017). Many studies have highlighted the importance of considering gender responsiveness for effective disaster preparedness and for reducing disaster impacts. However, gender gaps and imbalances shaped by cultural and social structures are often ignored in risk assessment and disaster mitigation planning (De Silva and Jayathilaka 2014; Reyes and Lu 2015; Rakib et al. 2017).

In Chapter 4, to investigate the interaction between climate change risk perceptions and message congruency, I proposed a research framework that is rooted in the theory of planned behaviours (TPB, Ajzen 1991) and the construal level theory (CLT, Trope and Liberman 2010). In general, the framework treats threat and efficacy perceptions as independent variables that affect the perceived responsibility and the intention to adopt responsive behaviours, with message congruency as a moderating factor. From EPPM theory (Witte 1992), I adopted perceived severity, susceptibility, self-efficacy, and response efficacy to climate change as the four independent variables. The two dependent (or outcome) variables to examine the predictors of behavioural change are perceived responsibility and mitigation intentions. I investigated the influence of the moderator variable 'congruency' by testing whether the relationship between individual perceptions on mitigation intentions and perceived responsibility is dependent on climate change message congruency.

In Chapter 5, I investigated how message framing affects the appraisal of threat and efficacy in climate change response behaviours among farmers as a communicative audience. I elaborated on the extended parallel processing model (EPPM, Witte 1992) to develop a conceptual framework that proposed a person's intention to protect oneself against a given risk depends on the perceived severity and susceptibility of the threat and the perceived self-efficacy and response efficacy. EPPM proposes four factors:

(i) perceived severity refers to an individual's subjective perception of the magnitude of a threat or risk; (ii) perceived susceptibility to a risk entails the appraisal of one's vulnerability regarding the risk; (iii) self-efficacy refers to an individual's subjective perception of his or her ability to successfully perform risk mitigation practices; and (iv) response efficacy means the perceived effectiveness of the risk mitigation behaviours. In response to communicative messages, the audience is expected to trigger their behavioural changes in terms of: (i) perceived responsibility and (ii) climate change adaptation or mitigation intention.

1.4.3. Data collection method and research questions/ hypothesis

The main data collection method applied in all studies is quantitative with a total sample of 2299. Data was collected through face-to-face interviews by trained data collectors using pre-designed questionnaires with response scales including five-point Likert scale, multiple choice, single choice and 'yes-no' questions. Samples were randomly selected among inhabitants in the coastal and delta communities in Vietnam, including lay residents, street vendors, farmers, and adolescents. For communicative experiments, I applied a 2 x 2 factorial design to explore manipulation effects in message framing (gain- vs. loss-framed and concrete- vs. abstract-framed messages; information- vs. action-framed and abstract- vs. concrete-framed messages). In addition, a qualitative method was used when necessary to collect more in-depth information, such as focus group discussions and in-depth interviews with key informants (see Table 1.1 for more details).

Table 1.1. Summary of research questions and methods

Study	Research questions/ Hypothesis	Main data collection method	Base theory*	Location	Sample size
Chapter 2	**Research question 1**: How does an individual's knowledge, past experience, frequency of community participation and socio-demographics influence the perceived severity of **flood** risks, the perceived own vulnerability, and the self-ascribed adaptive capacity, which in turn influence the intention to take or support **flood adaptive measures?** **Research question 2**: How does an individual's knowledge, experience, frequency of community participation and socio-demographics influence the perceived severity of **climate change** risks, the perceived own vulnerability, and the self-ascribed adaptive capacity, which in turn influence the intention to take or support **adaptive climate measures?**	Cross-sectional survey Data analysis built on a large dataset from a survey among inhabitants of three flood-prone communities. Data collected through face-to-face interviews by trained data collectors using a questionnaire with response scales including multiple choice, single choice and 'yes-no' questions.	CCRPM EPPM PMT	Delta: *Mekong River* Coastal: *Central coast*	1,086

Study	Research questions/ Hypothesis	Main data collection method	Base theory*	Location	Sample size
	Research question 3: How does an individual's **flood** knowledge, past experience, perceived own vulnerability and the self-ascribed adaptive capacity to **flood** influence the perceived own vulnerability and the self-ascribed adaptive capacity to **climate change**, which in turn influence the intention to take or support **adaptive climate change** measures?				
Chapter 3	**Research question 1**: How do people perceive flood risks on social, economic, and environmental impacts? **Research question 2**: How does gender influence the perception of flood risk on risks on social, economic, and environmental impacts?	Cross-sectional survey: primary. A survey conducted by trained data collectors with randomly selected inhabitants including 2 groups: residents and visitors. Qualitative: secondary, focused group discussion and in-depth interview with key informants.	GST	Delta: *Red River*	497

Study	Research questions/ Hypothesis	Main data collection method	Base theory*	Location	Sample size
Chapter 4	**Research question 1**: How do perceptions of risk and efficacy influence the relationship with predictors of behavioural change: perceived responsibility and mitigation intentions regarding climate change? **Research question 2**: How does message congruency moderate the strength of the relationship between risk and efficacy toward predictors of behavioural change?	Cross-sectional survey Experimental research A survey conducted among randomly selected adolescents in highly vulnerable communities, using a 2 x 2 factorial design. Data collected through face-to-face interviews by trained data collectors using a questionnaire and pre-printed message.	CLT EPPM PMT TPB	Delta: *Mekong River*	348
Chapter 5	**Research question 1**: How does a gain-framed message influence attitude toward climate change mitigation differently from a loss-framed message in comparison with attitude toward climate change adaptation?	Cross-sectional survey Experimental research A survey conducted among randomly selected farmers in highly vulnerable communities, using a 2 x 2 factorial design.	CLT EPPM PT	Coastal: *Central coast*	368

Study	Research questions/ Hypothesis	Base theory*	Location	Sample size	Main data collection method
	Research question 2: How does a concrete-framed message influence attitude toward climate change mitigation differently from an abstract-framed message in comparison with climate change adaptation? **Research question 3**: How does a gain- in combination with concrete-framed message influence attitude toward climate change mitigation differently from a loss- in combination with abstract-framed message, in comparison to climate change adaptation?				Data collected through face-to-face interviews by trained data collectors using a questionnaire and audio message.

* Note: CCRPM: comprehensive climate change risk perception model; CLT: construal level theory; EPPM: extended parallel processing model; GST: gender schema theory; TPB: theory of planned behaviour; PMT: protection motivation theory; PT: prospect theory

1.5 Research location

The research was conducted in three locations in Vietnam including Mekong River Delta (in the South), Red River Delta (in the North) and Coastal provinces. The research locations were selected because they represent diverse examples of coastal and delta communities frequently affected by floods in terms of geographical location, type of natural hazards, climate features and socio-economic conditions.

(1) Mekong delta, Can Tho city- suburban communities: Located in the Mekong Delta, Can Tho has a tropical and monsoonal climate with hot and humid weather all year. As the majority of the city area is only 0.5-1m above sea level, Can Tho suffers from flooding, SLR and saline intrusion.

(2) Coastal area, Binh Dinh province and Da Nang city- suburban communities: Quy Nhon and Da Nang are coastal cities located in the Central part of Vietnam. The local climate is characterized by strong monsoon influences: the southwest and the northeast monsoon with two seasons, rainy and dry. They are also impacted by typhoons, flash floods, and SLR.

(3) City: Hanoi city- urban communities: Located in the Red River Delta, Hanoi is the most important city in the country. Being the capital city, it is a centre for political, cultural, economic, and scientific activity. Monsoon weather, and annual typhoons coming from the East Sea, create regular high precipitation events across the northern region, which often lead to city flooding.

Figure 1.7. Research location

1.6 Structure of this thesis

The thesis consists of six chapters in total as presented in Figure 1.8.

Chapter 1 introduces the thesis with two main focuses: i) understanding flood and climate change risk perceptions and efficacy to respond to flood

and climate change, and ii) exploring message framing methods to influence behavioural intentions to adapt/mitigate flood and climate change impacts. This chapter starts by reviewing global warming, its associated climate change and sea level rise, and the urgent need to address its consequences, including flood risks and communication. The chapter also presents the research objectives, main research questions, location, and methodology.

Chapters 2 and 3 explore risk perceptions among various audience groups in coastal and delta areas in Vietnam. The purpose of Chapter 2 is to enhance understanding of the factors that influence flood and climate change risk perceptions, efficacy, and intention to take adaptive measures among inhabitants of Vietnam's low-lying coastal and delta communities. I expect that the findings are likely to be relevant to other developing (and developed) countries with similar contextual features and will contribute to broader discussions about the determinants of climate risk perception.

Chapter 3 analyses flood impact perceptions in Hanoi urban households and how gender influences these perceptions, with the aim of assessing the most important social, economic, and environmental impacts that local communities experience during flood disasters. The community-based assessment considers and compares gender-differentiated perceptions of social, environmental, and economic flooding impacts on Hanoi's road network. The findings of the assessment form the basis for flood mitigation policy recommendations which take the local community needs into account. This analysis will therefore offer a comprehensive understanding of flood impacts borne by communities, and complement other findings, based on the application of analytical models to assess the benefits of flood mitigation measures.

Chapters 4 and 5 focus on risk communication. Based on the results from Studies in Chapters 2 and 3, I developed the research framework for Chapter 4 and Chapter 5 to explore how the risk perceptions (severity, susceptibility) and efficacy (self- and response efficacy) influence the behavioural intentions to flood and climate change mitigation/adaptation through different message framing and manipulation. Chapter 4 focuses on climate change communication to foster mitigation behaviours among

adolescents in vulnerable locations in the global South. I investigated the role of communication in climate change mitigation among adolescents within the Vietnamese context, a country representative of an emerging economy in the developing world with a relatively young population. The aim of this research is to investigate how perceptions of climate change risk and efficacy influence two key predictors of behavioural change: one's perceived responsibility and a person's mitigation intentions regarding climate change; further, it tests how congruency in risk messages moderates this relationship.

Chapter 5 focuses on message framing and its applicability in changing farmers' perceptions of climate change risk efficacy and behavioural intentions. Over the past few decades, debate and conversations around climate change took centre stage in social, economic, and political avenues. Presently, impacts of climate change continue to affect the lives of people; especially those that depend on agriculture as a main source of income. Farming relies heavily on stable weather and seasons as any instability leads to loss of farm crops or animals. Therefore, proper message framing would influence farmer's decisions and perceptions on adapting to or mitigating climate change impacts. It is important for farmers to learn about climate change and how it affects their lives and livelihoods. I expect that based on psychological distance and gain versus loss message framing methods, farmers can consider decision options at their disposal that push them to adapt to or mitigate climate change.

The last chapter synthesizes the findings of the previous five chapters on flood and climate change risk perceptions and efficacy, and message framing methods to influence behavioural intentions. The research proposes communication implications and practices and presents policy recommendations. This chapter also discusses research limitations and proposals for future research.

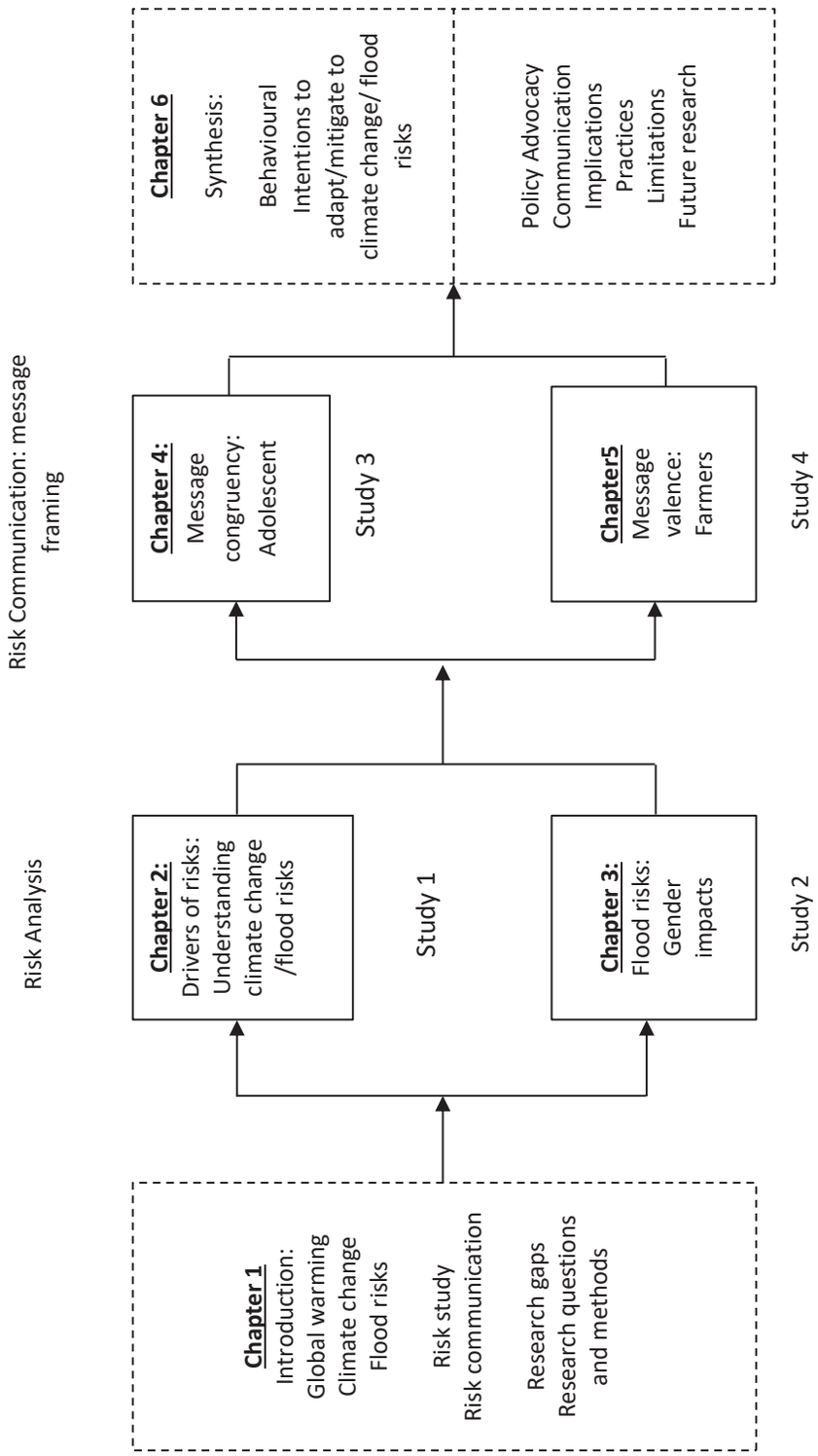


Figure 1.8. Thesis outline

Chapter 2: Drivers of flood and climate change risk perceptions and intention to adapt: An explorative survey in coastal and delta Vietnam

"The climate is changing. The proper political debate would be how to deal with these risks."

Steven Chu, Professor of Physics

Abstract:

This chapter contributes to current research about determinants of climate change and flood risk perception, and intentions to take adaptive measures. We propose a research model that distinguishes between vulnerability and severity components of perceived risks and adds perceived adaptive capacity as a third factor to predict the intention to take adaptive measures. We used this combined model as a conceptual lens for an explorative survey among 1,086 residents of coastal and delta communities in Vietnam. Pairwise analyses revealed a significant association of flood and climate change risk perceptions with individual's flood experience, climate change knowledge, frequency of community participation and socio-demographic factors. However, in multivariate analysis, the influence of most socio-demographic factors became weak or patchy. Flood experience was the most influential driver of flood-related risk perceptions but weak for climate change-related risk perceptions and behavioural intentions. Knowledge strongly increased the intention to adapt to flood and climate risks and the perceived vulnerability to and severity of climate change risks; but reduced the perceived capacity to adapt to climate risks. Frequency of community participation increased the perceived vulnerability and severity of climate change risks, the intention to adapt to both climate and flood risks and the perceived capacity to adapt to flood risks; but reduced the perceived capacity to adapt to climate risks. Our research confirms earlier findings that individuals' knowledge, place-specific experience and social-cultural influences are key predictors of both flood and climate change risk perceptions and intentions to take adaptive measures. These factors should therefore receive ample attention in climate risk communication.

Based on: Chinh Cong Ngo, P. Marijn Poortvliet, and Peter H. Feindt. 2019. "Drivers of flood and climate change risk perceptions and intention to adapt: an explorative survey in coastal and delta Vietnam". *Journal of Risk Research* 23(4), 424-446. doi:10.1080/13669877.2019.1591484

2.1 Introduction

Climate change has been widely recognized as a long-term global driver of increasing natural hazards. Its impacts, however, are place-specific. Adequate adaptation responses will typically require social coordination based on a shared understanding of climate risks and the benefits of adaptation. Though potentially affected populations are often familiar with local natural hazards (e.g. flood risks), they are often less aware of risks associated with a changing climate or they do not associate perceived hazards with climate change (Spence, Poortinga, and Pidgeon 2012; Lebel et al. 2013; Chinh et al. 2014). Such inadequate risk perceptions will likely hamper or delay mitigation and adaptation measures.

Adaptation to climate change has received increasing attention since the Intergovernmental Panel on Climate Change Fourth Assessment Report (Grothmann and Patt 2005; IPCC 2007). This includes a wide range of measures from policy making and social-economic development planning to infrastructure improvement, capacity building, education and communication. Public awareness and understanding of climate change risks are important to secure support for public measures and to encourage and enable spontaneous adaptation by households, community groups and private enterprises (Moser 2010; Moser and Dilling 2011; Chinh et al. 2014). However, effectively communicating the distant, complex, and uncertain phenomenon of climate change is difficult, in particular when aiming to empower the most vulnerable communities (Lebel et al. 2013).

For effective risk communication, understanding the perceptions of target audiences is essential (Rohrmann 1992; Moser 2010; Lebel et al. 2013). In global comparison, developing Asia is the region with the smallest percentage (31%) of people that consider climate change a threat (Capstick et al. 2014). At the same time, some of the most vulnerable populations are located there, in particular in densely populated low-lying delta and coastal regions, not least in Vietnam. On the one hand, local populations in Vietnam's flood and disaster prone regions have substantial experience in reducing risk and adapting to climate variability (WB 2011; UNDP 2007). They have developed livelihoods and lifestyles that cope with

extreme climatic hazards and natural disasters. But do these experiences instil residents with confidence that they will be able to cope with climate change and feel therefore not threatened, or is it rather a lack of knowledge or other factors that explain the relatively low level of concern? And how strong do past disaster experience and expected climate change impacts affect the willingness to take adaptive action?

This chapter aims to enhance understanding of the factors that influence flood and climate change risk perceptions and intention to take adaptive measures among inhabitants of Vietnam's low-lying coastal and delta communities. The findings are likely to be relevant to other developing (and developed) countries with similar contextual features and will contribute to broader discussions about the determinants of climate risk perception. After a brief discussion of previous research, we introduce an encompassing exploratory model that includes individual knowledge about flood and climate change, past experience with flood and weather pattern change, frequency of community participation and socio-demographics. After explaining our methodology, we present the findings from a survey conducted in three coastal and delta cities in Vietnam. Using pairwise and multivariate analysis we identify the most significant determinants of perceived vulnerability, severity, adaptive capacity and intention to take adaptive measures towards flood and climate change risks. The concluding section discusses our findings against the proposed research model, the contribution to current academic debates of climate risk perception and the implications of our findings for effective communication of flood and climate change risks.

2.1.1 Factors driving climate risk perception and risk behaviour

Risk perceptions have been theoretically and empirically studied as an 'important predictor' of people's decision to cope with natural hazards (Johnston et al. 1999; Peacock, Brody, and Highfield 2004; Terpstra, Lindell, and Gutteling 2009) and technical incidents (Slovic, Fischhoff, and Lichtenstein 1981; Nelkin 1989; Lima, Barnett, and Vala 2005). However, risk perceptions are not linked to hazards in a linear way; but result from

complex socio-psychological processes. Cognitive, subconscious, affective, socio-cultural, and individual factors influence the perception of risks (Hillson and Murray-Webster 2005; Helgeson, Van der Linden, and Chabay 2012). Various theoretical models have been proposed to understand the determinants of risk perception and risk behaviour. Four of them are pertinent to climate risk perception: the psychometric model, value-belief-norm theory, theory of planned behaviour and protection motivation theory.

The psychometric model (Fischhoff, Slovic, and Lichtenstein 1978) argues that risk perceptions are mainly influenced by risk characteristics, e.g. knowledgeability, controllability, dread and catastrophic potential (Slovic 1987; Slovic, Fischhoff, and Lichtenstein 1982). It explains why different types of risk are perceived differently rather than why individuals perceive risks differently and focuses on risk characteristics that shape people's risk perceptions and risk assessments (Slimak and Dietz 2006).

The value-belief-norm theory or VBN (e.g. Stern and Dietz 1994; Stern 2000) links three theoretical models – norm-activation theory, the theory of personal values and the new ecological paradigm – to present 'a unified explanation for environmental concern' (Slimak and Dietz 2006). According to VBN, five characteristics explain variation in individual risk perception: personal values, a general set of beliefs (worldview), awareness of consequences, ascription of responsibility, and personal norms for pro-environmental action (Slimak and Dietz 2006).

Risk behaviour approaches often build on the theory of planned behaviour (Ajzen and Madden 1986) which focuses on 'perceived personal and societal barriers and motivations that influence behaviour' (Hamilton-Webb et al. 2016). It highlights the role of cognitive and affective attitudes, subjective norms and perceived behavioural control in explaining the adoption of behaviours and has been successfully tested in different practices and settings. However, it has also been criticized for neglecting the influence of experience in explaining individuals' responses to risks (Beedell and Rehman 2000; Hamilton-Webb et al. 2016).

The protection motivation theory (PMT) (Rogers 1975) provides a conceptual framework for fear appeal studies and persuasive communication (Boer and

Seydel 1996). It includes four determinants of self-protection and adaptive intentions or behaviours: perceived vulnerability to a risk, perceived severity of the outcome, perceived effectiveness of available counter-measures (response efficacy) and perceived own ability to adopt effective protection (self-efficacy) (Floyd, Prentice-Dunn, and Roger 2000). Other studies confirm that higher levels of perceived risks increase peoples' motivation for self-protection (Witte 1992; Terpstra, Lindell, and Gutteling 2009).

Building on the various approaches, Van der Linden (2015) developed an integrative social-psychological model, the comprehensive climate change risk perception model (CCRPM). It proposes that the perception of climate change risks is a function of four main factors stemming from psychological processes, the cultural context, and personal background (Helgeson, Van der Linden, and Chabay 2012): (1) cognitive factors, (2) experiential processing, e.g. affective evaluations and personal experience, (3) socio-cultural influences, e.g. social norms and broad value orientations and (4) socio-demographic control variables, e.g. age, gender, education, political affiliation. In a national sample (N=808) of the UK population these four factors could explain 'nearly 70% of the variance in risk perception' (Van der Linden 2015, 112), confirming findings from earlier studies about the explanatory power of these factors.

Inspired by the CCRPM, we have identified sets of factors that could explain variation in climate risk perception and intention to take adaptation measures in countries such as Vietnam. We will now elaborate on each of the model's four factors.

1) Knowledge: Knowledge influences how climate change risks are judged (Sundblad, Biel, and Gärling 2007). However, knowledge is not an objective characteristic or resource of individuals. According to schema theory (Anderson, Spiro, and Anderson 1977), knowledge 'should be seen as an elaborate network of abstract mental structures that represent an individual's understanding of the external world' (Helgeson, Van der Linden, and Chabay 2012, 2). These mental structures are the changeable result of cognitive processes, which are 'the way individuals process and organize incoming information as an interrelated network of mental structure' (Helgeson, Van der Linden, and Chabay 2012). Most studies find that climate change knowledge is significantly and positively associated with risk perception (e.g. O'Connor, Bord, and Fisher 1999; Sundblad, Biel, and Gärling 2007; Hidalgo and Pisano 2010; Milfont 2012; Reser et al. 2012; Van der Linden 2015). A study in Sweden found that 'both cognitive risk judgements (of probability) of serious negative consequences and affective risk judgements (worry) were predicted by knowledge of causes and knowledge of consequences of climate change' (Sundblad, Biel, and Gärling 2007, 97). However, a study in Germany found that respondents who displayed more accurate knowledge of climate change perceived it as less hazardous; in contrast, those who merely claimed to have good knowledge of climate change perceived higher climate risks than those with a lower self-ascribed level of climate knowledge (Menny et al. 2011).

2) Personal experiences: The concept of experiential processing is rooted in experiential learning theory (ELT). Kolb (1984, 41) defines experiential learning as 'the process whereby knowledge is created through the transformation of experience'. Studies on the influence of personal experience on climate risk perceptions found ambivalent results. For example, UK citizens who had experienced flooding – the country's most widespread impact linked to climate change – differed very little from others in their perception of and response to climate change, while experience of air pollution was a more significant influence (Whitmarsh 2008). Conversely, another study in the UK identified personal experience with extreme weather events as one of several 'significant predictors' of climate risk perception, with people's experience having a stronger influence than cognitive or socio-demographic factors (Van der Linden 2015). Similarly, Dessai and Sims (2010) found that people in southeast England who had directly suffered from drought were more willing to accept restrictions in water consumption and more concerned about climate change. Spence et al. (2011) argue that the lack of 'first-hand experience' of potential climate change impacts could explain low perception of climate change risks since those who have experienced flooding were more concerned about climate change and more willing to take mitigation action.

However, a study in Sweden found that men who had experienced more incidents in their lifetime perceived risks as less severe in a range of risk domains (e.g. fire, drowning, violence, natural disaster) than other respondents (Sund, Svensson, and Andersson 2015). This would suggest that personal risk experience could be an important determinant of individuals' perception of climate change risks and their adaptation behaviour if sufficient insights can be gained into how their experiences affect their perceptions (e.g., better understanding their mental models and how their thinking may have changed as a result).

3) Socio-cultural influences: Cognitive and experiential explanations of (climate) risk perception have been criticised for neglecting the role of 'competing social and cultural structure in shaping individual risk perceptions' (Jackson, Allum, and Gaskell 2006). In Van der Linden's (2015) UK sample socio-cultural factors influenced risk perceptions stronger than cognitive or socio-demographic factors. One important factor here are social norms, which can be broadly defined as 'expectations of how people are supposed to act, think or feel in specific situations' (Popenoe 1983, 598). Various studies confirm a significant association between people's social and political norms and practices and their climate change risk perceptions (e.g. O'Connor, Bord, and Fisher 1999; Dunlap and McCright 2008; McCright 2010; McCright and Dunlap 2011; Spence et al. 2011). Depending on the context, such norms can be assessed through, for example, political party affiliation, membership of community organizations, or participation in voluntary social activities. For example, in the US, in the context of polarized public opinion on the issue, party affiliation correlates significantly with climate change beliefs even when statistically controlled for key demographic variables such as gender, age, ethnicity, income, and education (e.g. Dunlap and McCright 2008; McCright and Dunlap 2011; Spence et al. 2011). Other studies found that political ideology and worldviews influenced climate change risk perceptions stronger than knowledge (Stevenson et al. 2014; Mayer, Adair, and Pfaff 2013; Kahan et al. 2012). A survey among 387 respondents in North Carolina, USA showed that respondents with communitarian worldview more likely agreed that anthropogenic global warming is happening

than individualistic respondents (Stevenson et al. 2014). Kahan et al. (2012) found hierarchical individualists more sceptical about climate change than egalitarian communitarians.

4) Socio-demographic factors: Various studies have explored how social and demographic factors influence risk perceptions – with varying results (L. Hamilton and Keim 2009). Gender has significant association with risk perception in hazardous activities and technological hazards (e.g. Slovic 1999; O'Connor, Bord, and Fisher 1999; Sundblad, Biel, and Gärling 2007; Brody et al. 2008). Regarding climate change risks, women also tend to be more concerned than men (Finucane et al. 2000; Sund, Svensson, and Andersson 2015). Van der Linden (2015) identifies gender as a 'significant predictor' of climate change risk perception. Controlling for political, social and other demographic variables in a regression model, US women were found more concerned about climate change than men (McCright 2010; Hamilton 2010). For other demographic factors (e.g. education, age, income) no consistent or significant relationships with climate risk perception were found (e.g. Sjöberg 2000; Sundblad, Biel, and Gärling 2007; Brody et al. 2008; Milfont 2012). Spence et al. (2011) found no concrete evidence that living in areas vulnerable to climate change (i.e. the physical location) affected people's perception of climate change risks. In contrast, a study in the U.S. to examine the relationship between physical vulnerability and public perceptions of global climate change suggested that actual and perceived risk was driven by specific types of physical conditions (Brody et al. 2008). Importantly, socio-demographic factors are not necessarily independent; for example, geography is typically linked to factors like actual risk exposure (e.g., living in a flood-prone area) or socio-cultural influences (e.g., more liberal or conservative political geographies). A study on public awareness and risk perception about climate change in 199 countries found no major difference in people's awareness about climate change across countries worldwide when controlling for educational attainment; while climate change risk perceptions varied by region (Lee et al. 2015).

2.1.2. Representational imbalance

So far, most empirical studies on climate risk perceptions were conducted in developed countries, in particular the US (Bostrom et al. 1994; Lorenzoni and Pidgeon 2006; Carlton et al. 2015), the UK (Lorenzoni, Pidgeon, and O'Connor 2005; Whitmarsh 2008; Dessai and Sims 2010), or Sweden (Sund, Svensson, and Andersson 2015; Sundblad, Biel, and Gärling 2007). There is limited research on the perception of climate change risks and its determinants in developing countries, which are often more vulnerable to climate change impacts. The representational 'imbalance in the literature' constrains understanding of climate change perception around the globe (Capstick et al. 2014). Available research in developing countries differs in focus and has found diverse determinants. For example, a recent survey among rural farmers in Vietnam by Cullen and Anderson (2016) shows that respondents perceived both 'short- and long-term climate anomalies and trends' and were concerned about negative impacts on their livelihood. A study in West Africa found that people displayed more awareness of changes in weather patterns (e.g. increased temperature and declined precipitation) and confirmed the importance of experiential factors when participants with long occupation in farming were more likely to notice climate change (Maddison 2007). Whilst communities in Sahel were found to have a high awareness of climate issues, historical understanding about climate, shaped by indigenous beliefs, influenced responses to questions about climate (Mertz et al. 2009). Respondents in Bangladesh displayed understanding of specific local risks, climate variability (e.g. temperature and precipitation), changes in flood pattern, and identification of negative impacts of climate change on health, livelihood, and agriculture (Haque et al. 2012).

2.1.3 Knowledge gap

Depending on the conceptual model, the factors found to influence climate risk perception and adaptive responses are varied and some studies even arrive at conflicting conclusions. The relationship between climate change risk perceptions and knowledge about climate change, experiential processing, socio-cultural and socio-demographic factors therefore deserves further inquiry, initially through explorative studies that include a broad

range of factors that might influence climate risk perceptions. The relative lack of studies in developing countries might unintentionally tilt theoretical considerations towards factors that are more prominent in developed countries. The study presented here aims to address both issues through an exploratory survey on climate risk perceptions in three flood-prone cities in Vietnam that included a comprehensive set of determinants.

2.2 Study context and design

2.2.1 Research context: Climate change and risk perceptions in Vietnam

Located in Southeast Asia and facing the Pacific, Vietnam is regularly affected by weather-related disasters due to its exposed location and physical characteristics with a long coastline and two low delta regions. On average, between 1999 and 2010, weather-related natural disasters caused economic damage equivalent to 1.5% of the country's Gross Domestic Product (GSO 2017). The flooding in the Mekong Delta in 2000 caused devastation across the region (CCFSC, n.d.). In the Central Coast of Vietnam, floods associated with major typhoons regularly cause serious losses (CCFSC, n.d.). Vietnam has also been recognized as one of the countries likely to be most affected by climate change and associated sea level rise, given the large populations living in coastal and low-lying delta areas (MONRE 2012; WB 2011; UNDP 2007). According to climate change scenarios by Vietnam's Ministry of Natural Resources and Environment, sea level rise is projected to cause particularly serious challenges for the Mekong delta and the coastal plains (MONRE 2012b). In recent decades, Vietnam has already experienced extreme weather irregularities including unusual cold and heat waves, prolonged drought, torrential rainfall, 'super-typhoons' and devastating floods (MONRE 2012b).

Floods, typhoons, storm surges and sea level rise represent significant risk management challenges, from developing early warning systems through seasonal preparedness to strategic planning for future risks. Previous work on coastal and delta communities in Vietnam has highlighted the importance of local knowledge that has developed over time and that further evolves through experience of and adaptation to (changing) local flood regimes

(Shaw 2006; Sinh, Lebel, and Tung 2009; Tran et al. 2009). Climate change in interaction with human interventions in delta and upstream areas create complex and potentially novel impacts on flood attributes and risks (Le et al. 2007; Chinh et al. 2014). Creating more awareness of potential impacts of climate change requires addressing the determinants of inadequate climate change risk perceptions. So far research about risk perception on natural disasters and climate change in Vietnam has been limited to surveys conducted by various non-governmental organizations aiming to set up a baseline for project-based communication interventions (e.g. by ARC et al. 2013; OXFAM, MCD, and AMDI 2013; MCD and AMDI 2016).

2.2.3 Conceptual framework

Our conceptual framework, inspired by the CCRPM (Van der Linden 2015), includes indicators of the four groups of determinants of climate risk perception: cognitive factors, experiential processing, social-cultural and socio-demographic factors. Considering the available survey dataset, we constructed a simplified set of independent variables compared to the CCRPM model: individual knowledge, past experience, frequency of community participation and socio-demographics. Compared to previous studies, we include a broader set of dependent variables than merely risk perception. The reason is that in the end we are interested in risk perceptions as a determinant of the intention to take measures to adapt to climate change-related risks. Following protection motivation theory (Rogers 1975) and the extended parallel processing model (EPPM, Witte 1992), this intention will be influenced by perceived vulnerability to climate risks, their perceived severity and the perceived capacity to successfully carry out adaptive measures (perceived adaptive capacity):

- Perceived vulnerability (also labelled susceptibility) is defined as an individual's subjective perception of the likelihood of facing a threat or risk.
- Perceived severity refers to an individual's subjective perception of the magnitude of the threat or risk (Smith, Ferrara, and Witte 2007).
- Perceived adaptive capacity refers to an individual's subjective perception of his or her ability to successfully perform recommended responses and the perceived effectiveness of the response.

Figure 2.1 shows the full model. Individual knowledge, past experience, frequency of community participation and socio-demographics influence the perceived severity of climate change risks, the perceived own vulnerability and the self-ascribed adaptive capacity, which in turn influence the intention to take or support adaptive measures. The ambition in this study is to explore the relative importance of these influences among the population in our case study areas.

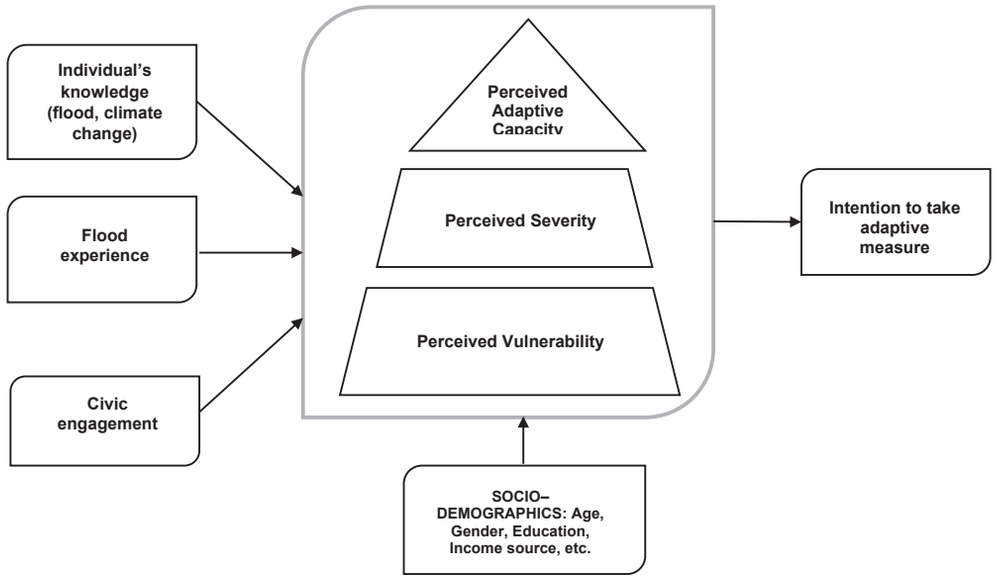


Figure 2.1. Proposed research model of climate change risk perceptions and its associations with determinants

2.3 Methodology

2.3.1 Data collection

Our analysis builds on a survey among inhabitants of three flood-prone cities in Vietnam. Data were collected through face-to-face interviews by trained data collectors in late 2012 as part of the project 'Communicating climate change risks for adaptation in coastal and delta communities in Vietnam'. The survey was designed to create a baseline for designing

communication interventions. It included respondents' perceptions of local flood and climate change risks as well as the measures they have taken and can take to adapt to future risks. The survey consisted of 101 questions about respondents' livelihoods; perceptions of flood (causes, magnitude, tendency and frequency in the future); impacts of flood on their livelihoods and well-being; disaster preparedness; knowledge of climate change; personal observations of climate variability and participation in community activities, intended flood and climate adaptation measures and demographic information. A short version of the questionnaire for the purpose of this research, developed from the full questionnaire, is in Appendix 2.2.

2.3.2 Research sites

The survey was conducted in 8 peri-urban municipalities in three cities in Vietnam: Quy Nhon, Da Nang, and Can Tho. These three sites were selected because they all represent examples of coastal and low-lying areas frequently affected by floods but differ in terms of geographical location, type of natural hazards, climate features and socio-economic conditions. Quy Nhon and Da Nang are coastal cities located in the central part of Vietnam. The local climate is characterized by strong influences of the southwest and the northeast monsoon with a rainy and a dry season. Both communities are affected by typhoons, flash floods and sea level rise. Located in the Mekong Delta Can Tho has a tropical and monsoonal climate with hot and humid weather all year. As the majority of the city area is only 0.5-1m above sea level (UBND 2010), Can Tho suffers from flooding, sea level rise and saline intrusion.

2.3.3 Participants

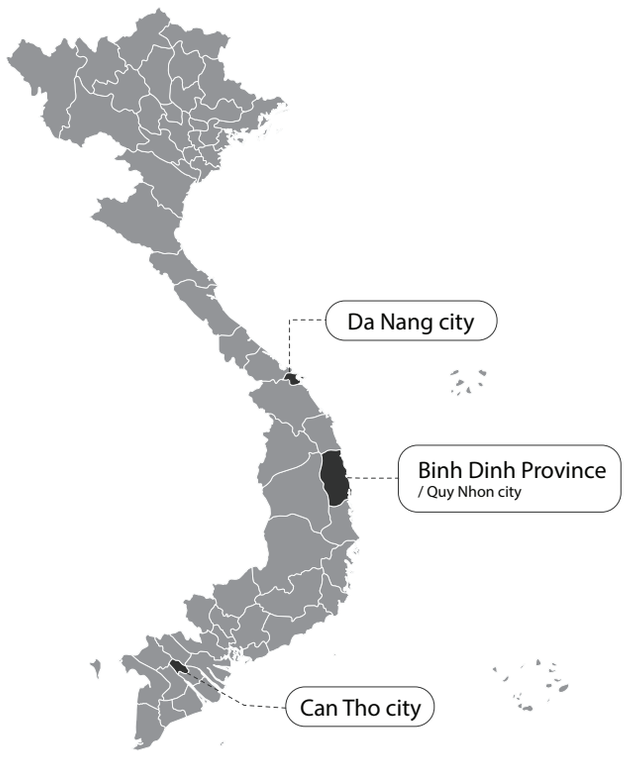
Based on official mandatory municipality household registration data, every household in each site was coded with a number. The sample was selected using a random number generator. According to local custom, the survey team contacted village leaders and arranged for household visits during daytime. Interviews were conducted with one adult in each selected household and lasted approximately 60 minutes. The aim of at least 300 interviews per city was met: Quy Nhon, n = 367; Can Tho, n = 358; Da

Nang, n = 361 (N=1,086). The response rate was above 90% due to collaborative attitudes, support from village leaders (not present during the interview) and repeat visits in case of absence.

Respondents were aged 16 to 90, with 49% of the sample 50 years and older. About 60% of respondents were female. About one third had at most primary school education. The sample composition reflects that in Vietnam rural women usually stay at home during the daytime while men typically work on fields, in factories or other workplaces. Furthermore, younger people tend to leave the countryside and move to the cities for work or study. In the sample communities, most respondents obtained income from agriculture or aquaculture. About 30% lived below the national poverty line and nearly half in temporary or semi-permanent houses. 65.2% of respondents reported flood experiences in the past ten years. In tune with a national pattern, 72% of the sample were members of voluntary community organizations (e.g. women, farmers or youth groups). Detailed respondents' socio-demographic characteristics are reported in Appendix 2.1.

2.3.4 Measures

The variables from our model were reconstructed from the baseline survey dataset. Response scales include multiple choice, single choice and 'yes-no' questions; for details see Appendix 2.2. Based on previously validated questionnaires (e.g. Chinh et al. 2014; Haque et al. 2012; Kievik and



2.2. Research Location (shared area)

Gutteling 2011; Spence, Poortinga, and Pidgeon 2012) a set of questions asked respondents about their knowledge about flood and climate change, experience with flood and weather pattern change, frequency of community participation in their communities and socio-demographics. We also constructed a set of questions to ask respondents about their perceived vulnerability, severity, adaptive capacity and intention to take adaptive measures to flood and climate change risks which aligned with other research (e.g. Chinh et al. 2014; Haque et al. 2012; Kievik and Gutteling 2011; Spence, Poortinga, and Pidgeon 2012). The measures are presented in Table 2.1.

Table 2.1. List of measures

Measure	Question	Explanation
Socio-demographics	City	Single choice, 3-options
	Gender	Single choice, 2-options
	Housing condition	Single choice, 4-options
	Age	Single choice, continuous
	Education	Single choice, 5-options
	Economy conditions	Single choice, 4-options
	Income sources	Multiple choices
Individual knowledge	What do you know about the causes and impacts of floods?	Multiple choices
	What do you know about the impacts of climate change?	Multiple choices
	Are you aware of the causes of climate change?	Yes-No
Flood experience	Did you experience a flood in your area in the last 10 year?	Yes-No
	Do you think that the long-term trends in weather are changing?	Yes-No and then follow-ups
	Do you think that the rain occurred more frequently in the dry season in the past decade or more?	Yes-No
Community participation	Do you regularly participate in community activities?	Yes-No
Perceived vulnerability	Is your house located in an area affected by flood risk?	Single choice, 4-options
	What do you think about the trend of flood frequency in the next decade?	Single choice, 4-options
	Do you think, in a decade or so, the trend in floods will stay for longer?	Single choice, 4-options
	What do you think the impact of climate change will be on your livelihood?	Multiple choices
Perceived severity	Do you think the flood level will be higher in the next decade?	Single choice, 4-options
	Does flood cause negative impacts on your livelihood?	Single choice, 4-options
	Are you concerned about climate change?	Single choice, 3-options
Perceived adaptive capacity	Before the flood season, do you prepare anything to cope with floods?	Yes-No
	How do you prepare?	Multiple choices
	Do you know what can be done to adapt to climate change?	Multiple choices
Intention to take adaptive measure	Are you doing any longer-term preparations for future flooding?	Yes-No
	What will you do?	Multiple choices
	Are you willing to learn more about climate change including mitigation and adaptation?	Single choice, 3-options

2.4 Results

This section first presents a descriptive analysis of respondents' knowledge and concern about flood risks and climate variability. Then we report the results of a pairwise analysis to test significant effects of all independent and control variables on flood and climate change risk perceptions. Finally, we present the results of a multivariate regression analysis of the relative influence of determinants to respondents' perception of flood and climate change risks and behaviour.

2.4.1 Individual knowledge and risk perceptions

Data were collected in communities with regular floods where many residents' livelihoods depend on agri- and aquaculture. Accordingly, the perception of flood risks was high. 87.6% of respondents named at least one cause of flooding in their area. (The multiple choice options for causes of flooding had been selected by review of national reports (MONRE 2012; CCFSC, n.d.) and consultation with local flood experts). Regarding perceived vulnerability to flood risk, 45.8% of respondents described the risk as "high" and a further 31.3% as "relatively high". 94.5% believed that floods had negative impacts on their livelihood, indicating high perceived severity.

84.0% described flood levels as "higher" than in the past, indicating an increasing severity of flood. 63.2% said that they took action to cope with flood before the rainy season by taking at least one preparatory measure (indicating a high sense of adaptive capacity). However, only 54.9% said that they would take longer-term preparations for coping with future floods (moderate intention to take adaptive measures). Of these, 87.4% would reinforce their houses, 12.6% would relocate to a safer area, 12.4% buy safety equipment, 4.6% change the seasonal farming calendar, 4.3% seek more information about floods and 1.3% would purchase insurance (see Appendix 2.3).

When respondents were asked about their perception of climate change risks, 64.0% answered that they were concerned about climate change and 59.9% mentioned at least one cause of climate change. (The causes of climate change had been selected by review of national reports (MONRE 2012b) and consultation with local climate change experts.) 96.9% affirmed their perception that the weather was changing and that patterns in rainfall, timing of seasons or temperature had changed over the past decade. 67.1% said climate change had negative effects on their livelihoods (high sense of vulnerability). But only 46.7% were much concerned about climate change while 35.9% were little concerned and 17.4% were not concerned (relatively low sense of severity). Only 17.4% of respondents could name at least one action to adapt to climate change impacts (of which 22.1% would change crop varieties, 15.8% change the seasonal farming calendar and 59.5% build their house in a higher place), 82.6% answered that they did not know how to adapt (low sense of adaptive capacity). However, 88.9% said that they were willing to learn more about climate change and prepare to adapt in the future (see Appendix 2.3).

Overall, most respondents recognized both flood and climate change risks. This is possibly linked to the communities' dependence on agriculture and their location in areas with high flood frequencies and/or impacts of climate change. However, sense of severity and vulnerability, sense of adaptive capacity, and intention to take adaptive measures were significantly lower for climate change risks than for flood risks, indicating both knowledge and motivation differences.

2.4.2 Factors influencing respondents' perceptions of flood and climate change risks: A Chi-square test

Flood risk perception (see Table 2.2): Pairwise analysis using a Chi-square test confirmed significant effects of all independent and control variables (socio-demographic, individual knowledge and frequency of community participation as well as flood and weather change experience) on flood perception and intended behaviour. Individual knowledge about flood risk, flood experience and frequency of community participation were all significantly associated with respondents' perception of flood vulnerability, severity, adaptive capacity, and intention to take adaptive measures. Specifically, the strong positive correlations between individual knowledge and perceived vulnerability (r = 0.192, P < 0.01), perceived adaptive capacity (r = 0.144, P < 0.01), and intention to take adaptive measure (r = 0.215, P < 0.01) indicate that individual knowledge increases flood risk perception. Similarly, the results show strong positive correlations of flood experience with perceived vulnerability (r = 0.364, P < 0.01), perceived severity (r = 0.091, P < 0.05), perceived adaptive capacity (r = 0.241, P < 0.01), and intention to take adaptive measures (r = 0.027, P < 0.01). Similarly, frequency of community participation is positively correlated with perceived vulnerability (r = 0.197, P < 0.01), perceived severity (r = 0.152, P < 0.05), perceived adaptive capacity (r = 0.237, P < 0.01), and intention to take adaptive measures (r = 0.280, P < 0.01). However, individual knowledge of flood risks was negatively correlated with their perceived severity (r = -0.099, P < 0.05). Among the socio-demographic variables, income source and city of residence, which reflect a household's exposure to floods, had significant effects on flood risk perceptions. Poverty status had significant effects on perceived flood vulnerability and severity, but not on adaptive capacity and intention to take adaptive measures. In contrast, higher age and male sex increased the perceived adaptive capacity and intention, but had no significant effect on flood risk perception. Higher levels of education reduced the perceived vulnerability and severity of flood risks; but were also associated with lower perceived adaptive capacity. The presence of at least one vulnerable dependent (children, elderly, disabled) in the household had only a weak statistical influence on flood risk perception (see Table 2.2).

Table 2.2. Pairwise correlation coefficients between socio-demographics, individual knowledge, flood experience, community participation and flood vulnerability, severity, adaptive capacity, and intention to take adaptive measures

Flood risk		Perceived vulnerability	Perceived severity	Perceived adaptive capacity	Intention to take adaptive measure
Socio-demographics	Age	n.s	n.s	0.073**	0.061*
	Gender	n.s	n.s	-0.138***	-0.118***
	Education	-0.154***	-0.145***	-0.090***	n.s
	Household's vulnerability status (having dependent members, e.g. children, elderly, disabled)	0.079**	n.s	n.s	n.s
	Income source	0.186***	0.314***	0.180***	0.161***
	Poverty status	-0.115***	-0.108**	n.s	n.s
	City of residence	-0.087***	-0.426***	-0.201***	-0.144***
Individual knowledge	What do you know about the causes of flood?	0.192***	-0.099**	0.144***	0.215***
Flood experience	Did you experience a flood in your area in the last 10 years?	0.364***	0.091**	0.241***	0.227***
Community participation	Participation in commune activities	0.197***	0.152***	0.237***	0.280***
Note: ***, **, * are significant at the 0.01; 0.05; 0.1 level; n.s. is not significant.					

Climate change risk perception (see Table 2.3): Similar to the patterns for flood risk perception, the Chi-square test showed significant positive statistical effects of individual knowledge, personal experiences and frequency of community participation on the perceived vulnerability to

and severity of climate change risks, the perceived adaptive capacity and the intention to take adaptive measures. Specifically, knowledge of climate change was strongly correlated with perceived vulnerability (r = 0.241, P < 0.01), perceived severity (r = 0.325, P < 0.01), perceived adaptive capacity (r = 0.302, P < 0.01), and intention to take adaptive measure (r = 0.190, P < 0.01). The results also show strong positive correlations of individual experience of changing weather patterns with perceived climate change vulnerability (r = 0.125, P < 0.01), severity (r = 0.158, P < 0.01), adaptive capacity (r = 0.068, P < 0.01), and intention to take adaptive measure (r = 0.179, P < 0.01). Similarly, more frequency of community participation increases perceived climate change vulnerability (r = 0.188, P < 0.01), severity (r = 0.341, P < 0.01), adaptive capacity (r = 0.163, P < 0.01), and intention to take adaptive measure (r = 0.247, P < 0.01). Among the socio-demographic control variables, city of residence and income source were significantly associated with all four – perceived climate change vulnerability, severity, and adaptive capacity as well as intention to take adaptive measures. Higher education and male gender were also positively associated with all four dependent variables. Poverty status had positive statistical associations with perceived vulnerability, severity, and adaptive capacity, but not with adaptive intention. The statistical effects of respondents' age and the existence of vulnerable household members were weak (see Table 2.3).

Table 2.3. Pairwise correlation coefficients between socio-demographics, individual knowledge, climate change experience, community participation and perception of climate change vulnerability, severity, adaptive capacity and intention to take adaptive measures

Climate change risk		Perceived vulnerability	Perceived severity	Perceived adaptive capacity	Intention to take adaptive measure
Socio - demographics	Age	n.s	n.s	n.s	-0.055*
	Gender	-0.086***	-0.234***	-0.216***	-0.072**
	Education	0.135***	0.215***	0.145***	0.167***
	Vulnerable status	n.s	n.s	n.s	-0.063**
	Income source	0.062**	0.091***	0.087***	0.075**
	Poverty status	0.139***	0.174***	0.193***	n.s
	City of residence	-0.069***	-0.171***	-0.219***	-0.067***
Individual knowledge	Do you know about the causes of climate change?	0.241***	0.325***	0.302***	0.190***
Climate change experience	Do you think weather is changing more drastically in recent years?	0.125***	0.158***	0.068**	0.179***
Community participation	Participation in commune activities	0.188***	0.341***	0.163***	0.247***

Note: ***, **, * are significant at the 0.01; 0.05; 0.1 level; n.s. is not significant.

2.4.3 Multivariate analysis: Factors influencing respondents' perception of flood risks and behaviours

After the bivariate analyses (Chi-square tests) had supported the potential relevance of all factors in our model – for the perception of both flood risks and climate change risks – we used multivariate analysis to separate the effect of each independent variable in our exploratory model.

Flood risk perception: Table 2.4 presents the results of the logistic regression analysis for the estimation of the effects of the independent variables on respondents' perception of flood vulnerability and severity, adaptive capacity, and intention to take action to reduce flood risks. In contrast to the bivariate analysis, in the logistic regression analysis most socio-demographic variables did not show strong associations with respondents' flood risk perceptions and intentions. Age was only significantly associated with the intention to take adaptive measures, with those 60 years and older more likely to contemplate action compared to younger age-groups (odds ratio (OR) of 2.286 at 5% significance level). The only statistically significant effect of gender was that female respondents were more likely concerned about flood severity (OR: 3.223 at 5% significance level). Respondents' educational level and poverty status had no significant relationship with risk perception and behaviour. In contrast, respondents' income source showed significant association with perceived flood risks and capacity; at 1% significance level, respondents whose income relied on agriculture were more concerned about flood vulnerability (OR: 4.618) and considered having more adaptive capacity to flood risks (OR: 4.278) compared to waged employees (see Table 2.4).

Compared to the bivariate analysis, the effects of respondents' knowledge were much weaker. The only significant influence found was that respondents with knowledge about flood risks were more inclined to contemplate adaptive measures (OR: 2.113 at 1% significance level) compared to respondents without flood knowledge.

In contrast, flood experience showed strong effects on flood risk perception. Respondents who had experienced flood in the past were more concerned about flood vulnerability (OR: 2.173 at 1% significance level) but less concerned about flood severity (OR of 0.295 at 5% significance level) compared to respondents without flood experience. They believed to have more adaptive capacity (OR: 1.575 at 5% significance level) compared to respondents without a flood experience and were more inclined to take adaptive measures.

Respondents' frequency of community participation had little statistical effect on perceived flood vulnerability, with the exception that respondents who frequently participate in community activities were more concerned about flood severity (OR: 11.959 at 1% significance level). In contrast, both occasional and frequent participation in community activities had strong positive effects on perceived adaptive capacity (OR: 2.189 (occasionally) and 2.095 (frequently) at 1% significance level) and intention to take action (OR: 2.477 (occasionally) and 2.371 (frequently) at 1% significance level) compared to respondents who said they never participated in community activities.

Table 2.4. Logistic regression analysis – flood risk perception

Dependent variables =>		Perceived vulnerability (OR)	Perceived severity (OR)	Perceived adaptive capacity (OR)	Intention to take actions for reducing flood risks (OR)
Socio-demographics	Age				
	under 30	1.000	1.000	1.000	1.000
	30-39	1.158	0.449	0.488*	1.092
	40-49	0.713	0.517	0.680	1.222
	50-59	0.763	0.287	0.748	1.261
	>=60	1.441	0.243	0.786	2.286**
	Gender				
	male	1.000	1.000	1.000	1.000
	female	0.973	3.223**	0.805	0.935
	Education				
	never go to school	1.000	-	1.000	1.000
	primary	0.374	1.150	0.920	1.849
	secondary	0.346	1.451	0.835	2.128*
	high school and higher	0.380	1.000	0.764	2.076
	Income source				
	waged employment	1.000	1.000	1.000	1.000
	small traders or casual labour	2.195***	3.443**	1.621**	1.357
	aquaculture	12.882**	-	2.565**	1.466
	agriculture	4.618***	18.230**	4.278***	1.928**
	Poverty status				
	non-poor	1.000	1.000	1.000	1.000
	poor and near poor	0.708	1.173	0.654*	1.067
Individual knowledge	Flood knowledge				
	no flood knowledge	1.000	1.000	1.000	1.000
	with flood knowledge	1.486	1.029	1.052	2.113***
Flood experience	Flood experience				
	no flood experience	1.000	1.000	1.000	1.000
	with flood experience	2.173***	0.295**	1.575**	1.429*
Community participation	Participation in community activities				
	never	1.000	1.000	1.000	1.000
	rarely	1.389	1.509	0.681	0.865
	occasionally	0.872	2.354	2.189***	2.477***
	frequently	1.163	11.959***	2.095***	2.371***
	Constant	5.577***	38.576***	1.279***	0.085**
	Number of obs.	694	423	711	712
	Pseudo R2	0.3228	0.3128	0.1448	0.1380
Note: ***, **, * statistically significant at 1%, 5%, 10% level					

2.4.4 Multivariate analysis: Factors influencing respondents' perception of climate change risks and behaviours

Table 2.5 presents the results of the multivariate regression analyses for the estimation of independent variables on respondents' perception of climate change vulnerability, severity, adaptive capacity, and behavioural intention. As with the perception of flood risks, most socio-demographic variables showed an even weaker influence than in the bivariate analysis. Respondents' age, gender, and poverty status had little significant statistical effect on climate risk perceptions, with two exceptions: those 60 and older were more concerned about climate change severity compared to younger age-groups (OR: 7.545 at 5% significance level); and poor and near poor respondents felt a lower ability to adapt to climate change risks (OR: 0.499 at 5% significance level). In contrast, respondents' educational level had some significant effects: respondents with high educational level (high school or more) were more concerned about climate change severity (OR: 16.576 at 1% significance level) and more likely to intend to take adaptive measures (OR: 11.782 at 1% significance level) compared to respondents who never went to school. The effect of income source was weaker than for flood risk perceptions. Other than for flood risk perceptions, respondents whose main income source was aquaculture did not significantly differ in their climate risk perceptions from those who mainly depend on waged employment. Respondents who mostly rely on agriculture for their income showed a higher concern about climate change severity (OR: 24.089 at 5% significance level) than those relying on waged employment.

In stark contrast to the findings for flood risk perception, respondents' knowledge had a strong influence on their climate risk perception and intention to take adaptive measures. At 1% significance level, respondents with knowledge about climate change were more concerned about climate vulnerability (OR: 3.923) and severity (OR: 6.461) and more likely to intend to take action for reducing climate change risk (OR: 4.580) than respondents

without climate change knowledge. In contrast, climate change knowledge strongly reduced the perceived capacity to adapt to climate change (OR: 0.225 at 1% significance level) compared to those without knowledge.

Again, in stark contrast to flood risk perception, experience of changing weather patterns had a weak influence on perceived climate vulnerability, severity, adaptive capacity, and intention to take measures to adapt to climate change.

Similar to flood risk perceptions, frequency of community participation had a strong and positive influence on the perceived climate risk vulnerability and severity, and on the intention to take adaptive measures, but a negative influence on the perceived adaptive capacity. The effect of perceived climate risk vulnerability and severity was significant only for higher frequency of community participation (OR: 2.503 at 5% significance level, OR: 16.211 at 1% significance level respectively). Perceived adaptive capacity was negatively affected by frequent participation (OR: 0.424 at 5% significance level). A positive effect of participation on the intention to take measures to adapt to climate change was visible for respondents who either occasionally participated in community activities (OR: 4.843 at 1% significance level) or who frequently participated (OR: 3.385 at 5% significance level).

Table 2.5. Logistic regression analysis – climate change risk

Dependent variables =>		Perceived vulnerability (OR)	Perceived severity (OR)	Perceived adaptive capacity (OR)	Intention to take actions for reducing flood risks (OR)
Socio-demo graphics	Age				
	under 30	1.000	1.000	1.000	1.000
	30-39	1.345	2.107	1.167	0.354
	40-49	1.062	2.901	1.035	2.804
	50-59	1.588	2.114	1.220	1.021
	>=60	1.300	7.545**	1.054	1.900
	Gender				
	male	1.000	1.000	1.000	1.000
	female	1.829	2.045	1.317	2.802*
	Education				
	never go to school	1.000	1.000	1.000	1.000
	primary	0.452	4.374**	0.600	2.747
	secondary	0.683	4.728**	0.673	4.842**
	high school and higher	0.867	16.576***	0.517	11.782***
	Income source				
	waged employment	1.000	1.000	1.000	1.000
	small traders or casual labour	0.948	0.844	0.910	1.411
	aquaculture	2.432	1.510	1.577	4.467
	agriculture	2.614*	24.089**	1.063	1.930
	Poverty status				
	non-poor	1.000	1.000	1.000	1.000
	poor and near poor	1.410	1.491	0.449**	0.867
Individual knowledge	Climate change knowledge				
	no CC knowledge	1.000	1.000	1.000	1.000
	with CC knowledge	3.923***	6.461***	0.225***	4.580***
Climate change experience	CC experience				
	no CC experience	1.000	1.000	1.000	1.000
	with CC experience	2.510	2.237	0.693	6.076*
Community participation	Participation in community activities				
	never	1.000	1.000	1.000	1.000
	rarely	2.018	1.998	0.500	5.241*
	occasionally	1.294	2.428*	0.573*	4.843***
	frequently	2.503**	16.211***	0.424**	3.385**
	Constant	0.281	0.025	121.938**	0.038
	Number of obs.	596	596	596	566
	Pseudo R2	0.1342	0.3236	0.1888	0.2908
Note: ***, **, * statistically significant at 1%, 5%, 10% level					

2.4.5 Influence of risk and capacity perceptions on adaptive behaviour

The third and final step in our analysis looked at the influence of perceived vulnerability, severity, and adaptive capacity of flood and climate change risks on the intention to take adaptive measures, as represented on the right-hand side of figure 2.1.

Table 2.6. Logistic regression analysis – perceived vulnerability, severity, adaptive capacity and intention to take adaptive measures to flood and climate change risks

Intention to take adaptive measures to flood risk	
Perceived risk and vulnerability	
no, in safe area	1.000
yes likely	1.479
yes high risk	1.239
Perceived severity	
not affected	1.000
little affected	1.534
somewhat affected	2.183**
a lot affected	2.299**
Perceived adaptive capacity	
no	1.000
yes	18.117***
Constant	0.081***
Number of obs.	581
Pseudo R2	0.2861

Intention to take adaptive measures to climate change risk	
Perceived risk and vulnerability	
no idea	1.000
no impact	0.795
has impact	1.368
Perceived severity	
not at all	1.000
yes a little	5.325***
yes a lot	18.367***
Perceived adaptive capacity	
no	1.000
yes	1.974
Constant	2.787**
Number of obs.	1008
Pseudo R2	0.2149

Note: ***, **, * statistically significant at 1%, 5%, 10% level

For this purpose, we conducted another regression analysis. The results, shown in table 2.6, confirm only parts of our model. They also reveal striking differences between the intention to take adaptive measures against flood risks and climate change risks. First, for neither risk is the intention to take adaptive measures significantly determined by the level of perceived vulnerability. In contrast, perceived severity of both flood and climate change risks was strongly and positively associated with the intention to take adaptive measures (at 5% significance level, OR: 2.299 and 2.183

for some and a lot concern over flood severity, and OR: 5.325 and 18.367 at 1 % significance level for some and a lot concern over the severity of climate change risks). Third, perceived adaptive capacity was strongly and positively associated with the intention to take adaptive measures against flood risks (OR: 18.117 at 1% significance level), while there was no significant statistic effect of perceived capacity to adapt to climate change and the actual intention to take measures to adapt to climate change.

2.5 Discussion

Our analysis confirms the usefulness of an exploratory approach with a broad set of variables to understand the determinants that influence flood and climate change risk perceptions and behavioural intentions to take adaptive measures in vulnerable communities in developing countries. Inspired by the CCRPM (Van der Linden 2015), we explored the role of knowledge, personal experience, frequency of community participation and socio-demographic factors on a broadened set of dependent variables (perceived vulnerability, severity, adaptive capacity and intention to take adaptive measures). We also compared risk perceptions and determinants for flood and climate change risks.

With three flood-prone communities in Vietnam as the research context, our data indicate that most respondents recognized they were residing in high flood risk areas and anticipated that floods would be more severe in the future (high sense of vulnerability). The majority of respondents believed that floods would have negative impacts on their livelihood and health (high sense of severity) and confirmed that they took action to respond to floods before disaster season (indicating a high sense of adaptive capacity). However, fewer respondents said that they would adopt longer-term preparations for future flooding (moderate intention to take adaptive measures). This finding reveals an intention gap to take more long-term adaptive measures which is important to address in risk communication.

When asked about climate change risks, most respondents affirmed their perception that the weather was changing, and a majority had heard about climate change and experienced its impacts on their livelihoods (high perceived vulnerability). However, only a small proportion of respondents

was concerned about climate change (low perceived severity) and a very low proportion said they knew how to deal with it (low sense of adaptive capacity). A majority of respondents confirmed that they were willing to learn and prepare to adapt to future climate change impacts (high intention to consider adaptive measures).

Overall, the share of respondents perceiving vulnerability, severity, and adaptive capacity of climate change was lower than the share perceiving severity and adaptive capacity of floods. This is in line with previous findings that people view climate change impacts as temporally and spatially distant and therefore often view climate change impacts as personally relevant only after directly experiencing disrupted weather patterns (O'Connor, Bord, and Fisher 1999; Leiserowitz 2005; Spence et al. 2011). Importantly, despite widely shared experiences with floods, only 54.9% of respondents intended to take more long-term adaptive measures. This intention was strongly determined by the perceived severity and adaptive capacity (table 2.6). While these findings are significant for consideration when designing risk communication for adaptive action, our findings also suggest that the intention to take measures to adapt to climate change was much lower and affected only by perceived severity, but not perceived adaptive capacity. This lack of a statistical correlation, however, can be explained by the fact that participants with increased knowledge of climate change were more sceptical about their adaptive capacity while becoming more intent to take adaptive measures. In other words: Increased knowledge reduces the more optimistic assumptions about adaptive capacity and creates a higher sense of urgency.

Pairwise analysis showed a significant association of flood and climate change risk perceptions with individual knowledge, personal experiences and frequency of community participation. Meanwhile, socio-demographic factors – apart from respondents' income source and city of residence, which reflect the often very place-specific climate change impacts – were no consistent predictors of perceived vulnerability, severity, adaptive capacity, and intention to take adaptive measures. This confirms similar findings in previous studies (Juliusson, Karlsson, and Gärling 2005; Bruine de Bruin, Parker, and Fischhoff 2007; Sanz et al. 2007; Stanovich and West 2008; Wolf and Moser 2011).

The multivariate analysis found that only a limited number of factors predicted the perception of flood and climate risks and the intention to take action to reduce potential impacts. The findings support the assumption that some socio-demographic factors become statistically insignificant when controlled for individual knowledge, personal experience and frequency of community participation influences. The analysis revealed that individuals' frequency of community participation and flood experience maintained significant associations with perceived vulnerability, severity, adaptive capacity, and intention to take adaptive measure when integrating these factors in one model, while flood knowledge remained significant only for the intention to take adaptive measures. In contrast, climate change knowledge – together with frequency of community participation – had a more consistent influence on climate risk perception and intention to take adaptive measures, while personal experience had little significant influence. This probably reflects that the more severe climate change impacts will occur in the future and that current impacts are not always attributed to climate change.

Compared against existing and recent investigations about the factors that influence flood and climate change risks, our research showed that respondents who were knowledgeable about floods were more concerned about climate vulnerability and severity, felt higher adaptive capacity and were more likely to take adaptive measures against future climate change impacts (see table 2.7). Flood experience was significantly associated with higher perceived climate change severity, adaptive capacity and intention to adapt to climate change. This contrasts with studies who found that people who had experienced flooding differed very little from those who have not regarding their understanding of and response to climate change (Whitmarsh 2008; Dessai and Sims 2010; Spence et al. 2011). Finally, the results confirm the assumption that risk perceptions are strongly influenced by knowledge about the causes and consequences of climate change (Sundblad, Biel, and Gärling 2007; Brody et al. 2008; Kellstedt, Zahran, and Vedlitz 2008; Menny et al. 2011).

Table 2.7. Correlation coefficients and association between flood risk and climate change risk perceptions

	Climate change vulnerability	Climate change severity	Climate change adaptive capacity	Climate change intention to adapt
Flood knowledge	0.1119***	0.2246***	0.1222***	0.3327***
Flood experience	0.0363	0.1175***	0.1582***	0.1868***
Flood vulnerability	-0.0563*	-0.0012	0.0368	0.1229***
Flood severity	0.0925*	0.0719*	-0.0266	0.0535
Flood adaptive capacity	0.2098***	0.2187***	0.1695***	0.2019***
Note: * Pearson correlation test and Chi-square statistic for independent is statistically significant at 5%				

The findings broadly confirm association of the explanatory variables from the CCRPM with perceived climate change vulnerability and severity among the sample population in Vietnam; however, the proposed conceptual model of climate risk perception was only partly confirmed in multivariate analysis. Our research revealed some surprising complexities. In our sample, individual knowledge and frequency of community participation increased the intention to adapt to climate change but reduced the perceived capacity to do so. At the same time, experience had a weak, and socio-demographic factors had an uneven influence on perceived capacity and intention to take adaptive measures to climate change. The proposed conceptual model also proved useful to understand perceptions and responses to flood risks in our sample population.

The findings from the present study are likely to be relevant to other countries with similar contextual features both in the developing and the developed world, and will contribute to broader discussions about the determinants of climate risk perception. We expect that the relative influence of the determinants will depend, inter alia, on the local exposure and visibility of climate change impacts, levels and modes of community participation, the prevalent worldviews and the type and degree of political mobilization around climate change issues. As argued above, the factors

found to influence climate risk perception and adaptive responses are varied and some studies arrive at contradictory conclusions.

The present study confirms that more integrative conceptual models are important to determine the factors influencing climate risk perception and adaptive responses. The findings suggest that further explorative studies are needed that include a larger number of potential factors that might influence climate risk perceptions. Such quantitative studies should be complemented with more in-depth qualitative research to enhance our understanding of how perceptions of climate change risks are embedded in local narratives. Our findings may also be useful to target interventions and communications to raise awareness of people's perceptions and practice in coping with flood and climate risks, such as: reinforcing the perception of continued vulnerability by highlighting personal experiences; providing concrete examples of adaptive measures; and encouraging adaptive measures through social influences such as utilization of community organizations. Not least, the research addresses the relative lack of studies on climate change risk perception in developing countries and confirms that this geographical imbalance in available data might have the unintended effect of tilting theoretical considerations towards factors that are more prominent in developed countries.

2.6 Conclusions

The research model proposed in this chapter distinguishes between a vulnerability and a severity component of perceived climate change risks and adds perceived adaptive capacity as a third factor to explain the intention to take adaptive measures. We compared determinants of climate risk perception with determinants of flood risk perception and the respective intention to take adaptive measures to better understand whether the distant, complex and abstract concept of climate change affects the risk perception and adaptation in comparison to the more graspable and experiential notion of floods. We also explored the relationship between flood experience and climate risk perception and adaptation.

Altogether, our research confirms earlier findings that individuals' knowledge, place-specific experience and vulnerability-related social-demographic factors are the most important predictors of both flood and climate change risk perceptions and intentions to take adaptive measures. Our findings suggest that combining theories of risk perception, protection motivation theory and the extended parallel processing model are a promising approach to integrate the understanding of the determinants of risk perceptions and adaptive behaviour related to climate change, but also other risks. Such a more integrated approach can have significant implications for climate change communication. However, the theoretical implications deserve further elaboration, including analysis of the statistical independence of the relatively large number of variables. Our results also indicate a need to apply a more comprehensive model in a broader range of locations to understand similarities and differences in the importance of the various factors. Furthermore, the significant differences in the relative importance of cognitive factors, experiential processing, socio-cultural and socio-demographic factors on the perception of climate risks as compared to flood risks calls for further research across different types of weather and climate-related risks.

Chapter 3: Community perceptions of social, economic and environmental impacts of flooding in central districts of Hanoi, Vietnam

"We are going to win this. The only question is how long it takes."

Al Gore, Founder and Chairman
The Climate Reality Project

Abstract:

This Chapter explores impacts of flooding on road infrastructure in Hanoi which are highly disruptive, despite recent progress by Vietnamese authorities in improving the city's drainage systems. The GCRF-OSIRIS Project aims to optimize investment strategies to minimise the impacts of flood disasters, making disaster risk reduction more effective, by introducing Operational Research methods. In support of this objective, the project carried out an impact assessment in four of the city's central districts. The assessment considered locally-perceived social, economic and environmental impacts on residents, local entrepreneurs, and on visiting street vendors and transport service providers. Impacts of flooding were found to be highly gender-differentiated. When roads are flooded, women – both resident and visiting – face greater conflicts between the need to maintain their incomes and the responsibilities of caring for vulnerable family members, resulting in increased stress and increasing risks to their health. The assessment suggests that such disproportionate impacts on women could be mitigated through public education and pre-emptive planning measures.

Based on: Maria Paola Scaparra, Ngo Cong Chinh, Dang Thu Phuong, Trung Hieu Tran. 2019. "Community Perceptions of Social, Economic and Environmental Impacts of Flooding in Central Districts of Hanoi, Vietnam". *Journal of the British Academy 7(s2), 137–154. doi:10.5871/jba/007s2.137*

3.1 Introduction

Vietnam is one of the most hazard-prone countries in Asia (GFDRR 2015). Riverine and coastal flooding represents one of the major natural risks faced by the country, due to its extended coastal areas, river basins and lakeshores. In a recent study by the World Resources Institute, Vietnam is ranked globally as the country with fourth highest exposure to river flooding (Luo et al. 2015). In addition, flood risk, exposure and impact are expected to increase because of climate change. Current literature shows that rising temperatures as a result of climate change will result in an intensification of rainfall (Arnell and Lloyd-Hughes 2014; Lehmann, Coumou, and Frieler 2015; Donat et al. 2016; Hettiarachchi, Wasko, and Sharma 2018) and, consequently, an increase in the frequency and intensity of floods (IPCC 2014; World Bank 2013).

Recent accelerations in population growth, changes in land use patterns and fast urbanization further exacerbate Vietnam's vulnerability to floods. The impact of land use change and urbanization on flooding has been widely documented in the literature (Huong and Pathirana 2013; Pham and Shannon 2020; Zope, Eldho, and Jothiprakash 2016). As more people move to the cities, they inevitably turn green areas and soft surfaces into impervious areas; in addition, higher population density in urban flood-prone areas increases exposure to flood hazards (Hammond et al. 2015).

In Hanoi, the capital city of Vietnam, flood risk is especially acute. The city has seen increasing urbanization and economic development during recent decades. However, the pace of supportive infrastructure development has lagged behind (Luo et al. 2018). The city has many hotspots that become waterlogged during heavy rain because of an outdated and overloaded drainage system (IMHEN-UNDP 2015). In 2008, an historic flood triggered by torrential rains killed 18 people in the city and caused massive economic losses. According to Luo et al. (2018:3), "up to one meter of water flooded the city's streets, and urban transportation was halted. Food prices, especially those of meat and vegetables, reached exorbitant levels in the city as the rains destroyed crops and livestock and crippled transportation corridors. The total economic loss due to this flood exceeded

177 million USD". Following the 2008 flood, the city spent millions of USD on infrastructure improvements. Nevertheless, Hanoi continues to experience serious flooding every year and the drainage system remains substandard and inadequate (VietNamNet 2018).

As in many other countries facing similar flood disasters, flood impacts in Vietnamese cities are especially felt by the poorest segments of society, as their income are more dependent on weather and their housing and properties less protected (Hallegate et al. 2016; Hallegatte et al. 2017; Narloch and Bangalore 2018; Bangalore, Smith, and Veldkamp 2019). For example, poor households may not be able to cover the cost of flood adaptation measures, such as wet-proofing their properties (Lasage et al. 2014). In addition, they are more vulnerable to increased food prices during and after floods, and less able to recover from property damages.

Women are another segment of society that is particularly vulnerable and highly affected by flood disasters. Differences in disaster vulnerability and impacts between men and women can be attributed to a variety of factors, including social roles (e.g. care for children, elderly and sick; food provision; household duties), education, employment status, income, household finance responsibilities, access to community services and infrastructure (Rahman 2013; Fakhruddin and Rahman 2015). In addition, female-headed households are typically more vulnerable to income and asset losses, and therefore more severely impacted by disasters, although female-headed household vulnerability also depends on other influencing factors, such as headship type (e.g. widows, never married women or women with a non-resident partner) and country context (Klasen, Lechtenfeld, and Povel 2015; Flatø, Muttarak, and Pelser 2017). Many studies have highlighted the importance of considering gender responsiveness for effective disaster preparedness and for reducing disaster impacts. However, gender gaps and imbalances shaped by cultural and social structures are often ignored in risk assessment and disaster mitigation planning (De Silva and Jayathilaka 2014; Reyes and Lu 2015; Rakib et al. 2017).

This study analyses flood impact perception among Hanoi urban households with the aim of assessing the most important social, economic and

environmental impacts that local communities experience during flood disasters in the city. The Community-Based Assessment was carried out by the Asian Management and Development Institute, as part of the GCRF-British Academy project titled: Optimal Investment Strategies to Optimize Flood Impact on Road Infrastructure Systems in Vietnam (OSIRIS). The OSIRIS project aims to identify gaps and inefficiencies in current infrastructure investment and maintenance programmes in Hanoi, especially in relation to climate change and flooding issues that affect transport. The project will then develop a multi-period optimisation model for strategic, long-term planning of mitigation actions which minimizes the impact of floods on the urban road network, depending on different flood scenarios. The Community-Based Assessment considers and compares local perceptions of social, environmental and economic flooding impacts on Hanoi's road network. The findings of the assessment form the basis for flood mitigation policy recommendations which take the local community needs into account. This analysis will therefore offer a comprehensive understanding of flood impacts borne by communities, and complement other findings of the OSIRIS project, based on the applications of analytical models to assess the benefits of flood mitigation measures.

3.2 Method and design

3.2.1 Study area

Hanoi has a population of approximately 7.7 million, with population density of 2,300 per km², and a growth rate slightly over 2% per year, compared to the national average of approximately 1%. Growth is high due to rural-urban migration, supported by rapid development of residential 'satellite' areas around the city. Being the capital city, it is a centre for political, cultural, economic and scientific activity. It lies in the centre of the northern part of the country, and borders nine largely rural provinces – Thai Nguyen, Vinh Phuc, Ha Nam, Hoa Binh, Bac Giang, Bac Ninh, Hung Yen, Hoa Binh and Phu Tho. Monsoon weather, and annual typhoons coming from the South China Sea, create regular high precipitation events across the northern region, which often lead to flooding. Flooding in Hanoi is often greater than in the

outlying provinces, because drainage systems are insufficient to carry away flood waters. Problems with drainage have been linked to the process of urbanisation in the city, which has been rapid, and which appears to have prioritised above-ground developments, such as roads and buildings, rather than drainage systems. The impacts of floods in Hanoi are especially felt along the city's roads. In a city where traffic is often gridlocked even in dry weather, flooded roads can make economic and social routines impossible. The city has twelve urban districts, one district-level town, and 17 rural districts. Of these, the project selected four urban districts: Dong Da, Nam Tu Liem, Hoang Mai and Ha Dong, as areas of study. These were selected in consultation with local project partners, due to their vulnerability to flooding; inclusion of both old and new districts in the study area; and the level and types of existing flood-mitigation investments. Dong Da is an old district, while Nam Tu Liem, Hoang Mai and Ha Dong are comparatively new. Prior to the assessment, it was generally known that older districts are less affected by floods compared to newly established districts, partly because drainage systems in newer urban areas were planned in haste, received less investment, and remain partly dependent on former agricultural drainage systems.

Interviews were carried out in the following wards (sub-divisions of districts): My Dinh, Me Tri, Co Nhue, Nhan My (Nam Tu Liem District); Kham Thien, Luong Dinh Cua, Kim Lien (Dong Da District); Van Quan, Duong Noi, Xa La, Yen Nghia, Phu Luong, Trieu Khuc, Kien Hung (Ha Dong District); Giap Bat, Tan Mai, Hoang Van Thu, Thinh Lien (Hoang Mai District).

Figure 3.1. The City of Hanoi

Figure 3.2. Hanoi's central districts

3.2.2 Research participants and data collection

The assessment considered two broad groups of people. The first group are residents of the assessment areas, 55% (164 out of 296) of whom are also local business people, trading from their homes, or from shops attached to their homes. Their businesses are mainly small grocery or food stores, coffee shops and iced tea stalls on pavements or by the roadside. The remaining 45% of residents are primarily employees in governmental or private agencies, or retired. The second group are visitors to the assessment areas, who work as street vendors, motorcycle-taxi or car-taxi drivers, most of whom come to the area to sell their goods and services early in the day, and leave at the end of the day, or when their produce has been sold. Street vendors in this category usually come into the urban area from outlying districts of the city, bringing food or vegetables, or ready-made snacks, often by bicycle or motorcycle. The assessment gives special attention to the different impacts experienced by women and men.

Table 3.1. Respondents included in the assessment

Respondents	Resident households		Visitors			
	Doing trade	Not trading	Street vendors	Motorcycle taxi drivers	Car taxi drivers	Total
Male	47 (9%)	65 (13%)	15 (3%)	86 (17%)	7 (1%)	220 (44%)
Female	117 (24%)	67 (13%)	88 (18%)	4 (1%)	1 (n.a.)	277 (56%)
Total	296 (60%)		201 (40%)			497

Table 3.2. Gender of resident respondents, by district

Gender/District	Dong Da	Ha Dong	Hoang Mai	Nam Tu Liem
Male	20 (7%)	50 (17%)	24 (8%)	18 (6%)
Female	14 (5%)	79 (27%)	54 (18%)	37 (13%)
Total	34 (11%)	129 (44%)	78 (26%)	55 (19%)

The survey took place in the midst of Hanoi's stormy season, in mid-2018, following a series of torrential downpours. This could be considered as an advantage for the assessment, as local people were able to reflect

quickly on their situation and to propose appropriate measures for dealing with the impacts of floods. The assessment comprised quantitative data collection among the two main stakeholder groups (residents and visitors), plus qualitative methods to corroborate (or otherwise) the data findings. Qualitative methods were focus group discussions, in-depth interviews with sub-groups or members of the two main stakeholder groups, consultations with local government, business and community-based organizations, and observations by the assessment team. Locally available literature such as government flood-damage assessments, were also consulted. Initial sets of indicators for social, environmental and economic impact were adapted into assessment questions. Different assessment forms were used for the two target groups – residents and visitors.

3.3 Findings

3.3.1 Analysis of community priorities and flood impact perception

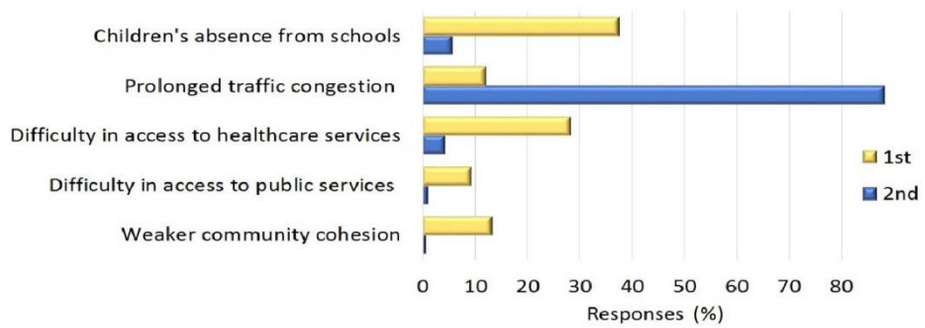


Figure 3.3. Residents' perception of most important social impacts

Social impacts were assessed through interviews with the residents' group, not with the visitors' group. Prolonged traffic congestion, and children's absence from school were found to be the most important social impacts, with almost 90% of respondents considering the traffic congestion as the second most important social impact of flooding (Figure 3.3). Interviews showed that traffic congestion was cited as important because it led to loss of time in traffic, turning normal journeys of 15 minutes, into one-hour journeys characterised by stress (water, other impatient drivers pushing

their motorbikes through traffic, fumes, and noise). Traffic congestion was also cited as important because it led to secondary impacts including difficulty in taking children to school, difficulty in accessing health care services, and difficulty in receiving services such as utility maintenance at home. Secondary impacts of traffic congestion were also economic impacts, such as loss of time from work, loss of wages, and broken motorbike engines.

Children's absence from school affected families socially and economically, as households needed to find suitable care for their children at home. Fifty percent of children were assessed to be absent from school during storms and flooding, with absence normally lasts one to two days. At those times, 75% of home carers were perceived to be mothers and grandmothers, 25% fathers, grandfathers, relatives or friends. These arrangements often required transport for children to grandparents' homes (or vice versa), or required one income-earner, usually the mother, not going out to work.

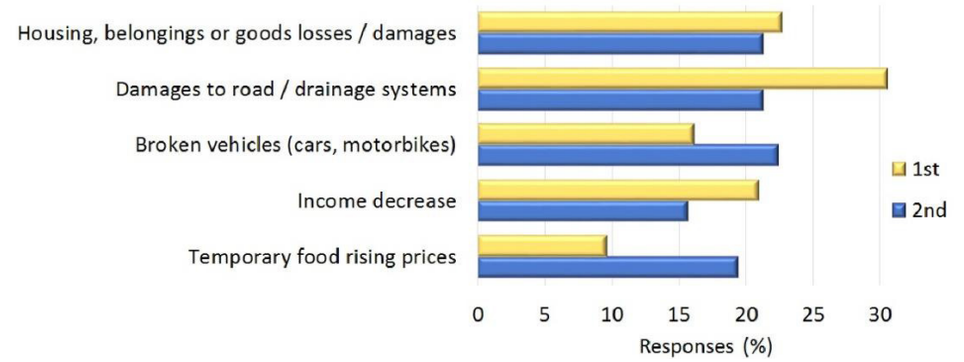


Figure 3.4. Household perception of most important economic impacts

The assessment showed that both residents (trading and non-trading households) and visitors (street vendors, motorcycle and car taxi drivers) were economically impacted. The greatest economic impact overall was considered to be damage to the road, pavement, and drainage system, which was surprising as these are public goods, while the second most important economic impact overall was considered to be damage to housing, belongings, and goods/stock (Figure 3.4).

More than half (58%) of resident households normally experience flood

waters entering their houses/stores/place of business during the flood season, causing damage to housing, belongings, and goods/stock. Trading households, such as coffee shops, grocery stores, food and beverage stalls along streets or pavements, were perceived as more vulnerable than non-trading households, due to their greater expenses for renting space, hiring staff, and vulnerability of their stock. Expenses also rose as these households faced increased prices for cooking ingredients from wholesalers, and obstacles in transportation. However, only 10% of trading households decided to increase the prices of their goods or services, to make up for their increased costs during the floods. Those with greater turnover were also those perceived as having greater losses during floods. Women were perceived as being more impacted than men, as women are more often working or trading from home. Resident men on the other hand were more likely to work away from home, for example in construction or as employees.

Amongst trading and non-trading residents, those in apartments (12% of those surveyed) were more impacted by electricity cuts during flooding, as cuts caused greater disruption to utilities such as water pumps and elevators. Perceived disproportionate impacts on women include having to prepare meals in flooded kitchens and running shops/restaurants/cafes in flooded conditions. The survey team observed that resident households were impacted by damp (mould and peeling paintwork inside houses) and subsidence, which householders attributed to persistent high water levels in the street. Both trading and non-trading households perceived damage to belongings, with 40% of respondents reporting the damage to their motorcycle. Others reported damage to their refrigerator (21%), stock (20%), furniture (19%), and other kitchen items (18%). Despite these property losses, only 12% of residents had insurance for their belongings. Focus group discussions with women residents showed that during flood periods, the greatest perceived price rises were for fresh vegetables, with lesser but still concerning price rises for meat and fish. These price rises led to women spending more time searching for food in more markets and more distant markets. This increased their levels of stress.

Amongst visitors, perceived economic impacts were also gender-differentiated. Most street vendors (88 out of 103) were women. In-depth

interviews showed these were women who travelled into the city at 4:00am or 5:00am, mainly from more rural outlying areas of the city, carrying their goods/wares on the back or front of their bicycles/motorcycles. They would suffer most economic damage if their goods became wet, as they faced the risk of a bicycle or motorcycle falling in flood water. They also faced economic damage through reduced time at their selling location, and fewer customers deciding to stop to make purchases. However, in addition to economic impacts, women street vendors felt stressed by gender roles which required them to buy food for the evening family meal, (with less income, and temporarily higher prices), and to somehow also care for more vulnerable family members, (children and elderly), who were left at home. Most motorcycle and car taxi drivers (93 out of 98) on the other hand, were men. In-depth interviews found that economic impacts on these drivers were twofold. First, from decrease in incomes, because traffic congestion led to all journeys taking far more time to complete, with only slightly higher customer fares. Second, drivers had significant risk of damaging their car and motorbike engines when flood water reached their exhaust pipes. Repair to engine damage was very expensive and time consuming.

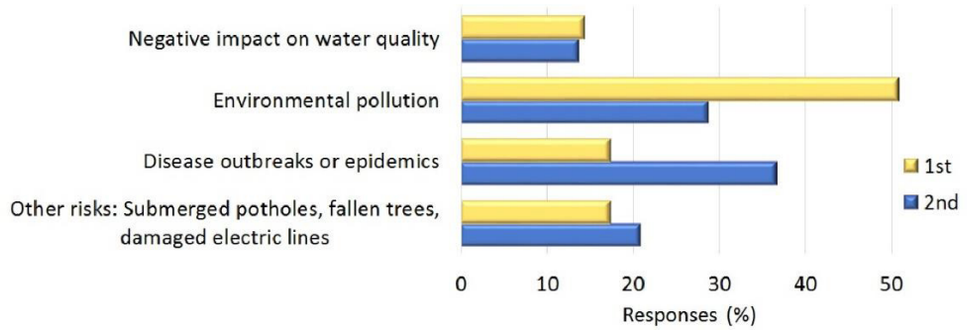


Figure 3.5. Household perception of most important environmental impacts

Resident trading and non-trading households perceived themselves to be more vulnerable to environmental impacts of flooding, than visitors. The most critical impact was considered to be from environmental pollution, as residents' homes were threatened by overflow of wastewater from canals and streams, garbage carried by floodwaters, and foul smells from the pollution (Figure 3.5). An outbreak of disease or epidemic was considered

as the second most significant environmental impact, while other risks, especially from items submerged in the floodwaters such as tree branches and open drains or pot-holes, were considered serious, especially to visitors (vendors and motorcycle taxi drivers). Contamination of water supply was also cited as a significant impact. Environmental impacts were also gender differentiated, with the overall impact on women being greater than on men. Women for example were more affected by contaminated water when it became difficult to wash clothes and dishes, bath children, and cook. Women were also more affected when children and elderly relatives became sick from environmental pollution. Women were also responsible for purchasing medicine or treatment for sick family members, and this became an additional economic impact for women during the flood period. Finally, the role of women to clean houses, kitchens and streets from garbage after floods subsided, was greater than the role of men.

During the assessment, residents expressed a high awareness of flood risk management and mitigation, and showed significant experience in minimizing risks and addressing impacts at household level. Less, but still significant numbers (67%) were aware of the concepts of urban flooding and climate change. Fewer still were knowledgeable about proper waste disposal, and the role of garbage and construction materials in blocking drainage systems.

Eighty-three percent of respondents were aware of floods prior to their occurrence, demonstrating that government early warning systems through public media are very effective. When asked to identify the main cause of urban flooding in the assessment area, 42% of respondents said the main cause was the aged drainage system. Twenty eight percent of respondents said the main cause was climate change, 17% said the main cause was people's low awareness of the effects of garbage discharge into the drainage system, and 13% blamed Hanoi's rapid urbanization.

3.3.2 Gender-differentiated impacts

Several gender-differentiated impacts of flooding in Hanoi have been highlighted in the sections above. Prior to flooding, during flooding and

following floods, women were perceived to work longer hours, and to take on more additional tasks both in the household and at work, especially those working as street vendors. Roles of men and women in the family are different, pre-flood, post-flood, and during floods. Before floods occur, women normally prepare food reserves, tidy the house, and move goods to higher places. Men carry out heavier tasks such as flood-proofing the house to the extent possible, moving heavy furniture, and occasionally raising the height of doorsteps to prevent water entering the house, or clearing drainage systems. During floods, both women and men discharge water from the house and address immediate needs at home. Men often carry out further dredging of drainage systems. After floods, women carry out most of the tidying and cleaning work. The most strongly perceived impacts of floods on women were economic, as their reduced daily income could not match the higher costs for family food and living expenses during periods of flooding. Women vendors also faced economic impact when their stock or produce became wet or damaged. Apparently as a result of these gender-differentiated impacts, women also perceived greater impacts to their health and greater stress, than was perceived by men for themselves. Focus group discussions showed that while decision-making power of women in Hanoi is greater than decision-making power of women coming from rural areas, this difference narrowed during flooding, as men took more decisions about mitigation measures. This also led to increasing conflicts between wives and husbands, often exacerbated by temporary flood-induced financial constraints.

Despite significantly assessed gender-differentiated impacts of flooding, when survey respondents were asked about solutions to better respond to flooding, they suggested improved storage of food, updated weather forecasts, raising floors and doorsteps, and other measures, but few people suggested that housework should be more evenly shared, or that women should have a stronger role in the management of household-level disaster responses.

3.4 Implications

A range of implications can be drawn from the assessment results, which can feed into the design and analysis of flood risk management interventions in Hanoi.

Regarding responsibilities, residents and visitors were able to identify mitigation measures which they themselves intended to carry out, and they presumed to carry out these measures at their own cost. These included better clearing of garbage and construction materials from waterways; improving storage management for reserve food supplies; paying greater attention to weather forecasts; and better planning for quick removal of furniture and belongings to higher places in the home. However, they also perceived the need for the government to take responsible action by upgrading or reconstructing the relevant drainage systems.

Regarding location, the assessment highlighted the fact that flood risks and impacts for communities – including traffic congestion, inadequate drainage, water intrusion into houses, environmental pollution, and dangers from submerged hazards for vendors and taxi services – were experienced almost exclusively along roads. This implies that the road network can be considered as a framework for flood risk management and mitigation measures.

Regarding risk reduction, local partners carrying out the assessment identified communication and awareness-raising about urban flood risks, and about the gender-differentiated impacts of flood, as priority measures to reduce risks effectively. Suggested gender-related measures include promotion of discussions between women and men to share their workload, reducing working times for women during floods, and joint decision-making between women and men regarding measures before, during and after floods, because these measures can be most cost-effective in reducing flood impacts at household level. Greater participation and integration of women in formal decision-making for disaster reduction planning was also advocated. The suggested risk reduction measures have implications for the work of civil society organisations and 'mass organisations' (the Women's Union, Youth Union, and Fatherland Front), and for media organisations with a role in providing early warning and advice.

Waste disposal was considered as a major contributing factor to the severity of Hanoi's flooding, and whilst residents and visitors identified their own responsibility in addressing the issue, they also suggested that wider awareness-raising was needed, especially for street businesses/food outlets which regularly discharged their waste into the city's drainage system. Respondents to the survey also suggested that the government introduce tighter regulation and punitive measures for construction companies which allow construction materials to block drains, and that government agencies ensure that waterways are clear, prior to the rainy season. This has implications for municipal departments under the Hanoi People's Committee, and for the City Water Drainage Company of Hanoi.

Given the 'soft' nature of many of these recommendations, the appropriate agencies to follow through are likely to be civil society organisations and the 'mass organisation' such as the Women's Union which exist in Vietnam. These organisations are able to facilitate preparations for households and local businesses prior to the flood season, and to promote gender-based measures for reducing flood risk. However, these agencies may require funding and resources to properly carry out these functions, either from city government, or from within internationally funded flood risk reduction projects. The complexities of flood risk management cannot be left to hard, infrastructural measures alone, but simultaneous complementary approaches are needed, including those which directly address the perceived needs of residents and visitors, women and men.

3.5 Conclusions

Hanoi, as many other cities in developing countries, is frequently exposed to severe flood disasters, which pose great risk to the life and livelihood of its urban communities and jeopardise its socio-economic development. Rapid urbanization, an aging drainage system and climate change impacts exacerbate the problem of floods in the city.

The Impact Assessment carried out in Hanoi as part of the OSIRIS project revealed that improving drainage systems remains the highest priority for communities, to reduce flood risk. It also highlighted that the impacts of urban flooding in Hanoi are felt most acutely, and have the greatest economic and social impacts, along roads. Perhaps this is not surprising, as roads are the arteries of the city, and the busiest places in Hanoi. Therefore, maintaining the efficiency of roads during the frequent periods of flooding is a priority for local and national government investment.

At community level, in areas of Hanoi which have rapidly urbanised, flooding has high social, economic and environmental costs for both resident households and for visiting traders. These costs are absorbed at personal and household level, with little or no recognition or support from government or non-government institutions. Most of these costs are also not included in official flood damage assessments.

A group especially vulnerable to the impacts of urban flooding are women who live in outlying, often rural areas near the edge of the city, who travel, with their wares for sale, into the city each day, by motorcycle, bicycle or bus. The study confirms findings already documented in the literature, that the impacts of flooding are gender-differentiated, with women experiencing greater impacts than men. However, gender measures were not identified by communities or visitors, as solutions to the impacts of flooding, implying that gaps still exist between knowledge, attitudes and practice on gender equality at community level.

An important recommendation emerging from the study is that the government and communities urgently need to address the issue of poor solid waste disposal practices. Action in this field will need to be taken with industry, infrastructure development stakeholders, small businesses, and households.

Chapter 4: Examining the effectiveness of climate change communication with adolescents in Vietnam: The role of message congruency

"Will our children ask, why didn't you act? or [will they ask], HOW DID YOU FIND THE MORAL COURAGE TO RISE UP AND CHANGE?"

Al Gore, Founder and Chairman
The Climate Reality Project

Abstract:

Climate change makes coastal communities more vulnerable to floods associated with storm surges and sea level rise, requiring both adaptation and mitigation measures. Moreover, proper understanding of flood risks and their potential impacts on climate change appears to be a communication challenge. In climate change communication, the effect of framing congruency on perception of risk, efficacy and behavioural intentions towards climate change adaptation and mitigation has received limited attention. Messages have not been congruent in framing risks associated with climate change. Congruency is defined as the coherent alignment of several aspects of message content. Messages are considered congruent when they provide recipients with consistent contents such as giving concrete and actionable advice, or by providing more abstract and general background information. This research focuses on climate change communication in fostering mitigation behaviours among adolescents in vulnerable locations in the global South. Based on Construal Level Theory, this chapter investigates how message congruency affects the link between perceptions of climate change risk and efficacy and two predictors of behavioural change: perceived responsibility and mitigation intentions. An experiment was conducted to test the effect of congruent vs. incongruent risk communication among adolescents in highly vulnerable coastal communities in the Mekong Delta in Vietnam (N = 348). Multiple regression analysis found strong effects of congruency in message framing; when messages were congruent in the content, communicative interventions changed adolescents' perceptions and attitudes toward climate change mitigation more consistently. This research contributes both theoretically and practically to risk communication among adolescents and toward climate change mitigation behaviour.

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4.1 Introduction

Global climate change is posing serious risks for ecological and social systems worldwide (IPCC 1990; Sala et al. 2000; Bartlett 2008; Bellard et al. 2012; IPCC 2018). Climate change makes coastal communities even more vulnerable to floods associated with storm surges and sea level rise (Hall et al. 2006; Boateng 2012; Vousdoukas et al. 2018). Addressing climate change and its impacts requires adaptation as well as mitigation efforts (IPCC 1995). While adaptation deals with the consequences of climate change, mitigation aims to tackle its causes. Both adaptation and mitigation involve individuals along with societal responses. Efforts to address macro issues on climate change adaptation have been taking place in both developed and developing countries, especially regarding urban and environmental planning (e.g., understanding social norms and human behaviours in addressing global environmental challenges (Kinzig et al. 2013; Schill et al. 2019); urban planning and social learning to adapt to climate change (Uittenbroek, Janssen-Jansen, and Runhaar 2013; Huong and Pathirana 2013; Clemens et al. 2016; Chu 2016; Phuong, Tuan, and Phuc 2019). Understanding flood risks and potential impacts of climate change appears to be a communication challenge in addressing the determinants of risk negligence (Ngo, Poortvliet, and Feindt 2019). Climate change communication is therefore important to raise awareness, to garner support for collective initiatives, and to motivate individual action.

This research focuses on climate change communication to foster mitigation behaviours among adolescents in vulnerable locations in the global South. Mitigation was emphasized in the Paris Agreement with the goal to keep global temperature rise by the end of this century "well below 2 degrees Celsius above pre-industrial levels" (UN 2015). It involves manifold measures to reduce anthropogenic greenhouse gas emissions through policy, technology and behavioural changes (IPCC 2007). Successful mitigation requires coordinated societal action, but also responsible behaviour at the individual or organizational level. Therefore, it is vital to understand how people can be motivated to feel responsible for the climate impacts of their conduct and to adopt behavioural changes to environmentally more sustainable lifestyles. From a behaviour change perspective, this is the key task of climate change

communication. An essential starting point is that people tend to base their future behaviours on their past behaviours or habits (Ouellette and Wood 1998; Danner, Aarts, and Vries 2008; Ajzen 2011; Sheeran et al. 2017). Therefore, it is important for climate communication efforts to target young people, who are still in the process of forming habits, in order to promote societal change.

Despite major efforts, in particular since the creation of the Intergovernmental Panel on Climate Change (IPCC) in 1998, to engage and mobilize public support to address the causes of climate change, risk communication has had limited effects with often polarized debates and wide-spread scepticism (Moser and Dilling 2011; Spence, Poortinga, and Pidgeon 2012; Brügger, Morton, and Dessai 2016; Leal Filho 2019). A number of studies have argued that communicating a psychologically distant risk like climate change remains the biggest challenge for attempts to change individuals' behaviours in response to climate change (Leiserowitz 2006; Lorenzoni, Nicholson-Cole, and Whitmarsh 2007; Brügger et al. 2015; Jones, Hine, and Marks 2017). The notion of psychological distance is described in Construal Level Theory (CLT) as the ways people experience an object or event to be psychologically distant (i.e., abstract construal) or close (i.e., concrete construal) (Trope and Liberman 2010). Psychological distance is commonly defined in several dimensions, with spatial, temporal, social, and hypothetical distance being considered most important (Trope and Liberman 2010; Trope and Liberman 2003).

The aim of this research is to investigate how perceptions of climate change risk and efficacy influence two key predictors of behavioural change: one's perceived responsibility and one's mitigation intentions regarding climate change (Rogers 1975); further, it tests how congruency in risk messages moderates this relationship. Often, it has been observed that messages are not congruent in framing risks associated with climate change. Messages are considered congruent when they provide recipients with consistent contents such as giving clear advice on concrete actions (i.e., action-oriented), or by providing more general and abstract background information (i.e., information-oriented). Messages are considered as incongruent when they provide recipients with inconsistent contents such as linking abstract background information with advice on concrete actions or conveying

urgency without advice on concrete actions. People's reactions are strongly influenced by how the risk is presented (Moser 2010; Keller, Siegrist, and Gutscher 2006). For example, one common message framing technique in climate change communication is to present actionable advice to tackle climate change with messages that are intended to arouse emotions (Moser 2010; Nerlich, Koteyko, and Brown 2010; UNEP 2005). This framing method was not applied in many climate change communication attempts over the last two decades, which tended to instil anxiety and concern amongst audiences without providing viable solutions or actions to take (Leiserowitz 2006; Nisbet 2009; Covello and Sandman 2001; Reser and Bradley 2017; Nabi, Gustafson, and Jensen 2018) which may cause low congruency in framing messages and limited effectiveness of risk communication. Therefore, it is necessary to look at the importance of message congruency and risk perception interaction.

The chapter first reviews the literature on climate change communication, message representation, and applications of the CLT in framing psychological distance in climate change communication. In the following section, we present our research framework for message representation on climate change mitigation. We then present the findings of an experiment with adolescents in Vietnam's Mekong delta to investigate the role of communication in climate change mitigation. Vietnam is a country representative of an emerging economy in the developing world with a relatively young population. During the period 1991–2012 Vietnam's greenhouse gas emissions (GHG) increased on average by 12% annually, recording 251.0 $MtCO_2e$ (or million metric tons of carbon dioxide equivalent) in 2012, equivalent to 0.53% of global GHG emissions (USAID 2016). In 2013, the total GHG emission was recorded at 259.0 MtCO2e with LULUCF (i.e., Land Use, Land-Use Change and Forestry) sector and 293.3 MtCO2e without LULUCF sector, as reported in the Second Biennial Updated Report of Viet Nam to the United Nations Framework Convention on Climate Change (MONRE 2017). A further rapid increase is projected in the coming decades if no action is taken (UNFCCC 2016).

Vietnam is ranked as one of the most vulnerable countries to climate change (WB 2011; UNDP 2007). As an emerging economy, Vietnam is

being industrialized rapidly. Children and young adults under the age of 29 make up 50.25% of its fast-growing population (UNFPA-GSO 2016). In the near future, these generations will have more money to spend, will consume more, and as a direct consequence, will cause more greenhouse gas emissions. If no proper action is taken to educate these populations and make them aware and feel responsible for their sustainable behaviour, climate consequences will be more serious and meeting the emission reduction targets agreed in the 2015 Paris Agreement (UN 2015) will become more difficult. In the past few decades, initiatives have been taking place in Vietnam by the education management agencies both at central and local levels (Tho 2011; Duc 2010; Heck 2015; Dung 2018), community level (Ngo, Poortvliet, and Feindt 2019; Nguyen, Boon, and King 2015), and by various non-governmental organizations (ARC et al. 2013; OXFAM, MCD, and AMDI 2013; MCD and AMDI 2016) with the aim of integrating environmental and climate change-related education topics into existing curricular or extra-curricular activities for school children. These efforts have met with some initial success in terms of raising awareness of the younger generations to protect the environment and adapt to climate change (ARC et al. 2013; OXFAM, MCD, and AMDI 2013; MCD and AMDI 2016).

The experiment was conducted with adolescents (N = 384) from secondary schools in highly flood-prone communities due to climate change and associated sea level rise. In the experiment, we adopted a 2 × 2 factorial design (information-oriented vs. action-oriented and abstract vs. concrete messages) to test the effectiveness of risk messages that were either congruent or incongruent in framing the risk. Overall, the findings demonstrate that message representation and congruency play an important role. When the messages were congruent in content (i.e., they were either concrete and action-oriented, or abstract and information-oriented) then communicative interventions changed adolescents' perceptions on climate change severity and susceptibility more consistently, achieved a higher sense of self-response efficacy, and more adolescents were willing to perform climate change mitigation behaviours. However, the communicative content that creates perceived proximity is specific to each case, context, and target group.

4.2 Materials and methods

4.2.1 Message Representation and Construal Level Theory (CLT) in Climate Change Communication

Message Framing in Risk Communication and Climate Change

Message framing refers to a technique that allows people or companies to package their information for their intended audience. The message or information targets specific people based on its agenda and one can determine its results by the effect it has on the targeted audience (Moser 2010). A number of ways exist to define frames in communication science. (Gitlin) 1980 defined frames as "principles of selection, emphasis, and presentation composed of little tacit theories about what exists, what happens and what matters". Entman (1993) emphasized that framing essentially involves selection and salience. In a theoretical review of message framing in health, Wilson, Purdon, and Wallston (1988) summarized three types: gain, loss and fear which had widely been applied by scientists and practitioners to explore the communication effect of the relationship between behaviour change and consequence valence in risk, health and recently environmental protection communication. For example, a study by Rothman et al. (2006) revealed that gain-framed messages are more effective when targeting disease mitigation behaviours whereas loss-framed messages are more effective when targeting disease detection behaviours. In a meta-analytic review of relative persuasiveness of gain-and loss-framed messages to promote vaccination, the authors found no significant difference in the persuasiveness framed messages for encouraging vaccination (O'Keefe and Nan 2012).

There are various message framing methods that relay information depending on the message and audience. Message framing is an important aspect of developing information that communicates with the audience Ideally, a message that ponders its audience's desires and needs may create a more positive response than a message that is insistent and demanding. The popularity of framing in communication helps scholars in different disciplines such as political science, behavioural economics

and psychology (Cacciatore, Scheufele, and Iyengar 2016). However, the ambiguities that surround their conceptualization may cause confusion and become ineffective which requires communication experts to shift from an era of mass communication to tailor-made and specific-target audience communication. For example, the use of logic, ethics or emotions may highlight a person or group's core motivations (Moser 2010; Nerlich, Koteyko, and Brown 2010; Lakoff 2010).

In recent decades, in climate change communication to promote mitigation and adaptation behaviours by individuals and society, one of the main challenges faced by experts and practitioners is that of invisible causes, whereby climate change traits are not visible, making it hard to convince people that it exists (Spence, Poortinga, and Pidgeon 2012; Moser 2010; Nerlich, Koteyko, and Brown 2010; Lakoff 2010). Another challenge is distant impacts, whereby the cause of climate change is far from its effects (Spence, Poortinga, and Pidgeon 2012; Brügger, Morton, and Dessai 2016; Brügger et al. 2015). For instance, emission of greenhouse gas causes global warming which threatens the life of polar bears which do not attract much attention from people living in the hot climatic zones. Thus, it is hard to convince individuals and companies of the need to secure the environment or reduce emission. Therefore, message framing requires one to understand climate change causes and consequences at first hand, then work on effective message framing that will educate a society regardless of whether it is the cause or feels the effect of climate change.

Psychological Distance in Climate Change Communication

In this section, we review the literature around the topic of psychological distance in climate change communication. According to Trope and Liberman (Trope and Liberman 2003), this is described as the ways people experience an object or event to be psychologically distant (i.e., abstract construal) or close (i.e., concrete construal) and is commonly defined on several dimensions (e.g., spatial, temporal, social, and hypothetical). A framing method that has received much attention in recent decades in climate change communication research has employed the concept of psychological distance (Brügger et al. 2015; Jones, Hine, and Marks 2017;

Brügger 2020; Singh et al. 2017; Terpstra 2011; Brody et al. 2008). CLT suggests that varying levels of psychological distance affect individuals' perceptions of risk and their judgments with regard to decision-making behaviours (Trope and Liberman 2010; Trope and Liberman 2003). When the perceived psychological distance between an individual and a risk increases, the risk is construed more abstractly (Zwickle and Wilson 2013). Consequently, individuals that experience a risk as psychologically distant and abstract, across a variety of domains, are more likely to downplay the risk than those who perceive it as psychologically proximal and concrete (Zwickle and Wilson 2013).

Despite numerous studies on climate change communication and message development, the effects of reframing climate change from "distal or further away" to "proximal or closer to the its origin" as a strategy to change the public's perceptions and behavioural intentions also significantly vary due to people's experience of climate change as something psychologically distant (Moser and Dilling 2011; Brügger et al. 2015; Trope and Liberman 2010; Spence and Pidgeon 2010). For example, Brügger et al. (2015) found that "participants with a distant focus relied more on scepticism to represent risks and make decisions about supporting climate change, whereas participants with a proximal perspective relied more on fear when making such judgments". In contrast, Spence and Pidgeon (2010) found that "framing climate change impacts as distant resulted in climate change impacts being perceived as more severe, whilst attitudes towards climate change mitigation were more positive when participants were asked to consider social rather than personal aspects of climate change".

Moreover, existing studies of psychological distance have so far underexplored individual differences or contextual variables as drivers for climate change perception and behavioural change (Moser and Dilling 2011; Brügger et al. 2015; Trope and Liberman 2010; Brügger 2020; Spence and Pidgeon 2010). This is an important aspect to consider because climate change communication meets recipients with existing attitudes, values, and perceptions. Therefore, in this research we investigate the effectiveness of climate change communication, given a person's appraisal of the climate change threat and of efficacy related to mitigation behaviours.

Appraisal of Threat and Efficacy in Mitigation Behaviour

According to the extended parallel processing model (EPPM) developed by Witte (Witte 1992) —a framework that predicts how individuals react when being confronted with appeals to fear—a person's intention to protect oneself against a given risk depends on the perceived severity and susceptibility of the threat and the perceived self-efficacy and response efficacy. We will now elaborate upon each of these four factors: (1) perceived severity refers to an individual's subjective perception of the magnitude of a threat or risk (Smith, Ferrara, and Witte 2007); (2) perceived susceptibility to a risk entails the appraisal of one's vulnerability regarding the risk; (3) self-efficacy refers to an individual's subjective perception of his or her ability to successfully perform risk mitigation practices; and (4) response efficacy means the perceived effectiveness of the risk mitigation behaviours. Reviews of EPPM (Witte 1992; Witte 1993; Witte and Allen 2000; So 2013) studies have firmly established that perceptions of severity, susceptibility, self-efficacy, and response efficacy are positively associated with peoples' inclination to exert self-protective behaviours. Threat and efficacy perceptions play a "critical role in determining" subsequent attitudes toward risks (Maloney, Lapinski, and Witte 2011). Communicating climate change threats without efficacy information failed to trigger changes in audience attitudes (Hart and Feldman 2014). The threats posed by climate change should be communicated, along with efficacy content, to be effective in climate change risk communication (Roser-Renouf et al. 2014). In the research presented here we put forward the notion that these perceptions of threats and efficacy are moderated by the congruency of climate change communication.

Congruency in Climate Change Communication

It is commonly agreed that climate change communication is challenging due to the inherently uncertain and abstract nature of climate change in terms of temporal, social, and geographical impacts (Spence, Poortinga, and Pidgeon 2012; Leiserowitz 2006; Jones, Hine, and Marks 2017; Liberman, Sagristano, and Trope 2002). Communication frames were effective if they participated in "reducing the amount of psychological distance separating

an individual and a risk" (Zwickle and Wilson 2013). For example, bringing "the abstract risk closer to the individual" makes a risk more personal to an individual and can reduce the abstractness of the risk (here: climate change); on the other hand, making "an individual think more abstractly (bringing the individual closer to the risk) also helps to reduce the amount of psychological distance about that risk (here: climate change) that closes the gap between the abstract risk and the person's experience" (Zwickle and Wilson 2013). However, risk communication may become ineffective if messages contain a mix of abstract and concrete elements (Zwickle and Wilson 2013).

In this research, we take this notion one step further by positing that congruency in terms of construal levels matters, as a message can be predominantly information-oriented or action-oriented. We define congruency as the coherent alignment of several aspects of message content. With regard to climate change communication, not only the level of abstraction in the presentation of the threat is important, but also whether the message is either information-oriented or action-oriented. We will explore message congruency, which has been extensively studied in brand marketing science (Halkias and Kokkinaki 2013) and health (Updegraff et al. 2007; Sherman, Traci, and Updegraff 2006; Kidwell, Farmer, and Hardesty 2013), by testing whether messages framed in a more congruent way are more effective in promoting behavioural intentions to climate change adaptation or mitigation than incongruently framed messages. We propose that messages are congruent if their content is either concrete and action-oriented, or abstract and information-oriented. In contrast, messages are incongruent when no such alignment exists—i.e., if messages are abstract and action-oriented, or concrete and information-oriented (see Table 4.1). We expect that the combination of concrete and action-oriented messages will couple lively psychological experience with clear behavioural options, thus reducing barriers to act; while the combination of abstract and information-oriented messages will facilitate the adoption of a more contemplative perspective, especially in the case of a long-term phenomenon like climate change.

Table 4.1. Factorial design 2 × 2 on message congruency

	Congruency	
Message Framing	Congruent	Incongruent
	Information-oriented × Abstract	Information-oriented × Concrete
	Action-oriented × Concrete	Action-oriented × Abstract

Climate change communication may become most effective when it connects to individuals' risk perceptions and helps the audience to make sense of the problem, while suggesting that response actions must also comply with the audiences' normative attitudes. From the perspective of CLT, it has been argued that "decreasing psychological distance should not itself influence people's willingness to act but change the processes that underlie individual decision-making" (Brügger, Morton, and Dessai 2016). Participants with a distant focus are more sceptical about the risks and about decision-making to support climate change, whereas participants with a proximal perspective tend to perceive a higher susceptibility when making such judgments (Brügger, Morton, and Dessai 2016). Simply making the climate change impacts seem closer to people will not necessarily increase their engagement in climate change actions, and therefore it requires a more differentiated perspective on the effects of psychological distance in the context of climate change, and one significantly related to decision-making behaviours (Spence, Poortinga, and Pidgeon 2012; Brügger, Morton, and Dessai 2016).

4.2.2 Research Framework

To investigate the interaction between climate change risk perceptions and message congruency, we propose a research framework (Figure 4.1) that is rooted in Construal Level Theory (CLT) developed by Trope and Liberman (2003) —a theory that describes the relation between psychological distance and the extent to which people's thinking is abstract or concrete. According to the Theory of Planned Behaviour (TPB), behavioural intentions "can be predicted with high accuracy from attitudes toward the behaviour", and these behavioural intentions "together with perceptions of behavioural

control, account for considerable variance in actual behaviour" (Ajzen 1991). In general, the framework treats threat and efficacy perceptions as independent variables that affect the perceived responsibility and the intention to adopt responsive behaviours, with message congruency as a moderating factor. From EPPM theory, we adopt perceived severity, susceptibility, self-efficacy, and response efficacy to climate change as the four independent variables. The two dependent (or outcome) variables to examine the predictors of behavioural change are perceived responsibility and mitigation intentions. We investigate the influence of the moderator variable congruency by testing whether the relationship between individual perceptions on mitigation intentions and perceived responsibility is dependent on climate change message congruency.

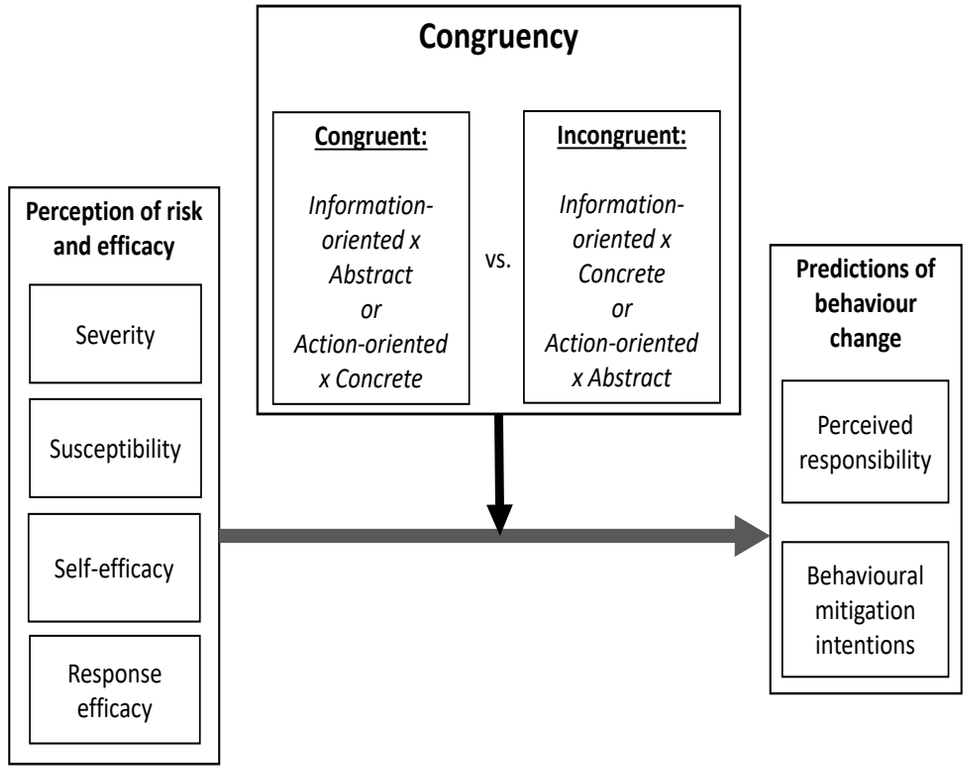

Figure 4.1. Research framework

The analysis was organized around two hypotheses:

Hypothesis 1: Perceptions of risk and efficacy have a positive relationship with predictors of behavioural change, i.e., perceived responsibility and mitigation intentions regarding climate change (see Figure 4.1).

Hypothesis 2: The strength of this relationship is moderated by congruency in risk messages: we expect a stronger relation when messages are congruent (either abstract and information-oriented, or concrete and action-oriented) rather than incongruent (messages that are either abstract and action-oriented, or concrete and information-oriented).

4.2.3 Methods

Research Sites

The research was conducted in Can Tho City, which is located in the Mekong Delta of Vietnam and adjacent to one of the arms of the Mekong River (see Figure 4.2). This region is one of the world's most vulnerable areas to climate change impacts (MONRE 2012). According to Vietnam Climate Change and Sea Level Rise scenarios, under the Representative Concentration Pathway (RCP) 6.0 (high emission scenario), the sea level is projected to rise between 37 to 82 cm by the end of the 21st century (MONRE 2016). This would cause major flooding in the Mekong delta; a sea level rise of 100 cm is projected to inundate 38.9% of the Mekong delta land surface. As a result, the biggest rice and aquaculture farming area of Vietnam will be under serious risk of lost production that will affect food security and people's livelihood.

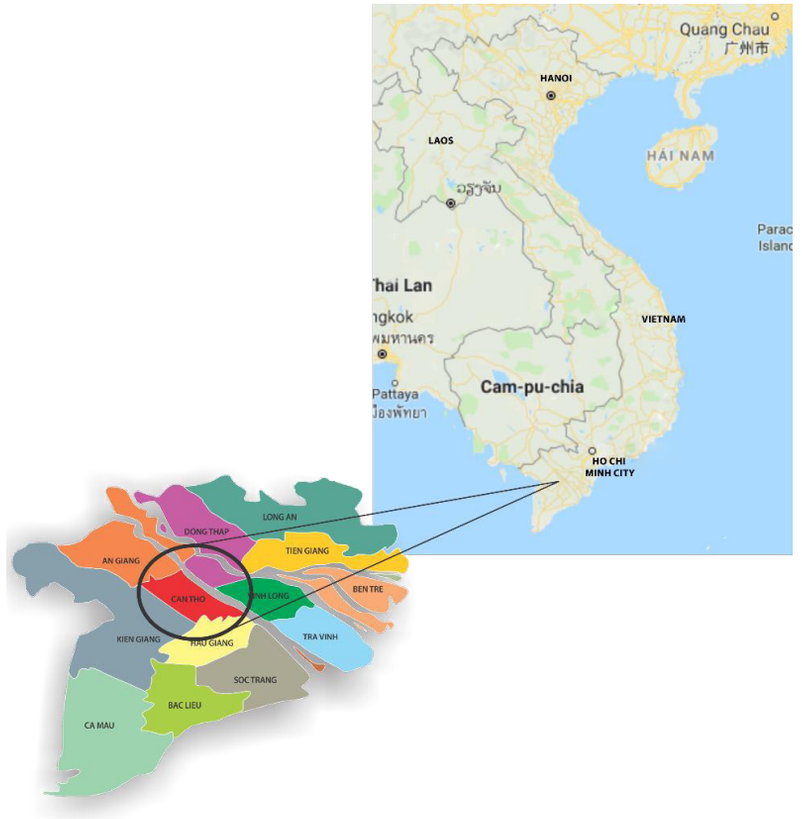

Figure 4.2. Research location

Participants and Design

This research was conducted among adolescents in the Mekong delta in Vietnam. This is a relevant target group and research location, because the frequency and intensity of extreme weather events and associated economic and health consequences will intensify and disproportionately affect vulnerable populations including children and adolescents, the poor, and the elderly (WB 2011; UNDP 2007; IPCC 2007). Secondary schools in the immediate vicinity of Can Tho City were designated as the research location. In consultation with the local climate change office, these schools were selected as they had no previous climate change project or communication campaign. The school headmasters announced the research and recruited a

voluntary sample of 348 secondary-school pupils (adolescents) of seventh and eighth grades, aged 13 to 15 years. Students were randomly assigned to one of the conditions of the 2 × 2 factorial design (information-oriented vs. action-oriented messages and abstract vs. concrete messages). Between 81 and 90 students participated in each condition.

Procedure

A pilot study to test the experimental materials and survey items and to optimize the final research setup was conducted with 24 eighth grade students in a secondary school in suburban Hanoi (to avoid potential spill-over effects on the participants in the main study in Can Tho City). Based on the pilot experiences, the research team adjusted some of the texts used in the communication messages to make them more relevant to adolescents and the local context of a rural setting.

For the main survey, ten university students from the Department of Environmental and Natural Resources at Can Tho University were trained as research assistants. The survey was conducted during one visit to the school. A month before the actual study was conducted at the selected schools, the research team worked with the schools' management boards to inform them about the study and to recruit the participants. At the beginning of the visit, all secondary-school participants were gathered in the school hall and briefed about the research. The researchers emphasized voluntary participation and informed that any students who felt not willing to participate were not required to do so. During the study, if students did not want to continue, they could stop and leave the classroom. Before participation in the survey, each student completed a consent form to document voluntary participation. The students were then randomly assigned to different classrooms for each of the conditions, where they received questionnaires and pens. The participants were first asked to respond to questions about their perceptions of climate severity and susceptibility, self-efficacy, and response efficacy. After a 15-min break, they were asked to read the communication messages pertaining to their experimental condition and to take notes; this took around 15 min. Finally, the participants received a questionnaire related to the dependent variables

of our research framework, i.e., perceived responsibility and mitigation intentions. In total, the experiment lasted around 120 min. Students were asked not to discuss the message content, nor how to answer the survey questions. Researchers were present in each classroom to supervise the experiment and provide support to students. At the end of the experiment, the teachers, researchers, and supervisors thanked the students for their participation and each student received a small gift.

Four versions of pre-printed climate messages were pre-tested in the pilot, then revised and used in the study. The messages were developed using IPCC's terms on climate change in the Fifth Assessment Report (IPCC 2014) and tailored to suit the research context in Can Tho City. Each set of communication messages represented one of the factorial conditions; either information-oriented and abstract, information-oriented and concrete, action-oriented and abstract, or action-oriented and concrete. The complete messages can be found in Appendix 4.1.

The information-oriented messages emphasized the information (threat: severity, susceptibility) about climate change without any suggested actions (abstract framed message, e.g., future, global/ polar, other/ out-group/ dissimilar, unlikely) while action-oriented message suggested specific actions to respond to climate change (concrete-framed message, e.g., present, local, self/in-group/ similar, likely) in the printed messages (self-efficacy). The abstract messages emphasized general information about climate change (threat: severity, susceptibility) while the concrete messages emphasized the benefits of taking suggested actions to encourage adolescents to do something to mitigate the climate change (response-efficacy).

For example, an information-oriented message in combination with an abstract message (congruent) was framed like this: "The phenomenon of climate change will very likely cause land and ocean surface temperatures to rise". An information-oriented in combination with a concrete message (incongruent) was framed like this: "The phenomenon of climate change has already caused Can Tho's temperature to rise and will very likely make Can Tho's weather hotter over the next 10 years". An action-oriented in

combination with abstract message (incongruent) was framed like this: "The phenomenon of climate change will highly likely cause land and ocean surface temperatures to rise. This effect can be countered by reducing deforestation and planting more trees". An action-oriented in combination with a concrete message (congruent) was framed like this: "The phenomenon of climate change has already caused Can Tho's average temperatures to rise and will very likely make Can Tho's weather hotter over the next 10 years. You can counter this effect indirectly by less burning of fuels, by walking instead of riding motorbikes, and by planting more trees to offer shade to people and farm animals".

Measurements

We now explain the measurements used to analyse the survey:

- The perceived severity of climate change impacts was measured by using four items, each with a 5-point Likert scale, which were combined to form a reliable scale (α = 0.80); (α or Cronbach's alpha was calculated by correlating the score for each scale item, with the total score for each response, then comparing the result to the variance for all individual item scores). A sample item was: "I believe that climate change is severe' with response options ranging from 1 (agree not at all) to 5 (agree very much)".
- The perceived susceptibility of climate change impacts was measured by a second scale (α = 0.71) that consisted of four items with 5-point Likert scale questions, for example, "I am at risk from the consequence of climate change".
- Self-efficacy was measured by five items with 5-point Likert scale questions (α = 0.67), for example, "I am capable of walking or going by bicycle to school to mitigate climate change".
- Response efficacy was measured by four items with 5-point Likert scale questions (α = 0.70), for example "Reducing the use of electricity and fuel is effective in mitigating climate change".

- Behavioural intentions for climate change mitigation were measured by eleven items (5-point Likert scale; α = 0.74). This section was introduced with the frame: "There are some things that can be done against climate change. Please indicate how likely it is that you personally will perform the activities mentioned below". Then participants were asked about the likelihood of adopting specific activities, e.g., "Will you turn off lights or fan after use?".
- Perceived responsibility was measured by six items (5-point Likert scale; α = 0.70). A sample item was, for example, "Not only the government is responsible for climate change problems, but me too".

In addition, the participants were asked about general demographic information (gender, age, school) and their current practices in everyday life to protect the environment. The complete questionnaire can be found in Appendix 4.2.

Data Analysis

Data from filled-in questionnaires were entered into SPSS by using data double-entry (data was entered into the system twice) to reduce errors. Descriptive statistics and regression analyses were conducted to test the conceptual model. In order to test the moderating role of message framing congruency, we first constructed the moderator variable by recoding the four treatment conditions into two congruency conditions: the congruent condition was formed by the concrete/action-oriented conditions and the abstract/information-oriented conditions; the non-congruent condition was formed by the abstract/action-oriented conditions and the concrete/information-oriented conditions. We performed regression analyses to look at the relationship between the independent variables of perception measures (risk: severity and susceptibility, and efficacy: self and response efficacy) and the outcome variables (predictors of behavioural change: perceived responsibility and mitigation intentions) for both congruent and non-congruent message framing conditions (moderator: congruency variable). To illustrate the trend of these relationships, we plotted the slopes in a 3-dimensional graph where the horizontal axis represents the independent variables, the vertical axis the outcome variables and the third dimension the message congruency (Dawson 2014).

4.3 Results

4.3.1 Descriptive Statistics

Of the 348 participants, 47.1% were male, 52.6% were female and 0.3% did not reveal their gender. Their age ranged from 12 to 15 years (*Mage* = 13.62; *SD* = 0.68). 58.6% of participants attended seventh grade and 41.4% eighth grade. Regarding environmental protection at home, in their school, or community, 60.6% indicated they never participated in such activities while 32.4% did. Asked about their current practices related to environmental protection, most participants (93.4%) responded that they turn off the lights when leaving a room, 91.7% turn off water taps after use, 64.1% protect trees around their homes, 56.0% separate household waste for recycling, 48.0% save water, and 43.1% limit the use of plastic bags.

4.3.2 Test of the Conceptual Model: Interactive Effects of Risk and Efficacy Perceptions and Congruency on Mitigation Intentions and Perceived Responsibility

We ran a series of regression analyses to test the hypothesized relationship between risk variables (severity, susceptibility), efficacy perception variables (self and response efficacy), the moderator variable (congruency) and the two outcome variables (mitigation intentions and perceived responsibility to climate change). Step 1 included the independent variables of perceptions of risk and efficacy and the congruency variable; step 2 included the interaction term between perceptions of risk and efficacy (independent variables) and congruency (moderator variables). We first report on the results of the interactive effect of congruency and severity perceptions, followed by its joint effects with susceptibility, self-efficacy, and response efficacy, respectively.

The results (see Table 4.2) show that perceived severity was positively related to perceived responsibility (β = 0.32, $p < 0.001$). Then in step 2, the interaction term between severity and congruency was entered into the analysis model. This yielded a significant interaction effect (β = 0.77, $p < 0.01$), as shown in Figure 4.3. The positive relationship between severity

and perceived responsibility was stronger under the high congruency conditions as compared to the low congruency conditions.

Table 4.2. Results of regression analysis of congruency and severity perceptions on predictors of behavioural change

	Perceived Responsibility		Mitigation Intentions	
Step and Variables	1	2	1	2
1. Congruency	−0.00	−0.76 **	−0.02	−0.56 †
Severity	0.32 ***	0.34 ***	0.15 **	0.15 **
2. Interaction		0.77 **		0.55 †
ΔR^2	0.10 ***	0.02 **	0.02 *	0.01 †
Adjusted R^2	0.10 ***	0.12 ***	0.02 *	0.02 *

Note: Standardized regression coefficients are reported. † $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

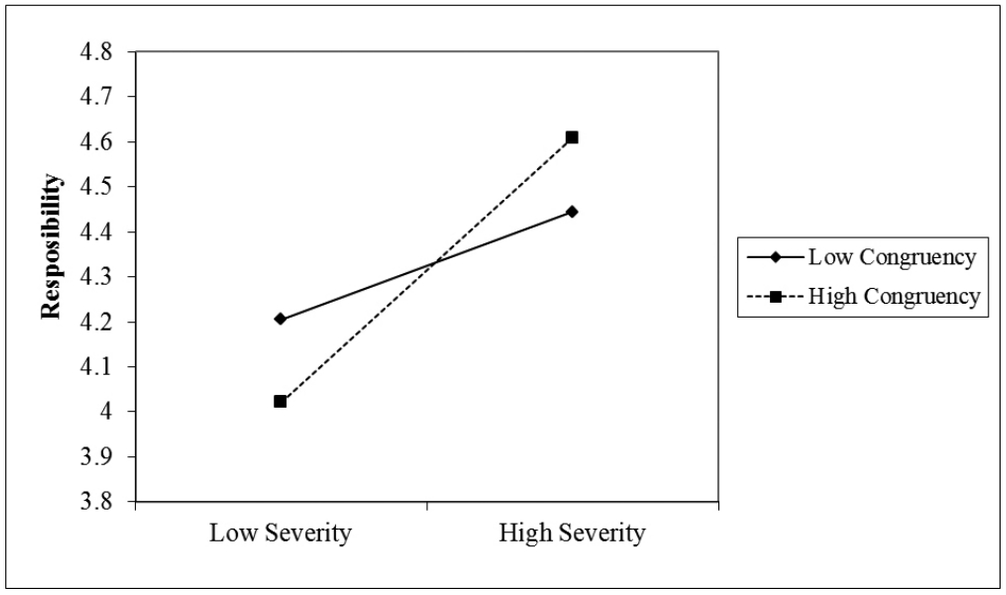

Figure 4.3. Interactive effect of perceived risk severity and level of congruency on perceived responsibility

Perceived severity (β = 0.15, $p < 0.01$) was also positively related to mitigation intentions (see Table 4.2). Entering the interaction term between severity and congruency yielded a marginally significant interaction effect (β = 0.55, $p < 0.10$) (see Table 4.2), as plotted in Figure 4.4. As predicted, the relationship between perceived severity and mitigation intentions

was stronger in the high congruency condition as compared to the low congruency condition.

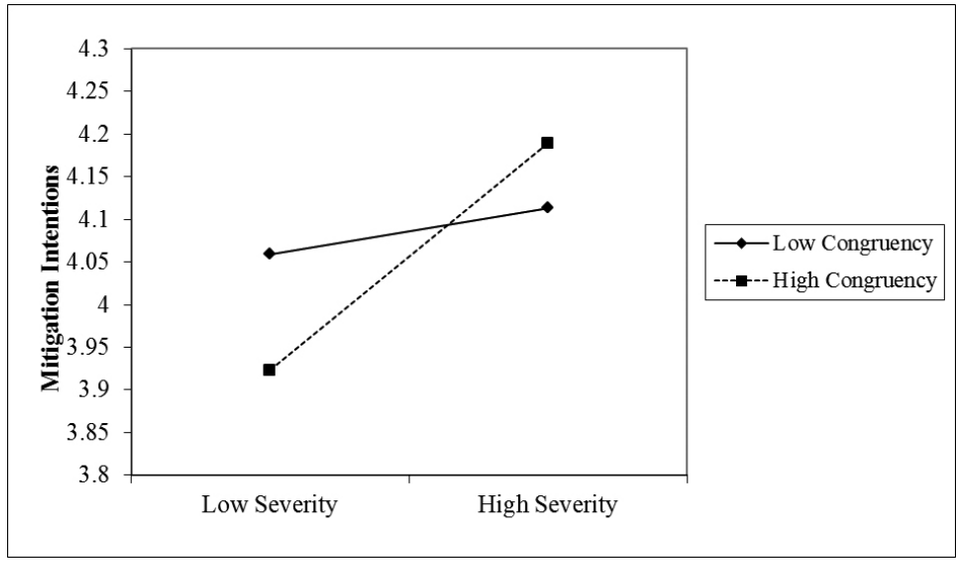

Figure 4.4. Interactive effect of perceived risk severity and level of congruency on mitigation intention

The results in Table 4.3 indicate that perceived susceptibility (β = 0.26, p < 0.001) was also positively related to perceived responsibility. Entering the interaction term between susceptibility and congruency into the analysis model yielded a marginally significant interaction effect (β = 0.36, p < 0.10). Figure 4.5 shows that the relationship between susceptibility and perceived responsibility was stronger in the high congruency condition as compared to the low congruency condition.

Table 4.3. Results of regression analysis of congruency and susceptibility perceptions on predictors of behavioural change

	Perceived Responsibility		Mitigation Intentions	
Step and Variables	1	2	1	2
1. Congruency	−0.01	0.36 *	−0.03	−0.48 *
Severity	0.26 ***	0.26 ***	0.12 *	0.12 *
2. Interaction		0.36 †		0.47 *
ΔR^2	0.07 ***	0.01 *	0.02 †	0.01 *
Adjusted R^2	0.06 ***	0.07 ***	0.01 †	0.02 *

Note: Standardized regression coefficients are reported. † p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

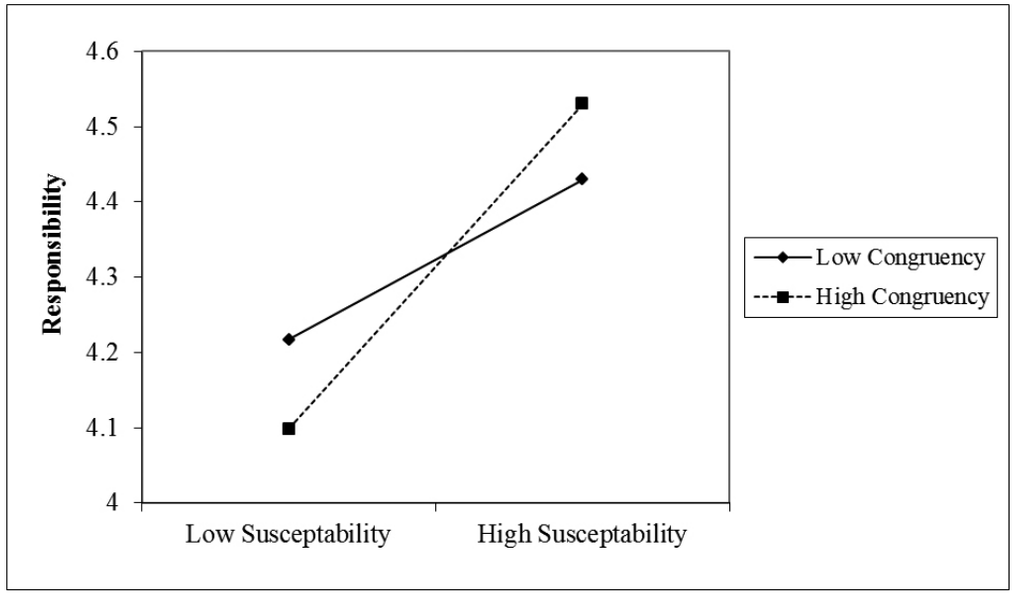

Figure 4.5. Interactive effect of perceived risk susceptibility and level of congruency on perceived responsibility

Perceived susceptibility to climate risks was also positively related to mitigation intentions (β = 0.12, p < 0.05) (see Table 4.3). Entering the interaction term between susceptibility and congruency yielded a significant interaction effect (β = 0.47, p < 0.05) (see Table 4.3), which is plotted in Figure 4.6. As predicted, the relationship between susceptibility and mitigation intentions was stronger in the high congruency condition as compared to the low congruency condition.

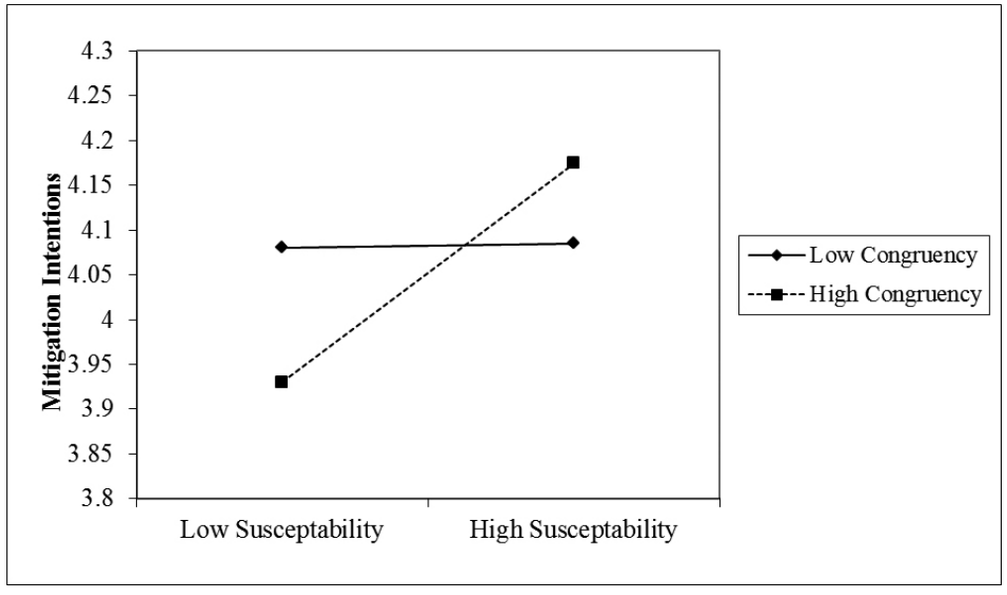

Figure 4.6. Interactive effect of perceived risk susceptibility and level of congruency with mitigation intention

Table 4.4 shows that also perceived self-efficacy (β = 0.32, $p < 0.001$) was positively related to perceived responsibility. When the interaction term between self-efficacy and congruency was entered into the analysis model, however, this did not yield a significant interaction effect (β = 0.43, n.s.).

Table 4.4. Results of regression analysis of congruency and self-efficacy perceptions on predictors of behavioural change

	Perceived Responsibility		Mitigation Intentions	
Step and Variables	1	2	1	2
1. Congruency	0.01	−0.42	−0.02	−0.56 *
Severity	0.26 ***	0.26 ***	0.17 **	0.18 **
2. Interaction		0.43		0.54 †
ΔR^2	0.07 ***	0.01	0.03 **	0.01 †
Adjusted R^2	0.06 ***	0.07 ***	0.03 **	0.03 **

Note: Standardized regression coefficients are reported. † $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Furthermore, perceived self-efficacy (β = 0.17, $p < 0.01$) was also positively related to mitigation intentions (see Table 4.4). When the interaction term between self-efficacy and congruency was entered into the analysis model, this yielded a marginal interaction effect (β = 0.54, $p < 0.10$), and we

plotted this in Figure 4.7 (see Table 4.4). As predicted, this showed that the relationship between self-efficacy and mitigation intentions was stronger in the high congruency conditions as compared to the low congruency conditions.

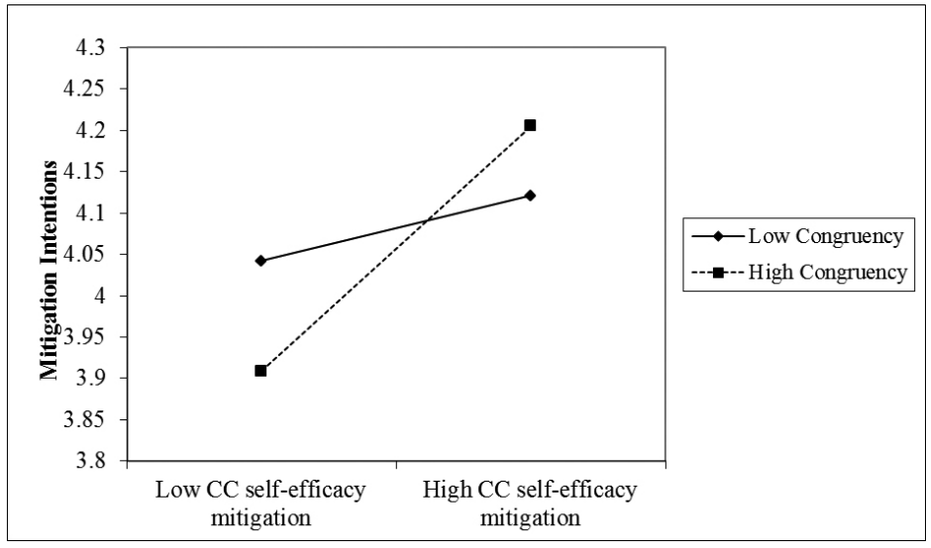

Figure 4.7. Interactive effect of perceived self-efficacy and level of congruency with mitigation intention

Table 4.5 shows that perceived response efficacy (β = 0.02, $p < 0.001$) was positively related to perceived responsibility. When the interaction term between response efficacy and congruency was entered into the analysis model, this yielded a significant interaction effect (β = 0.59, $p < 0.05$), as plotted in Figure 4.8. This showed that the relationship between response efficacy and perceived responsibility was stronger in the high congruency condition as compared to the low congruency condition.

Table 4.5. Results of regression analysis of congruency and response efficacy perceptions on predictors of behavioural change

	Perceived Responsibility		Mitigation Intentions	
Step and Variables	1	2	1	2
1. Congruency	0.01	−0.58 *	−0.03	−0.30
Severity	0.02 ***	0.22 ***	0.15 **	0.16 **
2. Interaction		0.59 *		0.27
ΔR^2	0.04 **	0.01 *	0.02 *	0.00
Adjusted R^2	0.03 **	0.04 **	0.02 *	0.02 *

Note: Standardized regression coefficients are reported. † $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

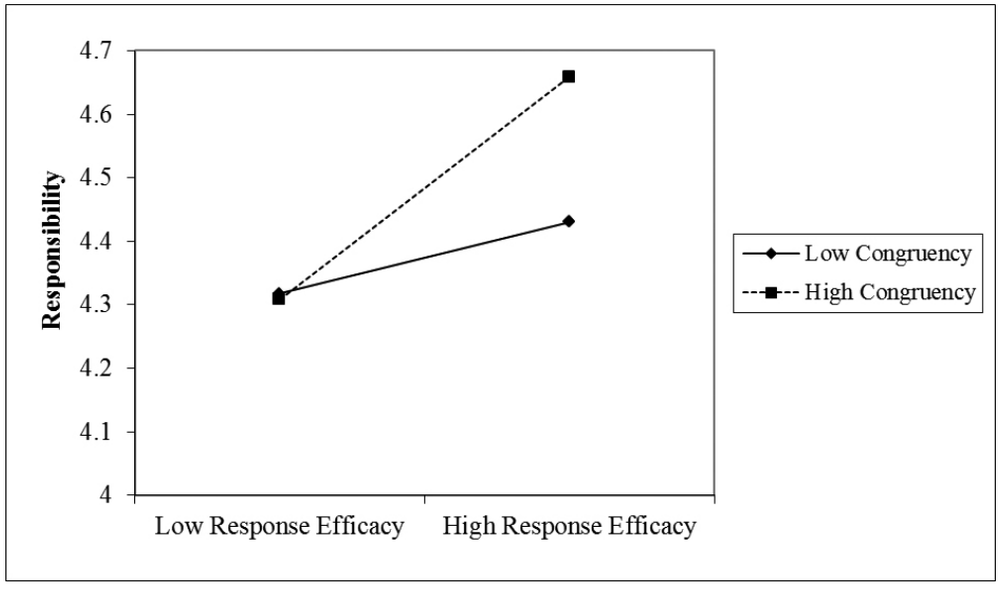

Figure 4.8. Interactive effect of perceived response efficacy and level of congruency on perceived responsibility

As expected, response efficacy (β = 0.15, p < 0.01) was also positively related to mitigation intentions (see Table 4.5). When the interaction term between severity and congruency was entered into the analysis model, however, this did not yield a significant interaction effect (β = 0.27, n.s.).

4.4 Discussion

4.4.1 General Discussion

Assessment of the effects of message framing in reducing the psychological distance of climate change as a strategy to change the public's perceptions and behavioural intentions have met with mixed success (e.g., Brügger et al. 2015; Jones, Hine, and Marks 2017; Trope and Liberman 2010; Trope and Liberman 2003; Terpstra 2011; Spence and Pidgeon 2010). Our approach suggests that previous research may not have sufficiently considered: (1) the effects of risk and efficacy perceptions on behavioural intentions and (2) the effects of message congruency on both risk and efficacy perceptions as well as on behavioural intentions among audiences. Therefore, our research framework combined perceptions of climate change

threats and efficacy as predictors of behavioural change with congruency in risk messages as a potential moderator of this relationship. This framework allows the assessment of an additional dimension of framing effects in climate change communication by testing the expectation that congruent message frames will bolster the relation between perceptions of risk and efficacy and adolescents' felt responsibility and behavioural intentions toward climate change mitigation.

We applied CLT in designing messages (abstract vs. concrete and information vs. action-oriented) to address psychological distance which is largely agreed as a barrier to effective climate change communication (Leiserowitz 2006; Lorenzoni, Nicholson-Cole, and Whitmarsh 2007; Jones, Hine, and Marks 2017; Trope and Liberman 2003). We further applied the concepts identified in the EPPM to assess the levels of risk and efficacy perceptions about climate change (severity, susceptibility, self and response efficacy), and evaluate their influence on the behavioural intentions of the message recipients (perceived responsibility and intentions towards climate change mitigation). We also measured the perceptions of risk and efficacy towards climate change mitigation before exposing adolescents to communication messages about climate change that were either low or high in message congruency.

The overall results of this study were consistent with previous studies on message framing, psychological distance, and congruency in message representation (Spence, Poortinga, and Pidgeon 2012; Brügger, Morton, and Dessai 2016; Trope and Liberman 2010; Zwickle and Wilson 2013). The research findings confirm existing arguments that communicating climate change threats in combination with efficacy is more effective in triggering changes in audience attitudes toward taking response measures (Hart and Feldman 2014; Roser-Renouf et al. 2014). The study further investigated messages framed either abstractly or concretely and framed as either action-oriented or information-oriented to predict changes in behavioural intention towards climate change mitigation among adolescents. The findings confirmed Hypothesis 1 that perceptions of risk severity and susceptibility as well as perceived self-efficacy and response efficacy have a positive relationship with two predictors of behavioural change:

perceived responsibility and mitigation intentions regarding climate change. We were able to confirm that the combination of concrete and action-oriented messages coupled lively psychological experience with clear behavioural options, thus reducing barriers to act; while the combination of abstract and information-oriented messages facilitated the adoption of a more contemplative perspective, especially in the case of a long-term phenomenon like climate change.

Furthermore, the research findings confirm Hypothesis 2 that the strength of this relationship is moderated by congruency in risk messages; a stronger relation was observed between risk and efficacy perceptions and predictors of behavioural intentions to climate change mitigation when messages were congruent, in line with earlier research (Zwickle and Wilson 2013). The research findings confirm that higher perception of risk (severity, susceptibility) and efficacy (self- and response efficacy) lead to higher levels of assumed responsibility and behavioural intentions towards climate change mitigation, but more strongly so under high message congruency conditions. We were able to conclude that messages which are congruently designed boost the relation between risk and efficacy perceptions and the behavioural outcome variables.

So far, studies on framing effects of climate change messages are limited (Feldman and Hart 2018; Bernauer and McGrath 2016; Wolsko, Ariceaga, and Seiden 2016), and even fewer address the effects in communicating with adolescents. For example, one study in Sweden on children's coping strategies revealed that different response strategies—problem-focused, de-emphasizing the seriousness of climate change, and meaning-focused—created either positive or negative effects on measures of children's environmental engagement (Ojala 2012). Another study among adolescents in North Carolina, USA, found that climate change messages—when congruently framed with agricultural and environmental content—elicited more worry and hope than messages when congruently framed with community and health frames; and adolescents who worried more about climate change were more supportive of taking individual or collective action (Stevenson et al. 2014).

As argued above, people's future behaviours are influenced by their past behaviours or habits; therefore, it is important to target the younger generations for any climate change communication effort aiming at societal change. Previous studies on children also confirmed that the "late childhood and early adolescent" development period is vital for children to develop their interest in environmental issues (Bartlett 2008; Ojala 2012; Blanchet-Cohen 2008; Chawla and Cushing 2007). Adolescents become capable of abstract thinking and start showing an interest in larger issues and global topics such as environmental crisis or climate change (Holden 2007); climate change creates particular and disproportionate risks to urban children in poverty due to both extreme events and changing weather patterns (Bartlett 2008). A study by Sheffield and Landrigan (2011) found that in the year 2000 climate change was responsible (directly and indirectly) for more than 150,000 deaths worldwide, of which children and adolescents accounted for 88%. Climate change urgently requires a sustainable society, especially among the younger generations (Ojala 2012). However, most previous studies were carried out in developed nations. Few studies are available in the developing world as well as studies to understand children's (or adults') perception of climate change risks, and even fewer on how to communicate climate change to adolescents (Ngo, Poortvliet, and Feindt 2019; Stevenson et al. 2014). This research contributed to a better understanding of the existing knowledge gap by conducting an experiment on climate change communication with adolescents in Vietnam, a developing country that is highly vulnerable to climate change impacts.

In summary this empirical research offers new evidence regarding message framing and congruency in climate change communication aimed at behavioural change among adolescents. An interesting observation was that, for this group of adolescents, climate change communication was more effective on mitigation than adaptation behaviours. This might reflect a perception of climate change as distant, due to the longer personal time horizon of adolescents and their currently limited autonomy in the household.

4.4.2 Theoretical and Practical Implications

In CLT, there are two approaches for reducing psychological distance: (i) bringing the risk closer to the individual or (ii) bringing the individual closer to the risk (Zwickle and Wilson 2013). For risk communication, framing messages is only effective on the individual's perceived construal level if it is "composed on a single level of construal" and in a congruent manner (Zwickle and Wilson 2013). In this research, by testing the effects of message congruency between the levels of threat proximity and action- vs. information-oriented construal, the research found that congruency in message framing plays an important role in explaining communication effects. Only when the messages are congruent in the content do the manipulations more consistently change adolescents' perceptions and attitudes. This research also contributed to narrowing the knowledge gaps about the conditions for climate change communication among adolescents in the developing world, and probably in other parts of the world, with the hope that they will foster a more sustainable lifestyle to combat global climate change impacts in the future.

This research contributes both theoretically and practically to climate change risk communication among adolescents towards mitigation behaviour. We established how message congruency affects the link between perceptions of climate change risk and efficacy and two predictors of behavioural change, namely perceived responsibility and mitigation intentions. Message manipulation and congruency in message framing were effective in influencing adolescents' attitudes toward climate change mitigation. However, we suggest that further studies on framing techniques, especially on psychological distance and message congruency, are needed to effectively design communication programs or campaigns on climate change mitigation, as well as adaptation with different target audiences.

Furthermore, previous communication efforts to change the public's perceptions and mitigation and adaptation intentions in order to reduce the psychological distance of climate change have gained mixed success (e.g., Brügger et al. 2015; Jones, Hine, and Marks 2017; Trope and Liberman 2010; Trope and Liberman 2003; Terpstra 2011; Brody et al.

2008). Therefore, our study proposes that previous research may not have sufficiently considered the effects of risk and efficacy perceptions on behavioural intentions and the effects of message congruency in climate change communications. Our research findings were able to confirm that the combination of perceptions of climate change threats and efficacy as predictors of behavioural change, with congruency in risk messages as a potential moderator of this relationship, is a successful research framework. Therefore, this framework would be applicable to explore additional dimensions of framing effects in climate change communication by testing the expectation that congruent message frames will bolster the relation between perceptions of risk and efficacy and participants' (e.g., adults, managers, policy makers) felt responsibility and behavioural intentions toward both climate change adaptation and mitigation. However, it is clear that the options for hydro-sociological adaptation to climate change are shaped not only by psychological constraints but also by limited financial and human resources, or legal frameworks. Practically, this approach can be applied to communicate flood-related issues in order to advocate for adaptation behaviours in sustainable watershed management, flood management and hydrology in the context of climate change. A congruent message should be composed of perception of risk and efficacy regarding flood and climate change severity, susceptibility, and self and response efficacy toward predictors of behavioural changes in adaptation to the hydrological impacts of climate change.

Our research also contributes mainly to climate change communication in the area of mitigation among a specific group of adolescents. However, it can be applicable to a broader and emerging research approach in climate change adaptation studies, particularly in developing countries, to address macro issues and interventions associated with urban and environmental planning. We proved that when properly-designed message framing was applied, in terms of consistency and congruency, the effect on changing behavioural actions towards climate change are more effective. Thus, we may interpret that for communicating macro-issues and interventions, such as those associated with the macro-level (e.g., urban and environmental planning) (Kinzig et al. 2013; Schill et al. 2019) our study method at the

micro-level (e.g., psychology) is feasible and applicable to address the broader challenges of achieving behavioural change through improved climate change communication in developing countries and with developing countries.

4.4.3 Limitations

The present study has several limitations. First, the research framework and hypotheses were limited to climate change mitigation only, while climate change action generally involves both adaptation and mitigation. In addition, the research did not include a follow-up study to measure the level of knowledge maintained and any real action taken by the participants after the communication interventions (e.g., six months after the experiment). Third, the participants only included seventh- and eighth-grade adolescents in a peri-urban setting in the Mekong delta, Vietnam. Findings might differ for other age groups and locations. Finally, future research could more solidly examine social desirability effects in assessing the effects of climate change communication.

4.5 Conclusions

Climate change has been causing and will continue to cause serious impacts on nature and humans in the future which will require more attention from researchers, government, and communities, including adolescents. This study is one of the first to examine the framing effects in climate change risk communication among adolescents, the future generation who will suffer most from climate change consequences, in order to influence their perception and behaviours toward mitigation. Our research confirms that perceptions of risk and efficacy positively influence the predictors of behavioural change in climate change mitigation. Most importantly, the research results confirm that congruency in message framing plays an important role in manipulation effects: only when the messages are congruent in content do the manipulations more consistently change adolescents' attitudes.

Chapter 5: The persuasiveness of gain vs. loss framed messages on farmers' perceptions and decisions to climate change

"SOLUTIONS TO THE CLIMATE CRISIS ARE WITHIN REACH, but in order to capture them, we must take urgent action today across every level of society."

Al Gore, Founder and Chairman
The Climate Reality Project

Abstract:

With a rise of 1.5°C in global temperature, climate change is projected to cause massive destabilized climatic events that will affect people's health, environment, biodiversity, and food security. One of the most vulnerable sectors to climate change is agriculture because farming relies heavily on planning for weather and seasons according to experience of past years, and therefore changes in seasons and unusual weather patterns lead to loss of crops or livestock. Responding to climate change impacts requires both mitigation and adaptation, in which communication plays an important role to raise awareness, change behaviours and gain policy support. Gain vs. loss message framing has been extensively studied in persuasive communication. Despite successful examples in risk communication, the effect of gain vs. loss message framing method in communicating climate change, a psychologically distant risk, is still not well understood. This study combines message persuasiveness with psychological distance to develop messages to encourage farmers on climate adaptation. We applied a 2 × 2 factorial design (gain/loss and abstract/concrete framed messages) and conducted the research in a coastal farming community (N = 368). Findings confirm that gain-framed messages are more effective in raising risk perceptions and efficacy, with stronger impact on behavioural intentions toward climate change, compared to loss-framed messages. Above all, farmers were more willing to take adaptation measures when exposed to gain- in combination with concrete-framed messages vs. loss- and abstract-framed. Implications for climate change communication research and practice are discussed.

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5.1 Introduction

A recent report by the Intergovernmental Panel on Climate Change (IPCC) concluded that a rise of 1.5°C in global temperature leads to massive destabilizing climatic events that will impact global society in 2040 and impact the lives of people alive today (Tatarski 2018). The associated sea level rise threatens coastal communities with higher storm surges, coastal erosion and flooding, saltwater encroachment, loss of mangrove ecosystems, and population displacement. One of the sectors most vulnerable to climate change is agriculture because farming relies heavily on planning for weather and seasons according to previous years' experience, and therefore changes in seasons and unusual weather patterns lead to loss of crops or livestock (IPCC 1995; FAO 2016; FAO-IPCC 2017). Presently, impacts of climate change continue to seriously affect the lives of farmers (Adams et al. 1995; Tran 2011; EEA 2019). It is important to understand farmers' perceptions about climate change risks, responsive strategies, and intentions to act (Peltonen-Sainio, Sorvali, and Kaseva 2020; Gaurav and Chaudhary 2020; Elum, Modise, and Marr 2017). According to IPCC, responding to climate change and its impacts involves both mitigation to address its causes, as well as adaptation to deal with its consequences (IPCC 1995); both require the participation of individuals along with societal responses. Climate change communication plays an important role to raise awareness, to change behaviours, and to mobilize policy and financial support for collective actions towards climate change (Moser and Dilling 2007; Spence, Poortinga, and Pidgeon 2012; Leal Filho 2019). While most research to date looks at climate change communication with the general public, our research targets a specific group: farmers. This research aims at offering important considerations for climate change communication with this specific group, whose livelihoods are projected to be most affected by climate change impacts in both immediate and long-term future.

Information regarding the extent and impacts of climate change is widely discussed, but the modality of which this information is communicated, perceived and acted upon is arguably of at least equal importance. Ahn et al. (2015) state that the greatest challenge to behavioural change lays

in the knowledge-to-action gap, whereby lack of actual environment or behavioural changes makes it hard to rally support. Public perception of climate change is low as people fail to recognize the current problems that arise from their actions. One major reason for this disconnect is the temporal gap between climate change consequences and individual actions, which renders the connection between effect and cause abstract (Ahn et al. 2015). For instance, overusing water in agriculture production for a few crops does not lead to perceivable consequences; similarly, the present generation often does not perceive the consequences of their actions, which may be experienced by later generations. Lack of sustainable consumption dominates in society and individual behaviours are difficult to improve when they depend on each individual's beliefs on the relationship between their actions and climate threats. Moreover, climate change brings significant changes in the environment that will affect how people relate to the environment (IPCC 2018). Farming as one of the sectors affected by climate change requires civil education. Educating the society will often bring a positive change, but combining perception with responsibility which generates action is a further challenge (IPCC 2018).

Existing studies on climate change risk communication with farmer groups have produced variegated findings and recommendations. For example, in a study by Raymond and Spoehr (2013), only one third of farmers in rural South Australia were willing to take adaptation measures by investing more in technologies to sow crops earlier or increase the amount of water stored when being communicated that climate change is human-induced phenomenon in comparison to those who rejected the cause. Another recent study by Morrison, Hine, and D'Alessandro (2017), argued that communication about climate change with farmers was challenging, 'with relatively low acceptance of anthropogenic climate change or the idea that climate change will negatively affect agriculture' due to the fact nature of farming, their worldviews, and the controversies about climate change in the media. They suggested that understanding farmers' values, beliefs, and behaviours is important for developing tailored and targeted communications approaches. This can be achieved by increasing participatory communication approaches with farmers, where they share and learn from others'

experience, and also by supporting influential farmers whose awareness of climate change impacts is already high. This is also a key process as development agencies – national, international, governmental and non-governmental – are increasingly engaged in communicating climate change risks to farmers, for the sake of poverty alleviation and to build resilience for national food security and economic development.

This research aims to investigate two types of massage framing – gain vs. loss framing and abstract vs. concrete framing – among farmers in vulnerable communities in a developing country. We conducted an experiment with a group of farmers in a coastal community in Vietnam, a country ranked as one of the most vulnerable countries to climate change in the world (World Bank 2011; UNDP 2007) where more than 50 million people are projected to be impacted by rising sea levels and powerful storms to their farming crops (MONRE 2016). Vietnam's geography exposes its people to imminent calamities, especially its 1,800 mile coastline (Tatarski 2018). Proper message framing would potentially influence farmers' decisions and perceptions on adapting or mitigating climate change impacts (Niles, Brown, and Dynes 2016; Asplund 2018; Arbuckle, Morton, and Hobbs 2013). It is important for farmers to learn about climate change risks, how they affect their lives and livelihoods, and what actions to take to adapt or mitigate (Eitzinger, Binder, and Meyer 2018; Arbuckle, Morton, and Hobbs 2013; Liverpool-Tasie, Sanou, and Tambo 2019).

5.2 Theoretical framework

5.2.1 Gain versus loss framing

In risk communication, message framing plays an important role in how audiences perceive messages. One of commonly-used message framing in health and consumer behaviour change communication is gain vs. loss. While a gain-frame message focuses on the positive outcome of a behaviour; a loss-frame message focuses on the costs or the loss of not adopting that behaviour. In a theoretical review about message framing in health, Wilson, Purdon, and Wallston (1988) discussed gain-framing versus loss-framing communication techniques as applied by scientists and

practitioners. The research indicated that people tend to be loss-averse, i.e. more motivated to avoid losses than to obtain gains. This finding is significant not only for message framing in health, but also for environmental protection communication (e.g. Meyerowitz and Chaiken 1987; Apanovitch, McCarthy, and Salovey 2003; Lauckner et al. 2012). Although there are a number of successful examples of gain vs. loss framing in risk and health communication, the concept has not been well applied or documented in communicating on environmental protection and climate change (e.g. Lord 1994; White, Macdonnell, and Dahl 2011; Meijers, Remmelswaal, and Wonneberger 2019). In environmental research, White, Macdonnell, and Dahl (2011) investigated gain and loss-framed messages on consumer recycling and how it changes the consumer's mindset. Loss frames have an efficacious effect compared to gain frames when paired with concrete, low-level mindsets while gain frames are effective in abstract and high-level mindsets. Specifically, the messages framed with matching mind-set (e.g., loss with how, gain with why) provides the most substantive improvements in consumer recycling behaviour. Moreover, loss (gain) framed messages prove most successful when the consumer activates a mind-set at a low (high) level of abstraction (White, Macdonnell and Dahl 2011). Therefore, it is important to focus on understanding the audience before choosing a framing method as their mindset plays a part in the final effect.

Message framing is a technique that allows people to package their information in a form that fits with the target audience. Gain and loss message framing techniques are expected to be influential in changing the audience's perceptions and expected attitudes (Detweiler et al. 1999; Dickinson et al. 2013; Bertolotti and Catellani 2014). Different frames (i.e. a gain or loss frame) should affect farmers' decision to adapt or mitigate climate change based on psychological distance. This research explores the impact of framing on climate change risk communication with farmers.

5.2.2 Psychological distance in climate change communication

In recent decades, another framing method on climate change communication that received much attention has employed the concept of psychological

distance, which suggests that varying levels of psychological distance affects individuals' perceptions of risk and their judgements on decision-making behaviours (Jones, Hine, and Marks 2017; Brügger, Morton, and Dessai 2016). A number of existing studies on climate change communication have argued that the greatest challenge to effectively communicate for individual behaviour change is the psychological distance of climate change risk (Brügger, Morton, and Dessai 2016; Jones, Hine, and Marks 2017; Ngo, Poortvliet, and Feindt 2019). The notion of psychological distance is described in the Construal Level Theory by Trope and Liberman (2010) as the ways people experience an object or event to be psychologically distant (i.e. abstract construal) or close (i.e. concrete construal); and commonly defined on several dimensions: spatial, temporal, social, and hypothetical distance (Trope and Liberman 2003; Trope and Liberman 2010). Individuals have an ability to think of their past, present, future, and remote locations, and ideally, they can transverse psychological distance, meaning they can go beyond their direct experience to contemplate unfamiliar scenarios. Psychological distance exists differently and affects how people react to messages in different situations. As per Trope and Liberman (2010), construal level theory (CLT) shows "(a) that the various distances are cognitively related to each other, (b) that they similarly influence and are influenced by level of mental construal, and (c) that they similarly affect prediction, preference, and action". The different distance plays a part in the influence of one's action, evaluation, and prediction, which in turn affects outcomes. Temporal construal theory focuses on temporal distance and future events that pertain to representation and judgment (Trope and Liberman 2010).

5.3 Research framework and hypotheses

As discussed above, existing research demonstrates framing effects in risk communication in general, and more specifically in climate change communication. The current study aims to explore the applicability of insights from the literature to climate change communication with farmers. We examine the impacts of differently framed climate change information, in terms of persuasive frames (gain vs. loss), and in terms of psychological

distance (abstract vs. concrete), on farmers' perceptions and attitudes on climate change mitigation and adaptation (see Figure 5.1).

Specifically, we look into how message framing will affect the appraisal of threat and efficacy in climate change response behaviours among farmers. As pointed out in the extended parallel processing model (EPPM: Witte 1992), a person's intention to protect oneself against a given risk depends on the perceived severity and susceptibility of the threat in combination with the perceived self-efficacy and response efficacy. EPPM proposes four factors: (i) perceived severity refers to an individual's subjective perception of the magnitude of a threat or risk; (ii) perceived susceptibility to a risk entails the appraisal of one's vulnerability regarding the risk; (iii) self-efficacy refers to an individual's subjective perception of his or her ability to successfully perform risk mitigation practices; and (iv) response efficacy means the perceived effectiveness of the risk mitigation behaviours. In response to communicative messages, the audience is expected to trigger their behavioural changes in terms of: (i) perceived responsibility and (ii) climate change adaptation or mitigation intention.

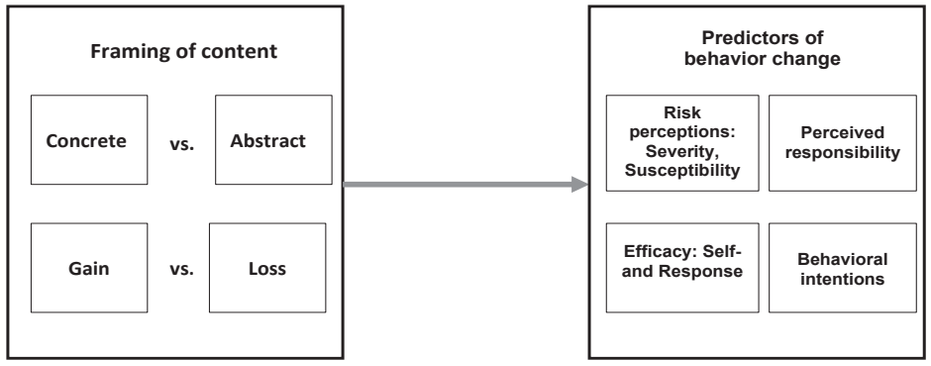

Figure 5.1. Research framework

This research hypothesizes that more concrete message framing (bringing the risk closer to the participants in all four dimensions: temporal, spatial, social and hypothetical) is more effective in changing farmers' risk perceptions and attitudes toward climate change. We further hypothesize that the gain framing method is most effective in increasing farmers' risk perceptions and most positively influences their behavioural intentions to

climate change. We expect that varying the message framing method of gain vs. loss (e.g. message persuasiveness) in combination with abstract vs. concrete framing (e.g. psychological distance) will differentially impact how farmers weigh the efficacy of their response options. We also expect this research will contribute to the framing disposal that stimulates them to adapt to or mitigate climate change. Above all is the expectation that this research will provide some insights on effectively framing communications of a psychologically distant risk like climate change to catalyse behavioural changes that can reduce climate change impacts.

H1a: A gain-framed message will elicit more favourable attitudes toward climate change mitigation than the loss-framed message

H1b: A gain-framed message will elicit more favourable attitudes toward climate change adaptation than the loss-framed message

H2a: A concrete-framed message will elicit more favourable attitudes toward climate change mitigation than the abstract-framed message.

H2b: A concrete-framed message will elicit more favourable attitudes toward climate change adaptation than the abstract-framed message.

H3a: A gain- in combination with concrete-framed message will elicit more favourable attitudes toward climate change mitigation than the loss- in combination with abstract-framed message.

H3b: A gain- in combination with concrete-framed message will elicit more favourable attitudes toward climate change adaptation than the loss- in combination with abstract-framed message.

5.4 Study context and design

5.4.1 Research site

The research was conducted in a suburban farming community of Quy Nhon city, Binh Dinh province, located in the south central coast of Vietnam (see Figure 5.2). This area is considered to be vulnerable to climate change impacts, especially to sea level rise (MONRE 2016). According to Vietnam

Climate Change and Sea Level Rise scenarios, under the RCP8.5 (high emission scenario) the average sea level in the whole coastal area of Vietnam is projected to rise 73 centimetres by the end of the 21st century (MONRE 2016). Moreover, the frequency and intensity of tropical typhoons is projected to increase and cause more damages to the vulnerable coastal communities (MONRE 2016). An agreement with the provincial authority of Binh Dinh which is in charge of climate change coordination to conduct the research was granted prior to the actual research.

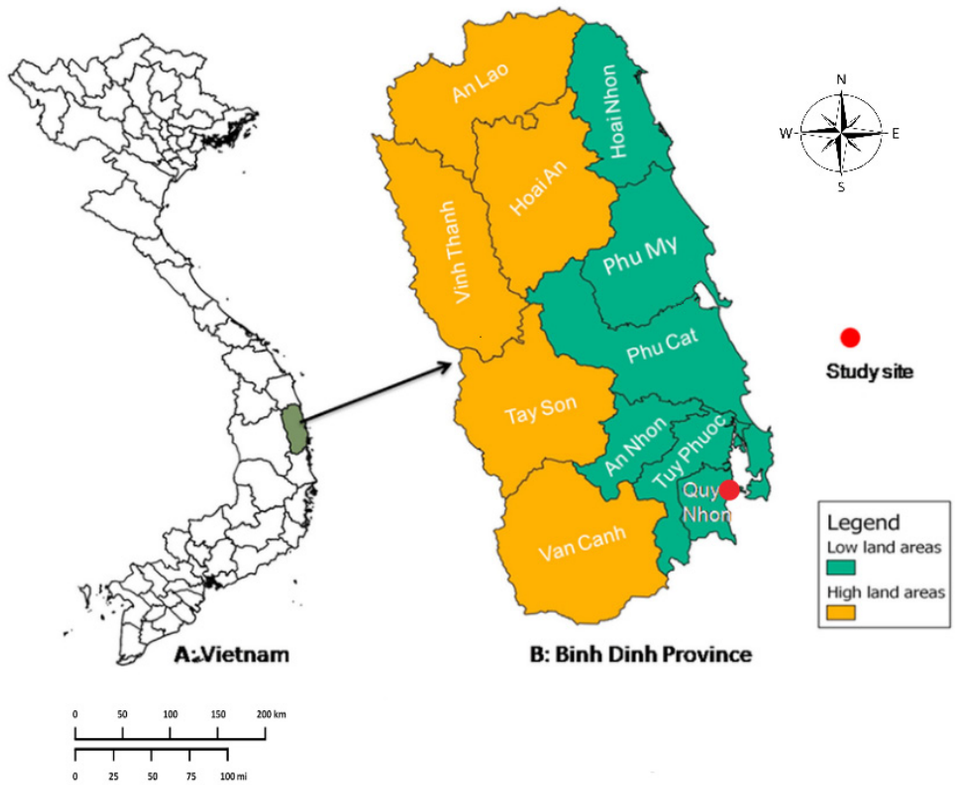

Figure 5.2. Research location

5.4.2 Design and participants

To investigate the impact of message framing on risks perceptions (severity, susceptibility, self- and response efficacy) and behavioural intentions (mitigation and adaptation intentions; perceived responsibility),

we conducted an experiment with a 2 (psychological distance: abstract vs. concrete) × 2 (message valence: loss vs. gain) factorial design.

We recruited a population sample of farmers from four coastal communities in a suburban district of Quy Nhon city, Binh Dinh province. Local authorities were informed of the research by the Binh Dinh Climate Change Coordination Office; then they invited farmers to voluntarily participate in the research. Farmers were invited to the community hall and randomly assigned to one of the experimental conditions. Before participation in the experiment, each farmer was given a consent form for voluntary participation; in total, 368 signed consent forms were collected.

5.4.3 Procedure

Considering the reading ability of the farmers, we developed four audio clips (instead of printed material) containing the experimental messages. The messages were developed using IPCC's terms on climate change in the Fifth Assessment Report (IPCC 2014) and tailored to suit the research context in Quy Nhon suburban district, Binh Dinh province. Text messages were read out loud by a research assistant and recorded into a voice recorder, and then transferred to tablets for actual use during the experiment.

Psychological distance message framing was manipulated by emphasizing the information about climate change without any suggested actions (abstract framed message, e.g. future, global/ polar, other/ out-group/ dissimilar, unlikely) or specific action (concrete-framed message, e.g. present, local, self/in-group/ similar, likely) in the audio message. For example: "Climate change may cause more disaster events such as flood, drought, or typhoon to occur in specific places in the world. These extreme events will likely cause more human and material losses in the future. If people around the world fail to prepare for responding to disasters associated with climate change impacts, they will face severe consequences in the future".

Message valence framing was manipulated by emphasizing the positive outcomes of taking the suggested actions (gain-framed message, e.g. gain-appeal including some recommended actions that empower farmers to do something for addressing the issue) or negative consequences of not taking

the suggested action (loss-framed message, e.g. loss-appeal including costs of failing to take action) in the audio message. For example: "Climate change may cause more disasters such as flood, drought, typhoon, riverbank erosion, or salinity in Quy Nhon in comparison to the past decades. These extreme events will likely cause mortality and damages to your family, house, animals, rice farm, or aquaculture pond. To cope with this change, we in Quy Nhon can take some immediate preparedness actions such as: strengthening your house, protecting and maintaining dykes and mangrove forest, or changing your harvesting time, to reduce the impacts of disasters associated with climate change" (see Appendix 5.1 for complete messages).

Ten university students from the Department of Environmental and Natural Resources of Quy Nhon University were trained as research assistants. Prior to the actual experiment, farmers gathered in the community hall to be briefed about the research. The farmers were then invited to four different rooms, one for each of four message manipulations. Direct interviews with each farmer were conducted by research assistants using tablets with pre-designed questionnaires. An audio message was recorded according to each message framing manipulation and installed into tablets and turned on for the farmer to listen to the message.

Before exposing farmers to the experimental messages, a questionnaire was administered to measure their level of understanding about climate risk, efficacy and behavioural intentions. After that, the farmers took a 15 minute-break, enjoyed some tea and cookies. Then they joined the experiment consisting of 30 minutes to listen to the audio messages which made up the experimental manipulations and took notes if they wanted; and then another questionnaire was asked to measure farmers' understanding about the risks, efficacy, and behavioural intentions to climate change. Farmers were asked to not discuss the message content or how to answer survey questions to other farmers after the experiment to avoid bias. Supervisors and researchers were present in each room to supervise the experiment and provide support to interviewers and farmers. Farmers were encouraged to answer the questions based on their understanding and were assured that there were no right or wrong answers. At the end of the experiment, the surveyors and supervisors thanked farmers for their participation and

each farmer received a small gift of soap bars and towels.

5.4.4 Measures

We developed a 41-item questionnaire with 5-point Likert scales (strongly agree - strongly disagree) (refer to Appendix 5.2).

Severity was measured by using four items of 5-point Likert questions and then combined into a reliable index for analysis. A sample item on this scale is 'I believe that climate change is severe'.

Susceptibility was measured by using four items of 5-point Likert questions and then combined into one index for analysis. A sample item on this scale is 'I am personally at risk for the consequences of climate change'.

Self-efficacy for climate change mitigation was measured by using three items of 5-point Likert questions and then combined into one Index for analysis. A sample item on this scale is 'I have the capabilities to reduce the use of fuels such as coal, petrol, diesel... to mitigate climate change'.

Self-efficacy for climate change adaptation was measured by using four items of 5-point Likert questions and then combined into one Index for analysis. A sample item on this scale is 'I am able to follow weather warning systems to adapt to climate change'.

Response efficacy for climate change mitigation was measured by using four items of 5-point Likert questions and then combined into one Index for analysis. A sample item on this scale is 'Reducing the use of electricity and water is effective in mitigating climate change'.

Response efficacy for climate change adaptation was measured by using four items of 5-point Likert questions and then combined into one Index for analysis. A sample item on this scale is 'Changing crops or aquaculture is an effective way to adapt to climate change'.

Behavioural intentions for climate change mitigation was measured by using six items of 5-point Likert questions and then combined into one Index for analysis. A sample item on this scale is 'I will use

electricity-saving light bulbs'.

Behavioural intentions for climate change adaptation was measured by using six items of 5-point Likert questions and then combined into one Index for analysis. A sample item on this scale is 'I will follow warnings during the storm season'.

Perceived responsibility was measured by using six items of 5-point Likert questions and then combined into one Index for analysis. A sample item on this scale is 'I feel jointly responsible for climate change problems'.

In addition, one question was asked to collect demographic information about participating farmers and their current practices in daily life on actions to protect the environment. A complete set of questions is attached in Appendix 5.2.

5.4.5 Data analyses

Responses by farmers to the questionnaire were directly entered into tablets using EpiData software (commonly used for simple or programmed data entry and data documentation); the dataset was cleaned for any missing information and later converted to SPSS for data analyses. Data was used to run for descriptive statistics (frequencies, means and standard deviations) and run a series of analysis of variance (ANOVA) tests to compare the means in order to measure the communication effect and explore what factors influence the communication message design. A total of 368 samples were received.

5.5 Results

5.5.1 Descriptive statistics

Of the 368 farmers, 174 were male (47.3%) and 194 were female (52.7%). Farmers were aged from 21 to 84 years (*Mage* = 49.32; *SD* = 11.88). Regarding educational level, participants with no education accounted for 1.4%, primary education 30.4%, secondary education 46.7%, high school education 18.8%, and college or higher education accounts for the remaining

2.7%. These farmers' main livelihood activities (multiple answers were accepted) were agriculture-based: farming (53.5%), aquaculture (41.6%), livestock (54.1%) fishing (21.7%), only a small percentage had other responses. Out of 324 participants who responded to the question 'have you ever participated in any climate change activities', 82.6% said they never participated before this experiment and 17.1% said they had participated. When being asked about the current practices relating to environmental protection behaviours, most farmers (93.4%) responded that they turned off the light when leaving the room; 91.7% turned off water tap after use; 48.0% saved water; 64.1% protected trees around homes; 43.1% limited use of plastic bags; and 56.0% separated waste for recycling.

5.5.2 Framing effects on risk and efficacy perceptions, and behavioural intentions: Means tests

The means and standard deviations of the framing manipulations (loss-framed vs. gain-framed and abstract-framed vs. concrete-framed) and climate change risk perceptions (severity and susceptibility), self- and response efficacy, and behavioural intentions to climate change (mitigation and adaptation) and perceived responsibility are displayed in Table 5.1. Gain-framed in combination with concrete messages yields higher means compared to loss-framed in combination with abstract messages for all variables except self-efficacy for mitigation.

5.5.3 Framing effects on risk and efficacy perceptions, and behavioural intentions: ANOVA test

In the next step, we used a series of 2-way ANOVAs to explore the effects of framing between loss vs. gain and abstract vs. concrete messages on farmers' perceptions and attitudes towards climate change including: severity and susceptibility, self- and response efficacy of messages being communicated. We further ran Analysis of Covariance (ANCOVA) (a general linear model that combines ANOVA and regression), using farmers' background (gender, age, education, main livelihood activities) as covariates to assess whether these control variables having influences on the climate change risk perceptions and behavioural intentions. However, the results of these ANCOVAs did not yield significant results.

Table 5.1. Means and standard deviations of risk and efficacy perceptions, behavioural intentions and framing methods

Dependent variable	Cronbach's alpha (α)	Framing method				
			Abstract (N = 184)		Concrete (N= 184)	
			M	SD	M	SD
Severity	0.73	Loss (N = 185)	4.16	0.66	4.42	0.57
		Gain (N= 183)	4.59	0.42	4.65	0.53
Susceptibility	0.71	Loss (N = 185)	3.77	0.65	4.05	0.49
		Gain (N = 183)	4.04	0.44	4.50	0.52
Self-efficacy to CC mitigation	0.76	Loss (N = 185)	4.45	0.62	4.32	0.74
		Gain (N = 183)	4.51	0.54	4.41	0.62
Self-efficacy to CC adaptation	0.70	Loss (N = 185)	3.82	0.56	4.24	0.62
		Gain (N = 183)	4.25	0.54	4.46	0.50
Response efficacy to CC mitigation	0.71	Loss (N = 185)	4.22	0.54	4.37	0.71
		Gain (N = 183)	4.37	0.51	4.54	0.53
Response efficacy to CC adaptation	0.70	Loss (N = 185)	4.16	0.51	4.21	0.66
		Gain (N = 183)	4.14	0.41	4.42	0.56
Behavioural intention to CC mitigation	0.70	Loss (N = 185)	4.32	0.55	4.42	0.63
		Gain (N = 183)	4.43	0.46	4.61	0.52
Behavioural intention to CC adaptation	0.74	Loss (N = 185)	3.82	0.61	4.23	0.73
		Gain (N = 183)	4.22	0.64	4.35	0.65
Perceived responsibility	0.70	Loss (N = 185)	3.91	0.70	4.31	0.74
		Gain (N = 183)	4.20	0.60	4.34	0.74

Note. Means are on 5-point scales, with higher values indicating more positive ratings of the dependent variable in question for all variables

Risk perceptions: Climate severity and susceptibility. A 2 (message valence: gain vs. loss) × 2 (psychological distance: concrete vs. abstract) univariate analysis (ANOVA) was performed on the severity variable. The ANOVA yielded a statistically significant main effect of gain/loss frame, $F(1, 364) = 32.64$, $p < .001$. In the loss frame condition ($M = 4.29$) lower severity ratings were reported compared to the gain frame condition ($M = 4.62$). The ANOVA also showed a main effect of psychological distance, $F(1, 364) = 7.82$, $p < .01$. In the abstract frame condition ($M = 4.38$) lower severity ratings were reported relative to the concrete frame condition ($M = 4.54$). These main effects were qualified by a marginally significant interaction effect, $F(1, 364) = 2.98$, $p < 0.09$. The effect of gain/loss frames was more extreme in the abstract frame condition than in the concrete condition.

Another ANOVA was performed on the susceptibility variable. This ANOVA yielded a main effect of gain/loss frame, $F(1, 364) = 41.96$, $p < .001$. In the loss frame condition ($M = 3.91$) lower susceptibility ratings were reported compared to the gain frame condition ($M = 4.27$). The ANOVA also showed a main effect of psychological distance, $F(1, 364) = 44.42$, $p < .001$. In the abstract frame condition ($M = 3.90$) lower susceptibility ratings were reported relative to the concrete frame condition ($M = 4.27$). These main effects were qualified by a marginal interaction effect, $F(1, 364) = 2.86$, $p < 0.10$. The effect of gain/loss frames was more extreme in the concrete frame condition compared to the abstract condition.

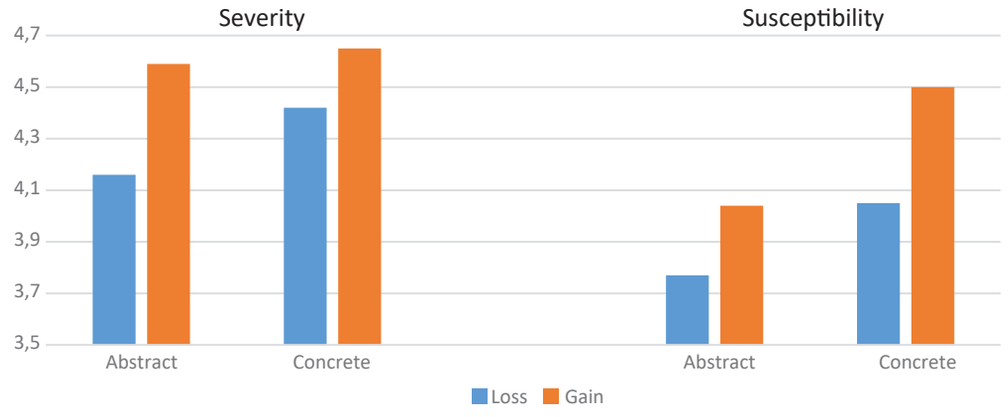

Figure 5.3. Mean ratings for message framing effect on risk perceptions

The mean ratings for gain-framed in combination with concrete-framed messages were the highest among four manipulations for both risk perceptions of severity ($M = 4.65$, $SD = 0.533$) and susceptibility ($M = 4.50$, $SD = 0.522$) (see Figure 5.3). These results confirmed the overarching research hypothesis that messages with more concrete actions are more

effective in changing farmers' risk perceptions and attitudes toward climate change; and the gain-framed message is more effective than the loss-framed message.

Efficacy: Self-efficacy to climate change mitigation and adaptation. In the next step, an ANOVA was performed on the self-efficacy to the climate change mitigation variable. It yielded a non-significant result of gain/loss framing. The ANOVA showed a marginal effect of psychological distance, $F(1, 364) = 2.97$, $p < .09$. In the abstract frame condition ($M = 4.48$) higher self-efficacy for mitigation was reported relative to the concrete frame condition ($M = 4.36$). This marginal main effect was not qualified by the interaction effect, $F(1, 364) = .064$, ns. These findings did not support hypotheses 1a and 2a.

The ANOVA was also performed on the self-efficacy to the adaptation variable. This ANOVA yielded a main effect of gain/loss frame, $F(1, 364) = 30.64$, $p < .001$. In the loss frame condition ($M = 4.03$) lower self-efficacy for adaptation ratings were reported compared to the gain frame condition ($M = 4.36$). The ANOVA also showed a main effect of psychological distance, $F(1, 364) = 29.46$, $p < .001$. In the abstract frame condition ($M = 4.04$) lower self-efficacy for adaptation ratings were reported relative to the concrete frame condition ($M = 4.35$). These main effects were qualified by a marginally significant interaction effect, $F(1, 364) = 3.24$, $p < .08$. The effect of gain/loss frames was much more extreme in the abstract frame condition compared to the concrete condition. Therefore, we are able to marginally support the hypotheses 1b and 2b.

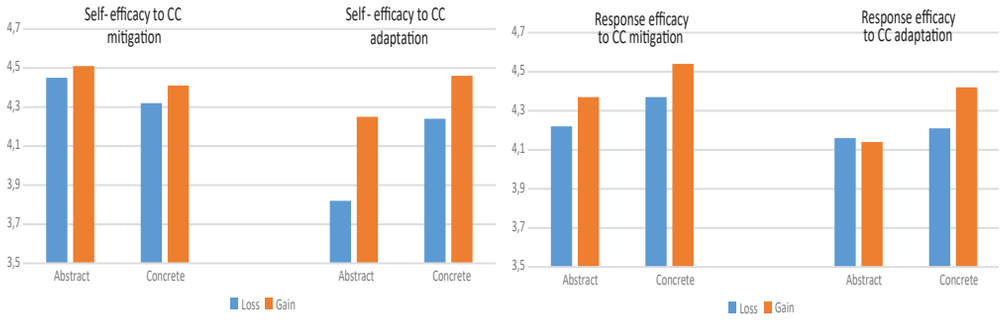

Figure 5.4. Mean ratings for message framing effect on self- and response efficacy

Furthermore, these research findings were in line with the mean ratings for gain-framed in combination with concrete-framed messages that were the highest among four manipulations for self-efficacy to climate change adaptation ($M = 4.46$, $SD = 0.501$); however, the message manipulation did not work for self-efficacy to climate change mitigation, instead the abstract-farmed in combination with gain-framed messages ($M = 4.51$, $SD = 0.538$) (see Figure 5.4).

Efficacy: Response efficacy to climate change mitigation and adaptation. Similarly, an ANOVA analysis was performed on the response efficacy to the mitigation variable. It yielded a main effect of gain/loss frame, $F(1, 368) = 6.96$, $p < .01$. In the loss frame condition ($M = 4.30$) lower response efficacy for mitigation ratings were reported compared to the gain frame condition (M = 4.46). The ANOVA also showed a main effect of psychological distance, $F(1, 368) = 6.61$, $p < .02$. In the abstract frame condition ($M = 4.30$) higher response efficacy for mitigation was reported relative to the concrete frame condition ($M = 4.45$). These main effects were not qualified due to a non-significant interaction effect. The effect of gain/loss frames was not significant in the concrete frame condition compared to the abstract condition. These findings rejected hypothesis 1a and 2a.

The ANOVA analysis was also performed on the response efficacy to the adaptation variable. This ANOVA yielded a main effect of gain/loss frame, $F(1, 368) = 2.84$, $p < .10$. In the loss frame condition ($M = 4.18$) lower response efficacy for adaptation ratings were reported compared to the gain frame condition ($M = 4.28$). The ANOVA also showed a main effect of psychological distance, $F(1, 368) = 8.54$, $p < .01$. In the abstract frame condition ($M = 4.15$) lower response efficacy for adaptation ratings were reported relative to the concrete frame condition ($M = 4.31$). These main effects were qualified by a significant interaction effect, $F(1, 368) = 4.28$, $p < .04$. The effect of gain/loss frames was much more extreme in the concrete frame condition compared to the abstract condition. These findings confirmed hypothesis 1b and 2b.

The mean ratings for response efficacy to climate change mitigation and climate change adaptation that the highest mean ratings were for the

farmers who received messages with gain-framed in combination with concrete-framed messages: *M* = 4.42, *SD* = 0.564 and *M* = 4.54, *SD* = 0.532, respectively (see Figure 5.4). These results disproved hypothesis 3a and confirmed hypothesis 3b.

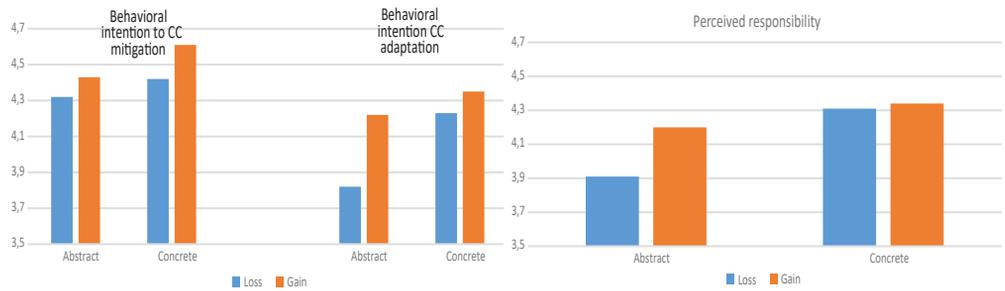

Figure 5.5. Mean ratings for message framing effect on behavioural intentions and perceived responsibility

Perceived responsibility: Lastly, an ANOVA was performed on the perceived responsibility to climate change variable. It yielded a main effect of gain/loss frame, $F(1, 364) = 4.60$, $p < .04$. In the loss frame condition ($M = 4.11$) lower behavioural intention for mitigation ratings were reported compared to the gain frame condition ($M = 4.27$). The ANOVA also showed a main effect of psychological distance, $F(1, 364) = 13.66$, $p < .001$. In the abstract frame condition ($M = 4.05$) higher perceived responsibility to climate change was reported relative to the concrete frame condition ($M = 4.32$). These main effects were qualified by a marginal interaction effect, $F(1, 364) = 3.06$, $p < .09$. The effect of gain/loss frames was extreme in the abstract frame condition compared to the concrete condition.

The mean ratings for gain-framed in combination with concrete-framed messages were the highest among four manipulations for perceived responsibility ($M = 4.34$, $SD = 0.735$) (see Figure 5.5). These findings confirmed the overarching research hypothesis that action-oriented, concrete and gain-framed messages are more effective in changing farmers' perceived responsibility to climate change than abstract or loss-framed messages.

5.6 Discussion

In recent decades, various framing methods have been explored to communicate climate change to positively influence individuals' behaviours (Moser 2010; Nerlich, Koteyko, and Brown 2010; Spence, Poortinga, and Pidgeon 2012). However, existing studies confirmed that challenges remain in communicating a psychologically distant risk like climate change (Brügger, Morton, and Dessai 2016; Leiserowitz 2006; Jones, Hine, and Marks 2017). Although gain vs. loss framing has been extensively studied in persuasive communication, the effect of gain vs. loss message in communicating climate change has yet to be thoroughly researched. In this research, we hypothesized that the more concrete in message framing (bringing the risk closer to the participants in all four dimensions: temporal, spatial, social and hypothetical) would be more effective in changing farmers' risk perceptions and attitudes toward climate change. We further hypothesized that gain framing would be most effective in increasing farmers' risk perceptions and have the greatest impact on their behavioural intentions regarding climate change mitigation and adaptation. The research findings were able to confirm most of the hypotheses and contribute to the existing literature.

5.6.1 Main findings

This research provides new evidence about effectiveness of message frames (gain vs. loss and concrete vs. abstract) in communicating climate change risk perception and efficacy for farmers' behavioural intentions to adapt to climate change. We utilize a persuasiveness frame in combination with psychological distances of climate change to design the research framework and messages. By combining gain-framed and concrete-framed messages vs. loss-framed and abstract-framed messages in the same experiment, we were able to confirm previous studies on gain vs. loss communication that gain frames were more persuasive than loss frames in scenarios that involved prevention behaviours (here: climate change adaptation actions) behaviours (Kahneman and Tversky 1984; Rothman and Salovey 1997; Dijkstraa, Rothman and Pietersma 2011). Farmers are dependent on weather and climate for their livelihoods and are therefore highly vulnerable to climate change impacts. This research demonstrated that certain frames

are more effective in supporting these vulnerable farmers to adopt climate change adaptation and mitigation behaviours.

It is worth highlighting that the messages were framed to inform the farmers of specific adaptation and mitigation actions they could take (e.g. crop farming, aquaculture, fishing, disaster preparedness, health protection) in this particular farming community (Quy Nhon rural coastal communities of Binh Dinh province, central coast of Vietnam). The messages were designed to inform farmers what gains they would receive (e.g. economic gains, health gains, general livelihood gains, and being better prepared for natural disasters).

Specifically, ANOVA test results confirm the Hypotheses H1b and H2b that gain-framed messages are more effective in changing farmers' risk perceptions and efficacy to climate change, as well as influencing behavioural intentions. Farmers responded more positively to messages that tell them what they gain (persuasiveness) in terms of income, health, or livelihood options than the messages about what they might lose if they do not take similar actions. Furthermore, the results of ANOVA regression confirm the Hypothesis H3b that farmers were more concerned on climate change adaptation (risk, efficacy) and more willing to take adaptive measures (behavioural intention to climate change adaptation) when receiving gain-framed and concrete-framed messages in comparison with loss-framed and abstract-farmed messages. In contrast, the same messages were not effective when communicating with farmers about climate change mitigation behaviours (rejected Hypothesis H1a, H2a, H3a).

It is worth noting that some ANOVAs produced only marginal effects. For instance, negative (loss-framed) messages and/or in combination with abstract-framed messages, were not significantly effective when communicating risk perceptions, efficacy and behavioural intentions to climate change mitigation among farmers. Further study would be required including more rigorous message design, larger population sampling, and follow-up experimental design, in order to firmly confirm the non-significant effects.

5.6.2 Practical implications to climate change communication to farmers

What does our research offer to the researchers and practitioners when communicating with farmers for behavioural change? First, it provides evidence that properly-designed messages which focus on positive outcomes (gain-framed) and relating to farmers' livelihood in the upcoming crops (psychological proximity) is an effective framing method. It has been convincingly argued that effective behaviour change communications must be tailored to specific target audiences (Dickinson et al. 2013; DeGolia, Hiroyasu, and Anderson 2019; Reser and Bradley 2017; Moser and Dilling 2011; Moser 2016). While communications campaigns can include information on the risks and threats faced, this research suggests placing greater emphasis on the potential gains of adaptation methods. Although our research was able to confirm that the negative (loss-framed) and abstract-framed messages were not as effective in communicating climate change with farmers, it is still necessary to tell them about the negative impacts and potential losses caused by climate change, if no proper actions are to be taken. Lastly, the research confirmed that persuasiveness and psychological distance did not work for communicating climate change mitigation with farmers; thus alternative message formulations should be studied given the importance of the agricultural sector's contribution to greenhouse gas emissions (FAO-IPCC 2017; EEA 2019; IPCC 2005).

5.6.3 Theoretical implications to message framing theories in climate change communication

In the case of communicating climate change risks to farmers, this research supports the original concept in Prospect Theory (Kahneman and Tversky 1984) that gain vs. loss framing dictates how one perceives messages. These concepts may be applicable to gain vs loss framing in general, but are demonstrated as valuable for mitigating and adapting to climate change. Moreover, the research confirms the effectiveness of the CLT when communicating about psychologically distant risks like climate change. It also contributes to the current debates within psychology, sociology and

communications sciences on the varied effects of message framing on target audiences' behaviour and/or decision making (Nisbet and Mooney 2007; Spence and Pidgeon 2010; Linden, Maibach, and Leiserowitz 2015). Moreover, the concepts that define framing have different operationalization especially between equivalent information and emphasis framing. This research is one of the first attempts to conduct empirical research on message persuasiveness in combination with psychological distance with vulnerable farmers in the developing world. This research proves the need for more empirical and longitudinal research with specific target audiences in varied contexts in order to explore the most effective communication strategy on climate change.

5.7 Conclusion

This research offers important considerations for climate change communication with a target audience whose main livelihood is projected to be most affected by climate change in the short- and long term. We conclude that gain-framed in combination with concrete-framed messages is the most powerful method in influencing farmers' risk perceptions and efficacy, and is more effective in triggering behavioural intentions to climate change adaptation. Conducting this research in a lower-middle income country is especially important for policy makers and practitioners in similar settings, who may wish to consider tailoring and testing their messages by population segment in order to effectively trigger behaviour changes. Efforts to promote climate change adaptation and mitigation in the agriculture sector would benefit from further empirical research that will require political will, participation and resilient funding mechanisms. Areas for further research include: applying more diversified factors that influences congruency in message framing; assessing the influence of the level of knowledge and/or the socio-cultural context of the audience prior receiving communication interventions; and a follow-up study to measure the level of knowledge maintained and any real action taken by the participants after the communication interventions.

Chapter 6: Synthesis

"NOW IS THE TIME for people all over the world to lend their voices to cause and urge their leaders to take this historic first step"

Al Gore, Founder and Chairman
The Climate Reality Project

6.1 Introduction

6.1.1 Purpose and structure of this Chapter

This chapter discusses and integrates the findings of the previous chapters. It starts with a summary of the findings pertaining to the specific research questions presented in the introduction. After that, the main findings are discussed in relation to the overall and cross-cutting insights they bring to the field of climate change risk perceptions and communication. Specifically, the findings reflect:

- how individual knowledge, past experience, frequency of community participation and socio-demographics influence the perceived severity and vulnerability of flood and climate change risks, adaptive capacity and intention to take adaptive measures;
- how perceptions of risk and efficacy influence adolescents' behavioural intentions to climate change mitigation; and how the combination of a gain- and concrete-framed message influences farmers' attitude toward climate change adaptation differently from a combination of loss- and abstract-framed message (see Figure 6.1).

Lastly, recommendations for climate change risk communication are proposed.

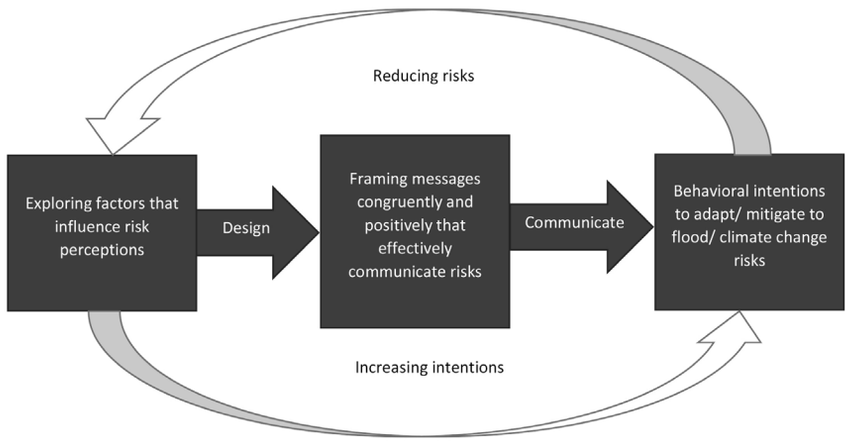

Figure 6.1. Exploring risk perceptions to frame climate change for behavioural intentions

6.1.2 Recap of the thesis objectives and questions

The main objective of this thesis was to understand which factors influence flood and climate change risk perceptions and efficacy towards responding to flood and climate risks among different groups of people living in coastal and delta communities in Vietnam. Through different experimental studies, the research also aimed to test message framing methods to effectively communicate flood and climate change risks for behavioural change toward mitigation and adaptation. This thesis had two specific objectives:

1. To explore what factors (e.g. cognitive; experiential processing; socio-cultural influences: social participation, political ideology, religion; or socio-demographics: age, gender, income source, place of residence) influence people in the coastal and delta communities in Vietnam in understanding flood and climate change risks perceptions, efficacy, and behavioural intentions to mitigate or adapt.
2. To study how message framing influences the risk perception, efficacy, and behavioural intentions to adapt or mitigate to flood and climate change risks among key audiences (e.g. schoolchildren, farmers).

Based on the results from earlier risk studies, I developed the research models to explore how the risk perceptions (severity, susceptibility) and efficacy (self- and response efficacy) influence the behavioural intentions to flood and climate change mitigation/adaptation through different message framing and manipulation. In each Study, presented in chapters 2 to 5, a main question was formed around some specific questions as presented below.

Topic 1: Risk perception

- How do individual knowledge, past experience, frequency of community participation and socio-demographics influence the perceived severity of risks, the perceived own vulnerability, and the self-ascribed adaptive capacity, which in turn influence the intention to take or support flood or climate change adaptive measures? (Chapter 2)

- How do people perceive risks in terms of social, economic, and environmental impacts? How does gender influence the perception of flood risk in terms of social, economic, and environmental impacts? (Chapter 3)

Topic 2: Risk communication

- How do perceptions of risk and efficacy influence the relationship with predictors of behavioural change: perceived responsibility and mitigation intentions to climate change? How does message congruency moderate the strength of the relationship between risk and efficacy toward predictors of behavioural change? (Chapter 4)

- How does a gain-framed (/concrete-framed) message influence attitude toward climate change mitigation differently from a loss-framed (/abstract framed) message in comparison with attitude toward climate change adaptation? How does the combination of a gain- and concrete-framed message influence attitude toward climate change mitigation differently from a combination of loss- and abstract-framed message? (Chapter 5)

6.2 Summary and reflections of research findings

6.2.1 Factors influencing risk perceptions and intentions for adaptive measures to climate change-related risks

Research framework: To understand the determinants of climate change risk perceptions associated with and intentions to take adaptive measures, I proposed a research model that distinguishes between vulnerability and severity components of perceived risks and adds perceived adaptive capacity as a third factor to predict the intention to take adaptive measures. I used this combined model as a conceptual lens for an explorative survey with residents of coastal and delta communities in Vietnam (Chapter 2). This model was based on Van der Linden's (2015) comprehensive climate change risk perception model (CCRPM). The CCRPM proposes that the perception of climate change risks is a function of four main factors stemming from

psychological processes, the cultural context, and personal background (Helgeson, Van der Linden, and Chabay 2012): (1) cognitive factors, (2) experiential processing, e.g. affective evaluations and personal experience, (3) socio-cultural influences, e.g. social norms and broad value orientations and (4) socio-demographic control variables, e.g. age, gender, education, political affiliation.

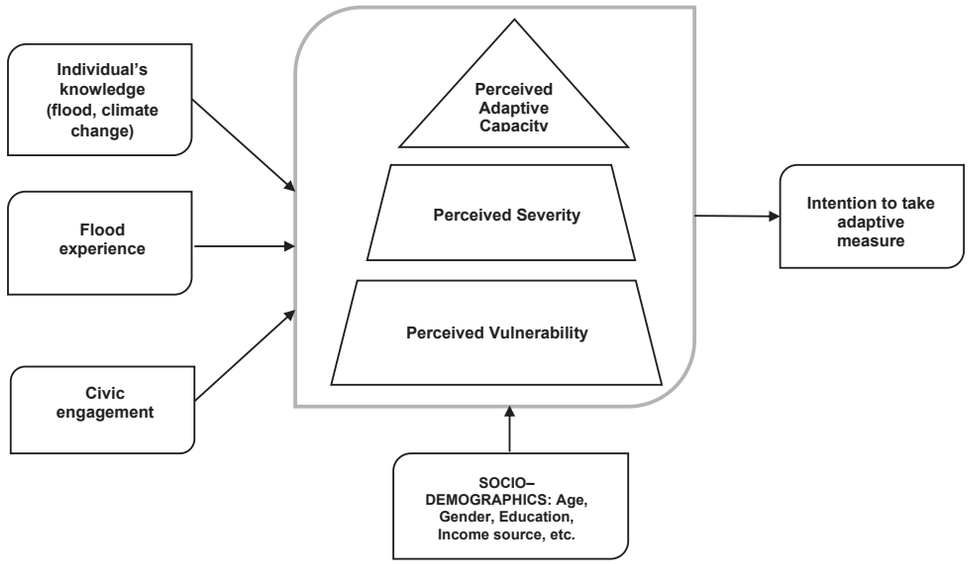

Figure 6.2. Research framework on risk perceptions

Main findings towards research questions/hypotheses: Pairwise analyses revealed a significant association of flood and climate change risk perceptions with the individual's flood experience, climate change knowledge, frequency of community participation and socio-demographic factors. However, in multivariate analysis, the influence of most socio-demographic factors became weak or patchy (Bruine de Bruin, Parker, and Fischhoff 2007; Juliusson, Karlsson, and Gärling 2005; Sanz et al. 2007; Stanovich and West 2008; Wolf and Moser 2011). Flood experience was the most influential driver of flood-related risk perceptions but weak for climate change-related risk perceptions and behavioural intentions. Knowledge strongly increased the intention to adapt to flood and climate risks and the

perceived vulnerability to and severity of climate change risks; but reduced the perceived capacity to adapt to climate risks. Higher frequency of community participation increased the perceived vulnerability and severity of climate change risks, the intention to adapt to both climate and flood risks and the perceived capacity to adapt to flood risks; but reduced the perceived capacity to adapt to climate risks.

The findings were in line with previous research findings suggesting that people view climate change impacts as temporally and spatially distant and therefore often view climate change impacts as personally relevant only after directly experiencing disrupted weather patterns (Leiserowitz 2005; O'Connor, Bord, and Fisher 1999; Spence et al. 2011). The research extended earlier findings that individuals' knowledge, place-specific experience and social-cultural influences are key predictors of both flood and climate change risk perceptions and intentions to take adaptive measures (Bruine de Bruin, Parker, and Fischhoff 2007; Juliusson, Karlsson, and Gärling 2005; Sanz et al. 2007; Stanovich and West 2008; Wolf and Moser 2011). The results also contributed to the assumption that risk perceptions are strongly influenced by knowledge about the causes and consequences of climate change (Brody et al. 2008; Kellstedt, Zahran, and Vedlitz 2008; Menny et al. 2011; Sundblad, Biel, and Gärling 2007). Finally, this research revealed that flood experience was significantly associated with higher perceived climate change severity, adaptive capacity and intention to adapt to climate change. This contrasted with most existing studies which found that people who had experienced flooding differed very little from those who have not, regarding their understanding of and response to climate change (Dessai and Sims 2010; Spence et al. 2011; Whitmarsh 2008). Most importantly, this research extended the earlier work on risk perception by applying a more integrative research framework that distinguished between vulnerability and severity components of perceived risks and added perceived adaptive capacity as a third factor to predict the intention to take adaptive measures.

Practical and theoretical reflections: While the research findings (Chapter 2) broadly proved association of the explanatory variables from the CCRPM with perceived climate change vulnerability and severity among the sample population in Vietnam; the proposed conceptual model of climate risk perception was only partly proved in multivariate analysis.

This research revealed some surprising complexities: individual knowledge and higher frequency of community participation increased the intention to adapt to climate change but reduced the perceived capacity to do so; at the same time, experience had a weak and socio-demographic factors had an uneven influence on perceived capacity and intention to take adaptive measures to climate change. The proposed conceptual model proved useful to understand perceptions and responses to flood risks in the research population.

The findings from this research are likely to be relevant to other countries with similar contexts to Vietnam, both in the developing and the developed world, and contribute to broader discussions about the determinants of climate risk perception. It may be assumed that the relative influence of the determinants depends on the local exposure and visibility of climate change impacts, levels and modes of community participation, the prevalent worldviews and the type and degree of political mobilization around climate change issues. Hence, the theoretical implication is that depending on the conceptual model, the factors found to influence climate risk perception and adaptive responses are varied and some studies have arrived at conflicting conclusions. The relationship between climate change risk perceptions and knowledge about climate change, experiential processing, socio-cultural and socio-demographic factors therefore deserves further inquiry, initially through explorative studies that include a broad range of factors that might influence climate risk perceptions. Ultimately, when conducting risk communication activities both researchers and practitioners need to consider this relationship to explore effectiveness of message framing towards behavioural change intentions.

6.2.2 Gender-differentiated perceptions on risk perceptions and adaptive measures

Research framework: Chapter 2's findings showed an association of risk perceptions with individual knowledge, personal experiences and frequency of community participation. However most socio-demographic factors – apart from respondents' income source and city of residence – were not consistent predictors of risk perceptions and intention to take adaptive measures. Moreover, the multivariate analysis found that only a limited

number of socio-demographic factors predicted risk perceptions and the intention to take action to reduce potential impacts. The research findings supported the assumption that some socio-demographic factors become statistically insignificant when controlled for individual knowledge, personal experience and frequency of community participation influences. Therefore, in Chapter 3, I applied a gender-differentiated framework (GST, Ben 1981) to explore how socio-demographic factors influence risk perceptions and adaptive measures in terms of social, economic and environmental impacts.

Main findings towards research questions/hypotheses: The research findings in Chapter 3 proved there was gender-differentiated perception on city flooding impacts on people's lives. Specifically, prior, during and following floods, women were perceived to work longer hours, and to take on additional tasks both in the household and at work. The roles of men and women in the family were also different, pre-, post- and during floods. The most strongly perceived impacts of floods on women were economic, as their reduced daily income made it difficult to cover the higher costs for family food and living expenses during periods of flooding. Apparently as a result of these gender-differentiated impacts, women also perceived greater self-impacts to their health and greater stress than men. In addition, focus group discussions showed that while decision-making power of women in city communities was greater than decision-making power of women coming from rural areas, this difference narrowed during flooding, as men took more decisions about mitigation measures. This also led to increasing conflicts between wives and husbands, often exacerbated by temporary flood-induced financial constraints. These findings revealed that women are one segment of society that is particularly vulnerable and highly affected by flood risks. This is due to their differences in disaster vulnerability and impacts, including social roles (e.g. caring for children, elderly and sick; food provision; household duties), education, employment status, income, household finance responsibilities, access to community services and infrastructure (Fakhruddin and Rahman 2015; Rahman 2013); and female-headed households are particularly vulnerable (Flatø, Muttarak, and Pelser 2017; Klasen, Lechtenfeld, and Povel 2015). Furthermore, this research suggested that such disproportionate impacts on women could be mitigated through public education and pre-emptive planning measures.

Practical and theoretical reflections: The research findings (Chapter 3) revealed that socio-economic factors including gender played important roles in risk perceptions and impacts in city flooding situations. The research extended findings already documented in the literature, that the impacts of flooding are gender-differentiated, with women experiencing greater impacts than men. However gendered measures were not identified by communities or people as solutions to the impacts of flooding, implying that gaps still exist between knowledge, attitudes and practice on gender equality at the community level.

The theoretical implication is that there needs to be more attention to the gendered-differentiated impacts of flood (and climate change) as priority measures to reduce risks. This showed that gender schema theory (GST) needs to better contemplate the role that gender plays in shaping risk perceptions and influencing risk management practices. For example, more empirical studies could help to assess how public education and pre-emptive planning measures mitigate such disproportionate flood risks for women. Furthermore, it is important to explore the psychological differences between men and women and then make suggestions for possible applications to climate change risk communication. While men perceive threat from intimacy; women sense threat from separation (Prakash and Flores 1985). Therefore it is important for risk communication researchers to explore the psychological differences between men and women and then make suggestions for possible applications to behavioural change communication efforts. Specifically, these gender differences need to be translated into framing for risk communications in order to make the framed messages more acceptable to each of the sexes.

6.2.3 Framing effectiveness on behavioural intentions and the role of message congruency in climate change communication with adolescents

Understanding risk perceptions among different stakeholders plays an important role in designing risk communication messages; and analysing how different techniques of communicating climate risks affect people's perceptions and attitudes towards climate change impacts. After exploring factors that influenced risk perceptions and the intention to take adaptive

measures in Chapters 2 and 3, in Chapters 4 and 5 I explored how to effectively communicate climate change risks by applying different message framing methods.

Research framework: In Chapter 4, to investigate the interaction between climate change risk perceptions and predictors of behavioural change, as well as the moderating role of message congruency in framing messages, I proposed a research framework that is rooted in the theory of planned behaviours (TPB, Ajzen 1991) and the construal level theory (CLT, Trope and Liberman 2010). The framework treats threat and efficacy perceptions as independent variables that affect the perceived responsibility and the intention to adopt responsive behaviours, with message congruency as a moderating factor. From EPPM theory (Witte 1992), I adopted perceived severity, susceptibility, self-efficacy, and response efficacy to climate change as the four independent variables; the two dependent (or outcome) variables selected were perceived responsibility and mitigation intentions. I investigated the influence of the moderator variable 'congruency' by testing whether the relationship between individuals' mitigation intentions and perceived responsibility is dependent on climate change message congruency.

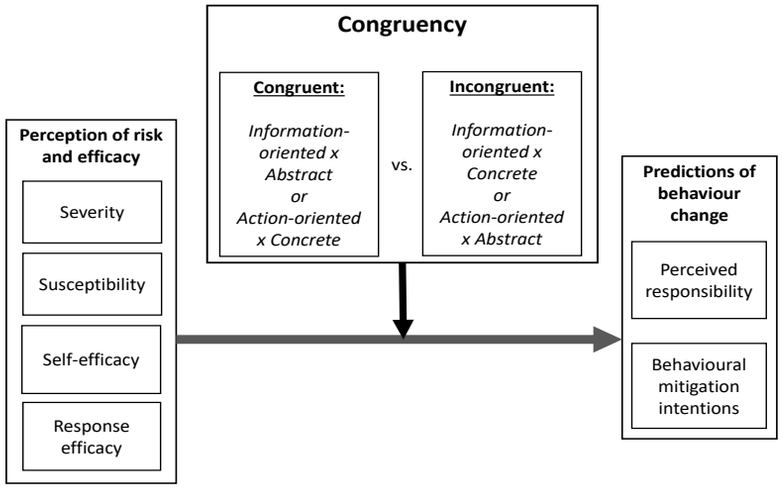

Figure 6.3. Research framework on risk communication

Main findings towards research questions/hypotheses: The overall results of this study extended earlier work on message framing, psychological

distance, and congruency in message representation (Brügger, Morton, and Dessai 2016; Spence, Poortinga, and Pidgeon 2012; Trope and Liberman 2010; Zwickle and Wilson 2013) by showing that communicating climate change threats in combination with efficacy is more effective in triggering changes in audience attitudes toward taking response measures than only communicating threats (Hart and Feldman 2014; Roser-Renouf et al. 2014). The study further investigated messages framed either abstractly or concretely and framed as either action-oriented or information-oriented to predict changes in behavioural intention towards climate change mitigation among adolescents. The research findings proved the hypothesis that perceptions of risk severity and susceptibility as well as perceived self-efficacy and response efficacy have a positive relationship with two predictors of behavioural change. The findings also showed that the combination of concrete and action-oriented messages coupled lively psychological experience with clear behavioural options, thus reducing barriers to act; while the combination of abstract and information-oriented messages facilitated the adoption of a more contemplative perspective, especially in the case of a long-term phenomenon like climate change. Furthermore, the research findings also proved another hypothesis that the strength of this relationship is moderated by congruency in risk messages; a stronger relation was observed between risk and efficacy perceptions and predictors of behavioural intentions to climate change mitigation when messages were congruent, in line with earlier research (Zwickle and Wilson 2013).

The research findings established that higher perception of risk (severity, susceptibility) and efficacy (self- and response efficacy) lead to higher levels of assumed responsibility and behavioural intentions towards climate change mitigation, but more strongly so under high message congruency conditions. It was concluded that messages which are congruently designed (e.g. messages are considered congruent when they provide recipients with consistent contents such as giving concrete and actionable advice, or by providing more abstract and general background information) boost the relation between risk and efficacy perceptions and the behavioural outcome variables.

Practical and theoretical reflections: Traditionally, climate change communication focused on scientific findings about global climate phenomena

and may have been raised due to extreme weather events or global climate change conferences. Over recent decades climate change communication has gained in theoretical and empirical interest for researchers; however it still lacks empirical and practical evidence to target specific audiences. In particular, the information deficit model (i.e. one way communication) applied in many communication strategies, which simply assumes that the public at risk is lacking knowledge and if provided more or better information will produce more rational responses, is most likely not successful in addressing complicated and highly-uncertain climate-related risks. This research successfully extended current work that communicating climate change risks needs a more integrated method and must be evidence-based in order to be effective.

This research also contributed to narrowing the knowledge gaps about the conditions for climate change communication among adolescents in the developing world, and likely in other parts of the world, with the hope that they will foster a more sustainable lifestyle to combat global climate change impacts in the future. Theoretically, the research findings demonstrated that the combination of perceptions of climate change threats and efficacy as predictors of behavioural change, with congruency in risk messages as a potential moderator of this relationship, was a successful research framework. Therefore, this framework would be applicable to explore additional dimensions of framing effects in climate change communication by testing the expectation that congruent message frames will bolster the relation between perceptions of risk and efficacy and the responsibility and behavioural intentions of participants (e.g., adults, managers, policy makers) toward both climate change adaptation and mitigation.

Previous research revealed that people view climate change impacts as temporally and spatially distant and therefore often view climate change impacts as personally relevant only after directly experiencing disrupted weather patterns (Brügger, Morton, and Dessai 2016; Spence, Poortinga, and Pidgeon 2012; Trope and Liberman 2010; Zwickle and Wilson 2013). This was the biggest challenge in effectively communicating climate change to various audiences. In CLT, there are two approaches for reducing psychological distance: (i) bringing the risk closer to the individual or (ii)

bringing the individual closer to the risk (Zwickle and Wilson 2013). For risk communication, framing messages is only effective on the individual's perceived construal level if it is "composed on a single level of construal" and in a congruent manner (Zwickle and Wilson 2013). In this research (Chapter 4), by testing the effects of message congruency between the levels of threat proximity and action-vs. information-oriented construal, the findings confirmed that congruency in message framing plays an important role in explaining communication effects. Only when the messages are congruent in the content do the manipulations more consistently change adolescents' perceptions and attitudes. This research also contributed to narrowing the knowledge gaps about the conditions for climate change communication among adolescents in the developing world, and likely in other parts of the world, with the hope that they will foster a more sustainable lifestyle to combat global climate change impacts in the future.

Furthermore, in this research, by applying a comprehensive research framework and inclusion of a moderator variable (i.e. message congruency) in message framing, the findings revealed strong effects of congruency in message framing; when messages were congruent in the content, communicative interventions changed adolescents' perceptions and attitudes toward climate change mitigation more consistently. Hence, the theoretical implication is that there needs to be more attention to framing climate change messages more congruently for reducing climate change's psychological distance as a strategy to change the public's perceptions and behavioural intentions towards climate change adaptation or mitigation. This thesis further extended the main argument by the CLT that varying levels of psychological distance affect individuals' perceptions of risks and their judgments with regards to decision-making behaviours. Moreover, existing studies of psychological distance so far have underexplored individual differences or contextual variables as drivers for climate change perception and behavioural change. Thus in the future, this will be an important aspect to consider because climate change communication meets recipients with existing attitudes, values, and perceptions in order to create behavioural changes that will reduce climate change risks.

6.2.4 Persuasiveness of gain vs. loss framed messages on risks perceptions and decisions to climate change responses among farmers

Research framework: In Chapter 5, I further investigated how message framing affects the appraisal of threat and efficacy in climate change response behaviours among farmers. I elaborated the extended parallel processing model (EPPM, Witte 1992) to develop a conceptual framework that proposed a person's intention to protect oneself against a given risk depends on this person's perceived severity and perceived susceptibility of the threat, as well as the levels of perceived self-efficacy and perceived response efficacy.

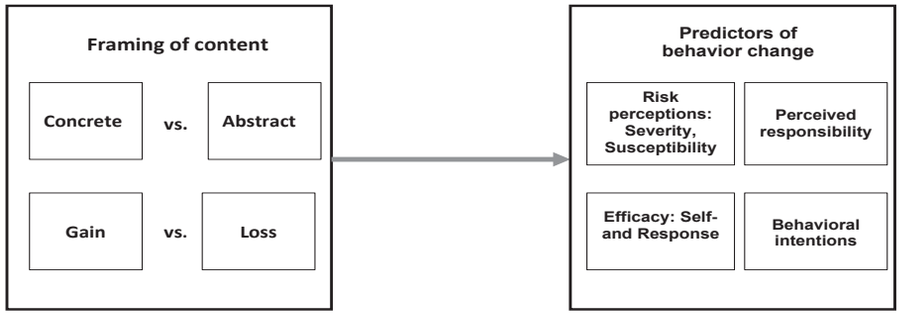

Figure 6.4. Research framework on risk communication

Main findings towards research questions/hypotheses: In this research, I investigated the effectiveness of message frames (gain vs. loss and concrete vs. abstract) in communicating climate change risk perception and efficacy for behavioural intentions to adapt to climate change among farmers. I utilized a persuasiveness frame in combination with psychological distances of climate change to design the research framework and communicative messages. By combining gain-framed and concrete-framed messages vs. loss-framed and abstract-framed messages in the same experiment, the research findings confirmed previous studies on gain vs. loss communication that gain frames were more persuasive than loss frames in scenarios that involved prevention behaviours (Detweiler et al. 1999; Dijkstraa, Rothman, and Pietersma 2011; Kahneman and Tversky 1984; Millar and Millar 2000; Rothman and Salovey 1997).

When being communicated to by gain-framed in combination with concrete-framed messages, the farmers cared more about what they could do to adapt to climate change now, in response to its psychological distance (temporal: present vs. future), in their community (spatial: physically close vs. far), for their household (social: self vs. others), and with less uncertainty (likely affect their crops this year or next year). Specifically, the research findings confirmed the hypothesis that gain-framed messages are more effective in changing farmers' risk perceptions and efficacy to climate change, as well as influencing stronger behavioural intentions. Farmers responded more positively to messages that tell them what they gain (persuasiveness) in terms of income, health, or livelihood options if they take recommended adaptive actions than the messages about what they might lose if they do not take similar actions. Furthermore, the research findings supported another hypothesis that farmers were more concerned about climate change adaptation (risk, efficacy) and more willing to take adaptive measures (behavioural intention to climate change adaptation) when being communicated to by gain-framed in combination with concrete-framed messages, compared to loss-framed in combination with abstract-framed messages. Most importantly, the research contributed to earlier work on the effectiveness of the CLT when communicating the psychological distant risk like climate change. Moreover, this research was one of the first attempts to successfully conduct empirical research on message persuasiveness in combination with psychological distance, with farmers of vulnerable communities in the developing world. This research proves the need for more empirical and longitudinal research with specific groups of audience in varied contexts in order to explore the most effective communication strategy on climate change.

Practical and theoretical reflections: One of the sectors most vulnerable to climate is agriculture. Because farming relies heavily on planning for weather and seasons according to experience of past years, changes in seasons and unusual weather patterns can lead to loss of farm crops and animals. Vietnam is one of the most agriculture-dependent countries in the world with 65.0% people living in rural areas and the agriculture sector contributing 14.0% of the country's GDP in 2019 (GSO 2019). The

current impacts of climate change continue to seriously affect the lives of farmers. Therefore, it is important to understand farmers' perceptions about climate change risks, responsive strategies and intentions to act. As largely argued by scientists, communication barriers in the society present significant challenges that require framing methods to target specific audiences (DeGolia, Hiroyasu, and Anderson 2019; Dickinson et al. 2013; Leiserowitz 2006; Morton et al. 2011; Moser 2016; Moser and Dilling 2011; Nerlich, Koteyko, and Brown 2010; Reser and Bradley 2017). In the case of communicating climate change risks to farmers, this research supported the original concept in Prospect Theory (Kahneman and Tversky 1984) that gain vs. loss framing dictates how one perceives their message. These concepts may be applicable to gain vs. loss framing in general, but are demonstrated as valuable for mitigating and adapting to climate change. Implementing gain and loss framing holds one at an equilibrium where a gain equates to a loss.

Moreover, the research findings confirmed the effectiveness of CLT when communicating about psychologically distant risks like climate change. It also contributed to the current discussion within psychology, sociology, and communication sciences on whether the effects of existing frames are varied and even contradictory in influencing audiences' decision-making (Cacciatore, Scheufele, and Iyengar 2016; Linden, Maibach, and Leiserowitz 2015; Moser and Dilling 2007; Nisbet and Mooney 2007; Spence and Pidgeon 2010). This empirical study was able to prove that gain-framed messages are more effective in raising risk perceptions and efficacy, making stronger behavioural intentions towards climate change risks, compared to when receiving loss-framed messages. Above all, farmers were more willing to take adaptation measures to climate change when they were exposed to gain- in combination with concrete-framed messages vs. loss- and abstract-framed messages. Moreover, this research is one of the first attempts to successfully conduct empirical research on message persuasiveness in combination with psychological distance, with developing world farmers in vulnerable communities. While most research to date looks at climate change communication with the general public, this research targets a specific group: farmers. This research also offered important considerations

for climate change communication with the farmers whose livelihoods are projected to be most affected by climate change impacts both immediate and long-term future by emphasizing the gains that farmers will get if they implement adaptive measures. Specifically, the research proved that properly-designed messages which focus on positive outcomes (gain-framed) and relate to farmers' livelihood in upcoming crops (psychological proximity) is the most effective framing method.

6.3 Recommendations for policy, practices, and future research

This thesis has yielded empirical and theoretical findings on the basis of which I propose several recommendations regarding policy, practices, and future studies on climate risk perception and communication for behavioural change.

6.3.1 Recommendations for policy advocacy and formation

Policy formation on climate change risk communication needs to be evidence-based to be effective

Although climate change communication has gained theoretical and empirical interest for researchers, it still lacks empirical and practical evidence to target specific audiences such as policy makers, farmers and adolescents, especially in developing countries. Traditionally, climate change communication focused on scientific findings about global climate and was triggered by extreme weather events or global climate change conferences. The communication was carried out mostly by scientists or environmentalists, with a lack of exchange among those doing the communication work and those who researched the topic, as well as a lack of empirical studies on climate change risk communication. Efforts by climate scientists to communicate climate change risks to non-scientific audiences have been largely ineffective. Especially the information deficit model (i.e. one way communication) applied in many communication strategies, which is most likely not successful in addressing complicated and highly-uncertain

climate-related risks (see section 6.2.3). In practice, many governments have tried to raise awareness about climate change through top-down and one-way communication campaigns with limited success. Therefore, it is recommended that in policy making, it would need to base on empirical evidence to effectively communicate climate change risks to the public. For example, prior to implementing a mass communication campaign on climate change, empirical studies should be conducted to explore factors influencing risk perceptions or to measure effectiveness of message framing with different target audiences.

Implementing more gender-sensitive risk adaptive measures can be most cost-effective in reducing flood (and climate change) impacts

While most existing research did not include a gendered analysis or explanation in disaster- and climate-risks, impacts and adaptive strategies, this research indicates that all three are gendered (see section 6.2.2). This points to the need to strengthen a gender-sensitive approach to adaptation programming at various levels such as conducting empirical studies to assess how public education and pre-emptive planning measures mitigate such disproportionate gender impacts, or to explore the psychological differences between men and women and then make suggestions for possible applications to climate change risk communication. Specifically, at the individual/household level, promotion of greater discussions between partners on distribution of domestic labour and joint decision-making on both disaster preparedness and response could be important in reducing negative household-level impacts. At the institutional level, greater involvement of women in disaster preparedness, planning, needs assessments and response could prove critical in ensuring women's differential experience of disasters is adequately addressed.

6.3.2 Recommendations for risk communication practices

More integrative conceptual models are needed to determine the factors influencing climate risk perception and adaptive responses

This thesis highlights the importance of assessing the potential impact of a wider set of factors in influencing climate risk perception and adaptive responses in order to effectively design risk communication messages. While current practice focuses primarily on adapting messaging for socio-demographic factors, this research underscores the need for a more nuanced, in-depth and integrative conceptual model to underpin communications campaigns. This would require additional quantitative and qualitative research to understand both broad trends and place- and audience-specific factors. Specifically, more attention is needed to address the local exposure and visibility of climate change impacts, level and modes of community participation, the prevalent worldview and the type and degree of political mobilization around climate change issues. Such research could inform the development of revised communications approaches that take into account the factors identified as significant in this research as well as others, like moving beyond the individual frame to look at collective actions (for example via interventions targeting community-based organizations). Not least, it is useful to design interventions and communications to raise awareness of people's perceptions and practice in coping with flood and climate risks, such as reinforcing the perception of continued vulnerability by highlighting personal experiences; providing concrete examples of adaptive measures; and encouraging adaptive measures through social influences ash as utilization of community organizations.

More effort is needed to communicate climate change risks to younger generations

Adolescents and young people are often assumed to be a critical audience for climate change-related communications campaigns. This is both due to the perception that their behaviours and habits are more malleable than those of adults, as well as the observation that the impacts of climate change will fall more heavily on them than on the current generation of adults. Previous research has indicated that "late childhood and early adolescence" is a vital period for the development of interest in environmental issues (Bartlett 2008; Blanchet-Cohen 2008; Ojala 2012). This is the phase at which people become capable of more abstract thought and display greater interest in large-scale or global topics like climate change (Holden 2007). It

is also clear that the burden of climate change is likely to be heavily skewed towards vulnerable children, particularly those in the developing world living in both urban (Bartlett 2008) and rural poverty. Nevertheless, most research to date has been conducted in the developed world and almost none has considered how to effectively communicate to adolescents in developing countries (Ojala 2012). While this research is a step in the right direction, additional research is certainly needed. It is recommended to further explore how the combination of concrete and action-oriented messages couple with psychological experience and behavioural options to climate change response; and how the combination of abstract and information-oriented messages facilitate the adoption of a more contemplative perspective, especially in the case of a long-term phenomenon like climate change. Practically, it is suggested that real communication activities are conducted to validate the empirical conclusion that higher perception of risk (severity, susceptibility) and efficacy (self- and response efficacy) lead to higher levels of assumed responsibility and behavioural intentions towards climate change mitigation among adolescents in other contexts. In particular, it would be useful to explore the finding that climate change communications was more effective on mitigation than adaptation behaviours: this could be due to adolescents' limited household autonomy, longer personal time horizons or other factors to be identified.

To communicate climate change with farming communities it is essential to distinguish between adaptation vs. mitigation

It is important for any public communication campaign or educational activity for farmers about climate change to include what actions are required to adapt to the changes. The research findings further imply that climate change communication experts and practitioners designing a public campaign or project should advocate for behavioural changes with farmers, should carefully look at the message frame, understand the aim (targeting adaptation or mitigation) and the local context where communication activities happen. Although this thesis was able to confirm that the negative (loss-framed) and abstract-framed messages were not effective in communicating climate change with farmers, it is still necessary to tell them about the negative impacts and potential losses caused by

climate change. Lastly, the thesis failed to show that persuasiveness and psychological distance did not work for communicating climate change mitigation with farmers. Thus alternative communication methods for farmers about mitigation behavioural change need to be explored, due to the fact that the agriculture sector also significantly contributes to greenhouse gas emissions (EEA 2019; FAO-IPCC 2017).

6.3.3 Recommendations for future research

Further studies are needed on psychological distance and message congruency

Previous studies have highlighted the challenges in effectively communicating about climate change mitigation and adaptation in order to drive behaviour change. This research has identified message congruency as an important factor that may have previously been overlooked in efforts to design climate change communications initiatives, and one which deserves further study. It also underlines the importance of assessing the impact of other dimensions of message framing. While this research examined the impact of congruency on adolescents, it would be important to assess whether these findings are also valid when it comes to other population segments or whether other framing devices prove more influential for other specific target audience segments. Specifically, it is recommended that more empirical studies are needed to confirm that message congruency boosts the relation between risk and efficacy perception and the behavioural intentions to climate change among different audience groups such as students, farmers, workers, women, and policy makers, and in different contexts of both developed and developing countries.

Alternative communication methods need to be explored for farmers mitigation behavioural change

This research also underlined the continued challenges in devising effective climate change adaptation and mitigation communications interventions for farmers. While it was able to confirm that loss-framed messages were less effective than gain-framed approaches, it found that persuasiveness and psychological distance-based messaging was not effective for climate

change mitigation. Given that farmers' behaviours are critical not just for adaptation but are also required for mitigation given the significant contribution of certain forms of agriculture to greenhouse gas emissions (in 2010 the Agriculture, Forestry, and Other Land Use sector accounted for 24% of total global emission) (IPCC 2014), further research will be required to establish how to more effectively drive behaviour change in this critical population segment. Specifically, research should further test that the farmers responded more positively to messages that tell them what they gain in terms of income, health or livelihood options if they take recommended adaptive actions than the message about what they might lose if they do not take similar actions; or that farmers were more concerned about climate change adaptation and more willing to take adaptive measures when being communicated to by gain-framed in combination with concrete-framed messages in comparison with loss-framed in combination with abstract-framed messages.

More empirical studies in developing countries are needed to effectively communicate climate change risks for adaptation and mitigation

Regarding climate change risk perceptions, this thesis found that depending on the conceptual model, the factors that influence climate risk perception and adaptive responses are varied and some studies arrive at conflicting conclusions. The relationship between climate change risk perceptions and knowledge about climate change, experiential processing, socio-cultural and socio-demographic factors therefore deserves further inquiry, initially through explorative studies that include a broad range of factors that might influence climate risk perceptions. The relative lack of studies in developing countries might unintentionally tilt theoretical considerations towards factors that are more prominent in developed countries.

Regarding climate change risk communication, despite many studies on communicating climate change and its associated risks in Europe, America, and Australia, there are fewer studies into how to effectively communicate climate change risks in the developing world. This study provided additions to this body of work, by showing that individuals' knowledge, place-specific experience and vulnerability-related socio-demographic factors

are important predictors of both flood and climate change risk perception and intentions to take adaptive measures. The study also confirmed the importance of combining theories of risk perception, protection motivation and the extended parallel processing model to better understand influential behavioural factors and devise more effective communications campaigns. In a developing country like Vietnam, a number of factors such as a lack of climatologists and prominent meteorologists, the media landscape, socio-economic characteristics and literacy rates can impede the effectiveness of climate change communication. The message framing methods will further need more empirical studies to understand the most effective combination of messages to effectively communicate climate change risks for adaptation and mitigation among different groups like farmers, children or policy makers.

6.4 Conclusion

The aim of this thesis was to understand which factors influence flood and climate change risk perceptions and efficacy towards responding to flood and climate risks among different groups of people living in the coastal and delta communities in Vietnam. Through different experimental studies, the thesis also aims to test message framing methods to effectively communicate flood and climate change risks for behavioural changes toward mitigation and adaptation. This research was able to contribute to the evidence base on the determinants of climate change and flood risk perceptions and intentions to adopt mitigation and adaptation measures in the Vietnamese context. A starting point was to compare the extent to which the distant, complex and abstract concept of climate change exhibits different behavioural barriers and levers in comparison with the more immediate, concrete and experiential phenomenon of floods. It further examined whether the flood experience of individuals impacted their perceptions of climate risks and adaptation. In line with previous findings, I found that individuals' knowledge, place-specific experience and vulnerability-related socio-demographic factors are important predictors of both flood and climate change risk perception and intentions to take adaptive measures. In addition, the findings from Vietnam suggest the

importance of combining theories of risk perception, protection motivation and the extended parallel processing model to better understand influential behavioural factors and devise more effective communications campaigns. It suggests the importance of validating this approach in other contexts and settings.

In addition to underlying factors of importance in the Vietnamese context, this research also contributes to broader theoretical debates and to the global conversation by recommending how to effectively communicate climate change to different audiences, including:

- be consistent in message framing;
- discuss risk rather than uncertainty;
- apply visuals more than text;
- tell human stories and give the top-line message before the caveats; and
- be clear about the scientific consensus.

By highlighting the differential nature of significant factors in two different climate-impacted demographic sectors within the Vietnamese context – adolescents and farmers – it highlights the need for continued research on the specific drivers of mitigation and adaptation behaviours in specific population segments and the need to develop, deploy and test more tailored climate change communications interventions to reduce vulnerability and contribute to more sustainable development pathways.

This research also addressed a gap in the literature regarding research on climate change risk communication in lower-middle income settings. It showed that:

- Although risk perception is a well-established concept, climate change risk perception has rarely been addressed, especially in developing countries like Vietnam where climate change risks are high and threaten the livelihoods and safety of millions of people.

- An intention gap to take more long-term adaptive measures exists which is important to address in risk communication. Gender gaps and imbalances shaped by cultural and social structures are often ignored in risk assessment and disaster mitigation planning. Gender gaps still exist between knowledge, attitudes and practice on gender equality at community level.
- The communication was typically carried out by scientists or environmentalists, with a lack of exchange among those doing the communication work and those who researched the topic, as well as a lack of empirical studies on climate change risk communication.
- Despite many studies on communicating climate change and its associated risks in developed countries, there are fewer studies into how to effectively communicate climate change risks in the developing world.
- Few studies are available to understand children' (or adults') perception of climate change risks, and even fewer on how to communicate climate change to adolescents.

This thesis also underlines the importance of pursuing additional research in other lower- and lower-middle income countries to validate these findings and deepen our understanding of effective communications approaches in these contexts. It will be critical for donors, policy makers and researchers to take up this research agenda in the coming years given the major potential impacts of climate change on vulnerable populations in lower- and lower-middle income countries. Without a sufficiently robust evidence base, climate change mitigation and adaptation measures in these countries are likely to continue to have only limited effectiveness, posing further risks to the livelihoods of vulnerable communities, the sustainable development objectives at national levels and the global climate change agenda.

The Paris Agreement (UNFCCC) aims at "reducing global GHG emissions so as to limit the earth's temperature increase in this century to 2 degrees Celsius above pre-industrial levels while taking steps to limit the increase to 1.5 degrees" (UNFCCC 2016). In order to achieve this ambitious goal, countries

have been laying out their Intended Nationally Determined Contributions to help cut emissions. While technological advances will provide some of the reductions, changes in a wide range of human behaviours are also critical to success. This research emphasizes the importance of investing in appropriate research to determine the most effective communications strategies to drive behaviour change across different population segments around the world.

References

Adams, Richard M., Ronald A. Fleming, Ching-Chang Chang, Bruce A. McCarl, and Cynthia Rosenzweig. 1995. "A Reassessment of the Economic Effects of Global Climate Change on U.S. Agriculture." *Climatic Change* 30 (2): 147–67. doi:10.1007/BF01091839.

Ahn, Sun Joo (Grace), Jesse Fox, Katherine R. Dale, and J. Adam Avant. 2015. "Framing Virtual Experiences: Effects on Environmental Efficacy and Behaviour Over Time." *Communication Research* 42 (6): 839–63. doi:10.1177/0093650214534973.

Ajzen, Icek. 1991. "The Theory of Planned Behaviour." *Organizational Behaviour and Human Decision Processes* 50: 179–211. doi:10.4135/9781446249215.n22.

———. 2011. "The Theory of Planned Behaviour: Reactions and Reflections." *Psychology and Health* 26 (9): 1113–27. doi:10.1080/08870446.2011.613995.

Ajzen, Icek, and Thomas J. Madden. 1986. "Prediction of Goal-Directed Behaviour: Attitudes, Intentions, and Perceived Behavioural Control." *Journal of Experimental Social Psychology,* no. 22: 453–74.

Anderson, Richard C., Rand J. Spiro, and Mark C. Anderson. 1997. "Technical Report No. 24: Schemata as Scaffolding for the Representation of Information in Connected Discourse."

Apanovitch, Anne Marie, Danielle McCarthy, and Peter Salovey. 2003. "Using Message Framing to Motivate HIV Testing among Low-Income, Ethnic Minority Women." *Health Psychology* 22 (1): 60–67. doi:10.1037/0278-6133.22.1.60.

Arbuckle, J. Gordon, Lois Wright Morton, and Jon Hobbs. 2013. "Farmer Beliefs and Concerns about Climate Change and Attitudes toward Adaptation and Mitigation: Evidence from Iowa." *Climatic Change* 118 (3–4): 551–63. doi:10.1007/s10584-013-0700-0.

ARC, GRC, VNRC, and AMDI. 2013. "Baseline Study for Climate Smart Community-Based Disaster Risk Reduction Project in the Mekong, Vietnam."

Arnell, Nigel W., and Ben Lloyd-Hughes. 2014. "The Global-Scale Impacts of Climate Change on Water Resources and Flooding under New Climate and Socio-Economic Scenarios." *Climatic Change* 122 (1–2): 127–40. doi:10.1007/s10584-013-0948-4.

Arunrat, Noppol, Can Wang, Nathsuda Pumijumnong, and Sukanya Sereenonchai. 2017. "Farmers ' Intention and Decision to Adapt to Climate Change : A Case Study in the Yom and Nan Basins , Phichit Province of Thailand." *Journal of Cleaner Production* 143: 672–85.

Asplund, Therese. 2018. "Communicating Climate Science: A Matter of Credibility: Swedish Farmers' Perceptions of Climate-Change Information." *The International Journal of Climate Change* 10: 23–28.

Aven, Terje, and Ortwin Renn. 2009. "On Risk Defined as an Event Where the Outcome Is Uncertain." *Journal of Risk Research* 12 (1): 1–11. doi:10.1080/13669870802488883.

Bangalore, Mook, Andrew Smith, and Ted Veldkamp. 2019. "Exposure to Floods, Climate Change, and Poverty in Vietnam." *Economics of Disasters and Climate Change* 3: 79–99. doi:10.1007/s41885-018-0035-4.

Bartlett, Sheridan. 2008. "Climate Change and Urban Children: Impacts and Implications for Adaptation in Low- and Middle-Income Countries." *Environment and Urbanization* 20 (2): 501–19. doi:10.1177/0956247808096125.

Beedell, Jason, and Tahir Rehman. 2000. "Using Social-Psychology Models to Understand Farmers' Conservation Behaviour." *Journal of Rural Studies* 16: 117–27.

Bellard, Céline, Cleo Bertelsmeier, Paul Leadley, Wilfried Thuiller, and Franck Courchamp. 2012. "Impacts of Climate Change on the Future of Biodiversity." *Ecology Letters* 15: 365–77. doi:10.1111/j.1461-0248.2011.01736.x.

Ben, Sandra Lipsitz. 1981. "Gender Schema Theory: A Cognitive Account of Sex Typing." *Psychological Review* 88 (4): 354–64. doi:0033-295X/81/8804-0354$00.75.

Bernauer, Thomas, and Liam F. McGrath. 2016. "Simple Reframing Unlikely to Boost Public Support for Climate Policy." *Nature Climate Change* 6 (7): 680–83. doi:10.1038/nclimate2948.

Bertolotti, Mauro, and Patrizia Catellani. 2014. "Effects of Message Framing in Policy Communication on Climate Change." *European Journal of Social Psychology* 44 (5): 474–86. doi:10.1002/ejsp.2033.

Blanchet-Cohen, Natasha. 2008. "Taking a Stance: Child Agency across the Dimensions of Early Adolescents' Environmental Involvement." *Environmental Education Research* 14 (3): 257–72. doi:10.1080/13504620802156496.

Boateng, Isaac. 2012. "GIS Assessment of Coastal Vulnerability to Climate Change and Coastal Adaptation Planning in Vietnam." *Journal of Coastal Conservation* 16 (1): 25–36. doi:10.1007/s11852-011-0165-0.

Boer, Henk, and Erwin R. Seydel. 1996. "Protection Motivation Theory." In *Predicting Health Behaviour: Research and Practice with Social Cognition Models*, edited by Mark Conner and Paul Norman, 95–120. Buckingham, UK: Open University Press.

Bostrom, a., M. G. Morgan, B. Fischhoff, and D. Read. 1994. "What Do People Know about Global Climate Change? 1. Mental Models." *Risk Analysis* 14 (6): 959–70. doi:10.1111/j.1539-6924.1994.tb00065.x.

Brody, S D, S Zahran, a Vedlitz, and H Grover. 2008. "Examining the Relationship between Physical Vulnerability and Public Perceptions of Global Climate Change in the United States." *Environment and Behavior* 40 (1): 72–95. doi:10.1177/0013916506298800.

Brügger, Adrian. 2020. "Understanding the Psychological Distance of Climate Change." *Global Environmental Change* 60. doi:10.1016/j.gloenvcha.2019.102023.

Brügger, Adrian, Suraje Dessai, Patrick Devine-Wright, Thomas A. Morton, and Nicholas F. Pidgeon. 2015. "Psychological Responses to the Proximity of Climate Change." *Nature Climate Change* 5 (12): 1031–37. doi:10.1038/nclimate2760.

Brügger, Adrian, Thomas A. Morton, and Suraje Dessai. 2016. "'Proximising' Climate Change Reconsidered: A Construal Level Theory Perspective." *Journal of Environmental Psychology* 46: 125–42. doi:10.1016/j.jenvp.2016.04.004.

Bruin, Wändi de, Andrew M Parker, and Baruch Fischhoff. 2007. "Individual Differences in Adult Decision-Making Competence." *Journal of Personality and Social Psychology* 92 (5): 938–56. doi:10.1037/0022-3514.92.5.938.

Cacciatore, Michael A., Dietram A. Scheufele, and Shanto Iyengar. 2016. "The End of Framing as We Know It … and the Future of Media Effects." *Mass Communication and Society* 19 (1): 7–23. doi:10.1080/15205436.2015.1068811.

Capstick, Stuart, Lorraine Whitmarsh, Wouter Poortinga, Nick Pidgeon, and Paul Upham. 2014. "International Trends in Public Perceptions of Climate Change over the Past Quarter Century." *WIREs Climate Change* 6 (1): 35–61. doi:10.1002/wcc.321.

Carlton, Stuart J., Perry-Hill Rebecca, Matthew Huber, and Linda S. Prokopy. 2015. "The Climate Change Consensus Extends beyond Climate Scientists." *Environmental Research Letters* 10. doi:10.1088/1748-9326/10/9/094025.

CCFSC. n.d. "Central Committee for Natural Disaster Prevention and Control, Government of Vietnam."

———. 2015. "Tình Hình Hạn Hán, Xâm Nhập Mặn Khu Vực Tây Nguyên, Nam Trung Bộ, Đồng Bằng Sông Cửu Long và Những Công Việc Triển Khai Tiếp Theo [Situation of drought, saltwater intrusion in Central Highlands, South Central, Mekong Delta and follow-up actions]."

CGIAR. 2016. "The Drought and Salinity Intrusion in the Mekong River Delta of Vietnam." CGIAR Research Center in Southeast Asia. https://cgspace.cgiar.org/handle/10568/75633%0Apapers3://publication/uuid/1F44F90C-A3AD-4202-B9EE-EDB184F85B37.

Chapman, Daniel A., Brian Lickel, and Ezra M. Markowitz. 2017. "Reassessing Emotion in Climate Change Communication." *Nature Climate Change* 7 (12): 850–52. doi:10.1038/s41558-017-0021-9.

Chawla, Louise, and Debra Flanders Cushing. 2007. "Education for Strategic Environmental Behavior." *Environmental Education Research* 13 (4): 437–52. doi:10.1080/13504620701581539.

Cho, Hyunyi, and Franklin J. Boster. 2008. "Effects of Gain versus Loss Frame Antidrug Ads on Adolescents." *Journal of Communication* 58 (3): 428–46. doi:10.1111/j.1460-2466.2008.00393.x.

Chu, Eric K. 2016. "The Governance of Climate Change Adaptation Through Urban Policy Experiments." *Environmental Policy and Governance* 26 (6): 439–51. doi:10.1002/eet.1727.

Clemens, Maria, Jeroen Rijke, Assela Pathirana, Jaap Evers, and Nguyen Hong Quan. 2016. "Social Learning for Adaptation to Climate Change in Developing Countries: Insights from Vietnam." *Journal of Water and Climate Change* 7 (2): 365–78. doi:10.2166/wcc.2015.004.

"Climate Change History." n.d. Accessed January 9, 2021. https://www.history.com/topics/natural-disasters-and-environment/history-of-climate-change.

"Communicating Water-Related Climate Change Risks: Lessons from a Multi-Tool and Multi-Country Study in the Mekong Region." 2014. In *Climate Risks, Regional Integrations, and Sustainability in the Mekong Region*. MY.

Cook, John. 2016. "Countering Climate Science Denial and Communicating Scientific Consensus." *Oxford Research Encyclopedia of Climate Science*. doi:10.1093/acrefore/9780190228620.013.314.

Copsey, Tan, Yen Nguyen, and Phuong Ha Pham. 2012. "Vietnam Report: How the People of Vietnam Live with Climate Change and What Communication Can Do." *Climate Asia*.

Covello, V., and P. Sandman. 2001. "Risk Communication: Evolution and Revolution." In *Solutions for an Environment in Peril*, edited by Anthony B. Wolbarst. Baltimore: the Johns Hopkins University Press.

Cullen, Alison C, and C Leigh Anderson. 2016. "Perception of Climate Risk among Rural Farmers in Vietnam: Consistency within Households and with the Empirical Record." *Risk Analysis*. doi:10.1111/risa.12631.

Dang, Hoa Le, Elton Li, Ian Nuberg, and Johan Bruwer. 2014. "Understanding Farmers' Adaptation Intention to Climate Change: A Structural Equation Modelling Study in the Mekong Delta, Vietnam." *Environmental Science and Policy* 41: 11–22. doi:10.1016/j.envsci.2014.04.002.

Danner, Unna N., Henk Aarts, and Nanne K. de Vries. 2008. "Habit vs. Intention in the Prediction of Future Behavior: The Role of Frequency, Context Stability and Mental Accessibility of Past Behaviour." *The British Psychological Society* 47: 245–65. doi:10.1348/014466607X230876.

Dawson, Jeremy F. 2014. "Moderation in Management Research: What, Why, When, and How." *Journal of Business and Psychology* 29 (1): 1–19. doi:10.1007/s10869-013-9308-7.

DeGolia, Alexander H., Elizabeth H. T. Hiroyasu, and Sarah E. Anderson. 2019. "Economic Losses or Environmental Gains? Framing Effects on Public Support for Environmental Management." *Plos One* 14 (7): e0220320. doi:10.1371/journal.pone.0220320.

Dessai, Suraje, and Catherine Sims. 2010. "Public Perception of Drought and Climate Change in Southeast England." *Environmental Hazards* 9: 340–57. doi:10.3763/ehaz.2010.0037.

Detweiler, Jerusha B., Brian T. Bedell, Peter Salovey, Emily Pronin, and Alexander J. Rothman. 1999. "Message Framing and Sunscreen Use: Gain-Framed Messages Motivate Beach- Goers." *Health Psychology* 18 (2): 189–96. doi:10.1037/0278-6133.18.2.189.

Dickinson, Janis L., Rhiannon Crain, Steve Yalowitz, and Tammy M. Cherry. 2013. "How Framing Climate Change Influences Citizen Scientists Intentions to Do Something about It." *Journal of Environmental Education* 44 (3): 145–58. doi:10.1080/00958964.2012.742032.

Dijkstraa, Arie, Alexander Rothmanb, and Suzanne Pietersma. 2011. "The Persuasive Effects of Framing Messages on Fruit and Vegetable Consumption According to Regulatory Focus Theory." *Psychology and Health* 26 (8): 1036–48. doi:10.1080/08870446.2010.526715.

Donat, Markus G., Andrew L. Lowry, Lisa V. Alexander, Paul A. O'Gorman, and Nicola Maher. 2016. "More Extreme Precipitation in the World's Dry and Wet Regions." *Nature Climate Change* 6: 508–13. doi:10.1038/nclimate2941.

Duc, Nguyen Trong. 2010. "Giáo Dục Biến Đổi Khí Hậu qua Môn Địa Lí ở Trường Trung Học Cơ Sở [Climate Change Education through Geography in Middle School]." *Khoa Học Giáo Dục* 61 (10): 31–34.

Dung, Dinh Thi Thuy. 2018. "Những Cơ Hội và Thách Thức Trong Việc Giáo Dục Nhận Thức Cho Học Sinh Vùng Đồng Bằng Sông Cửu Long Sẵn Sàng Thích Ứng Với Biến Đổi Khí Hậu [Opportunities and Challenges in Educating Students Awareness in the Mekong Delta Climate Change Adaptation]." *Journal of Science* 15 (4): 168–78.

Dunlap, Riley E., and Araon M. McCright. 2008. "A Widening Gap: Republican and Democratic Views on Climate Change." *Environment: Science and Policy for Sustainable Development*, September, 26–35. doi:10.3200/ENVT.50.5.26-35.

EEA. 2019. "Climate Change Adaptation in the Agriculture Sector in Europe." Copenhagen, Denmark. doi:10.2800/537176.

Eitzinger, Anton, Claudia R. Binder, and Markus A. Meyer. 2018. "Risk Perception and Decision-Making: Do Farmers Consider Risks from Climate Change?" *Climatic Change* 151 (3–4): 507–24. doi:10.1007/s10584-018-2320-1.

Elum, Zelda A., David M. Modise, and Ana Marr. 2017. "Farmer's Perception of Climate Change and Responsive Strategies in Three Selected Provinces of South Africa." *Climate Risk Management* 16: 246–57. doi:10.1016/j.crm.2016.11.001.

Entman, Robert M. 1993. "Framing: Toward Clarification of a Fractured Paradigm." *Journal of Communication* 43 (4): 51–58. doi:10.1111/j.1460-2466.1993.tb01304.x.

Fakhruddin, S. H.M., and Juma Rahman. 2015. "Coping with Coastal Risk and Vulnerabilities in Bangladesh." *International Journal of Disaster Risk Reduction* 12: 112–18. doi:10.1016/j.ijdrr.2014.12.008.

FAO-IPCC. 2017. "FAO-IPCC Expert Meeting on Climate Change, Land Use and Food Security." Rome. doi:10.1038/embor.2009.27.

FAO. 2016a. 2016 The State of Food and Agriculture: Climate Change, Agriculture and Food Security. Rome: FAO. doi:10.1093/nq/s8-IV.94.301-a.

———. 2016b. "'El Niño' Event in Viet Nam: Agriculture, Food Security and Livelihood Needs Assessment in Response to Drought and Salt Water Intrusion." http://www.fao.org/3/a-i6020e.pdf.

———. 2016c. "FAO Ứng Phó Nhanh Với Hạn Hán Nghiêm Trọng ở Việt Nam [FAO Rapid Response to Severe Drought in Vietnam]."

Feldman, Lauren, and P. Sol Hart. 2018. "Climate Change as a Polarizing Cue: Framing Effects on Public Support for Low-Carbon Energy Policies." *Global Environmental Change* 51 (July): 54–66. doi:10.1016/j.gloenvcha.2018.05.004.

Finucane, Melissa L, Paul Slovic, C K Mertz, James Flynn, and Satterfiel A Theresa. 2000. "Gender, Race, and Perceived Risk: The 'white Male' Effect." *Health, Risk & Society* 2 (2). doi:10.1080/713670162.

Fischhoff, Baruch. 1995. "Risk Perception and Communication Unplugged: Twenty Years of Process." *Risk Analysis* 15 (2).

———. 2007. "Nonpersuasive Communication about Matters of Greatest Urgency: Climate Change." *Environmental Science and Technology* 41 (21): 7204–8. doi:10.1021/es0726411.

Fischhoff, Baruch, Paul Slovic, Sarah Lichtenstein, Stephen Read, and Barbara Combs. 1978. "How Safe Is Safe Enough? A Psychometric Study of Attitudes toward Technological Risks and Benefits." *Policy Sciences* 9 (April): 127–52. doi:10.1007/BF00143739.

Fishbein, Martin, and Icek Ajzen. 1975. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.

Flatø, Martin, Raya Muttarak, and André Pelser. 2017. "Women, Weather, and Woes: The Triangular Dynamics of Female-Headed Households, Economic Vulnerability, and Climate Variability in South Africa." *World Development* 90 (February): 41–62. doi:10.1016/j.worlddev.2016.08.015.

Flyod, Donna L., Steven Prentice-Dunn, and Ronald W. Rogers. 2000. "A Meta-Analysis of Research of Protection Motivation Theory." *Journal of Applied Social Psychology* 30 (2): 407–29.

Garschagen, Matthias. 2013. "Resilience and Organisational Institutionalism from a Cross-Cultural Perspective: An Exploration Based on Urban Climate Change Adaptation in Vietnam." *Natural Hazards* 67 (1): 25–46. doi:10.1007/s11069-011-9753-4.

Gaurav, Sarthak, and Vaibhav Chaudhary. 2020. "Do Farmers Care about Basis Risk? Evidence from a Field Experiment in India." *Climate Risk Management* 27 (2019): 100201. doi:10.1016/j.crm.2019.100201.

GFDRR. 2015. "Country Profile for Vietnam." https://www.gfdrr.org/en/publication/country-profile-vietnam.

Gitlin, Todd. 1980. *The Whole World Is Watching: Mass Media in the Making and Unmaking of the New Left*. Berkeley: The University of California Press. doi:10.1177%2F000271628145600152.

Grothmann, Torsten, and Anthony Patt. 2005. "Adaptive Capacity and Human Cognition: The Process of Individual Adaptation to Climate Change." *Global Environmental Change* 15 (3): 199–213. doi:10.1016/j.gloenvcha.2005.01.002.

Grothmann, Torsten, and Fritz Reusswig. 2006. "People at Risk of Flooding: Why Some Residents Take Precautionary Action While Others Do Not." *Natural Hazards* 38 (1–2): 101–20. doi:10.1007/s11069-005-8604-6.

GSO, Vietnam. 2011. "General Statistical Office, Vietnam." 2011.

Gustafson, Shelley, Angela Joehl Cadena, Chinh Cong Ngo, Ammar Kawash, Ienkate Saenghkaew, and Paul Hartman. 2018. "Merging Science into Community Adaptation Planning Processes: A Cross-Site Comparison of Four Distinct Areas of the Lower Mekong Basin." *Climatic Change* 149 (1): 91–106. doi:10.1007/s10584-016-1887-7.

Halkias, Georgios, and Flora Kokkinaki. 2013. "Increasing Advertising Effectiveness through Incongruity-Based Tactics: The Moderating Role of Consumer Involvement." *Journal of Marketing Communications* 19 (3): 182–97. doi:10.1080/13527266.2011.592346.

Hall, Jim W., Paul B. Sayers, Mike J.A. Walkden, and Mike Panzeri. 2006. "Impacts of Climate Change on Coastal Flood Risk in England and Wales: 2030-2100." *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 364 (1841): 1027–49. doi:10.1098/rsta.2006.1752.

Hallegate, Stephane, Mook Bangalore, Laura Bonzanigo, Marianne Fay, Tamaro Kane, Ulf Narloch, Julie Rozenberg, David Treguer, and Adrien Vogt-Schilb. 2016. *Shock Waves: Managing the Impacts of Climate Change on Poverty*. Washington, DC, USA: World Bank Group. doi:10.1596/978-1-4648-0673-5.

Hallegatte, Stephane, Adrien Vogt-Schilb, Mook Bangalore, and Julie Rozenberg. 2017. *Unbreakable: Building the Resilience of the Poor in the Face of Natural Disasters*. Washington, DC, USA: World Bank Group.

Hamilton-Webb, Alice, Louise Manning, Rhiannon Naylor, and John Conway. 2016. "The Relationship between Risk Experience and Risk Response : A Study of Farmers and Climate Change." *Journal of Risk Research*. doi:10.1080/13669877.2016.1153506.

Hamilton, Lawrence C. 2010. "Education , Politics and Opinions about Climate Change Evidence for Interaction Effects." *Climatic Change* 104 (2): 231–42. doi:10.1007/s10584-010-9957-8.

Hamilton, Lawrence C., and Barry D. Keim. 2009. "Regional Variation in Perceptions about Climate Change." *International Journal of Climatology* 29 (May): 2348–52. doi:10.1002/joc.

Hammond, M. J., A. S. Chen, S. Djordjević, D. Butler, and O. Mark. 2015. "Urban Flood Impact Assessment: A State-of-the-Art Review." *Urban Water Journal* 12 (1): 14–29. doi:10.1080/1573062X.2013.857421.

Haque, Md Aminul, Shelby Suzanne Yamamoto, Ahmad Azam Malik, and Rainer Sauerborn. 2012. "Households' Perception of Climate Change and Human Health Risks: A Community Perspective." *Environmental Health: A Global Access Science Source* 11 (1): 1. doi"10.1186/1476-069X-11-1.

Hart, P. Sol, and Lauren Feldman. 2014. "Threat Without Efficacy? Climate Change on U.S. Network News." *Science Communication* 36 (3): 325–51. doi:10.1177/1075547013520239.

Heck, Emily. 2015. "Environmental Education in Vietnam : A Case Study at Le Loi Elementary School." *Independent Study Project (ISP) Collection*.

Helgeson, Jennifer, Sander van der Linden, and Ilan Chabay. 2012. "The Role of Knowledge, Learning and Mental Models in Public Perceptions of Climate Change Related Risks." In *Learning for Sustainability in Times of Accelerating Change*, edited by Arjen E J Wals and P.B. Corcoran, 1–16. Wageningen, Netherlands: Wageningen Academic Publishers.

Hettiarachchi, Suresh, Conrad Wasko, and Ashish Sharma. 2018. "Increase in Flood Risk Resulting from Climate Change in a Developed Urban Watershed - the Role of Storm Temporal Patterns." *Hydrology and Earth System Sciences* 22 (3): 2041–56. doi:10.5194/hess-22-2041-2018.

Hidalgo, M. Carmen, and Ignacio Pisano. 2010. "Determinants of Risk Perception and Willingness to Tackle Climate Change. A Pilot Study." *Psyecology* 1 (1).

Hillson, D, and R Murray-Webster. 2005. *Understanding and Managing Risk Attitude*. VT, USA: Gower Publishing.

Holden, Cathie. 2007. "Young People's Concerns." In *Teaching The Global Dimension: Key Principles and Effective Practice,* edited by David Hicks and Cathie Holden, 31–42. New York: Routledge.

Huong, H. T.L., and A. Pathirana. 2013. "Urbanization and Climate Change Impacts on Future Urban Flooding in Can Tho City, Vietnam." *Hydrology and Earth System Sciences* 17: 379–94. doi:10.5194/hess-17-379-2013.

IFRC. 2020. "Tackling the Humanitarian Impacts of the Climate Crisis Together." *World Disaster Report 2020*. https://media.ifrc.org/ifrc/world-disaster-report-2020%0ACover.

IIE. 2020. "Insurance Information Institute." Facts + Statistics: Global Catastrophes. 2020. https://www.iii.org/fact-statistic/facts-statistics-global-catastrophes.

IMHEN-UNDP. 2015. "Summary for Policy Makers." In *Viet Nam Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*, edited by Tran Thuc, Koos Neefjes, Ta Thi Thanh Huong, Nguyen Van Thang, Mai Trong Nhuan, Le Anh Tuan, Le Dinh Thanh, Huynh Thi Lan Huong, Vo Thanh Son, and Nguyen Thi Hien Thuan, 1–30. Hanoi: Natural Resources and Environment Publishing House.

IPCC. 2007. *Climate Change 2007: Impacts, Adaptation and Vulnerability: Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel*. Edited by Martin Parry, Osvaldo Canziani, Jean Palutikof, Paul van der Linden, and Clair Hanson. Genebra, Suíça. Cambridge, UK: Cambridge University Press.

IPCC. 1990. "Climate Change: The IPCC Scientific Assessment." Cambridge, UK: Cambridge University Press.

———. 1995a. *CLIMATE CHANGE 1995 Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses*. Edited by Robert T. Watson, Marufu C. Zinyowere, Richard H. Moss, and David J. Dokken. Cambridge, UK: Cambridge University Press. doi:10.1016/0009-2614(90)85169-D.

———. 1995b. "Impacts, Adaptations and Mitigation of Climate Variability. Scientifi-Teaching Analysis. Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel of Climate Variability." Cambridge, UK.

———. 2001. *Climate Change 2001: Impacts, Adaptation, and Vulnerability*. Edited by James J. McCathy, Osvaldo F. Canziani, Neil A. Leary, David J. Dokken, and Kasey S. White. Cambridge, UK: Cambridge University Press.

———. 2005. *Carbon Dioxide Capture and Storage*. Edited by Bert Metz, Ogunlade Davidson, de Heleen Coninck, Manuela Loos, and Leo Meyer. MRS Bulletin. Vol. 33. Cambridge, UK: Cambridge University Press. doi:10.1557/mrs2008.63.

———. 2007a. *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Edited by Martin Parry, Osvaldo Canziani, Jean Palutikof, Paul van der Linden, and Clair Hanson. Cambridge, UK: Cambridge University Press.

———. 2007b. "Climate Change 2007: Mitigation of Climate Change." http://www.ipcc.ch/publications_and_data/.htm.

———. 2014a. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects*. Edited by Vincente R. Barros, Christopher B. Field, David Jon Dokken, Michael D. Mastrandrea, Katharine J. Mach, T. Eren Bilir, Monalisa Chatterjee, et al. Cambridge, UK: Cambridge University Press.

———. 2014b. "Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change." *IPCC, Geneva, Switzerland*. Geneva, Switzerland. https://www.ipcc.ch/site/assets/uploads/2018/02/AR5_SYR_FINAL_Front_matters.pdf.

———. 2014c. "Fifth Assessment Report of the Intergovernmental Panel on Climate Change." Cambridge, UK.

———. 2018a. "Global Warming of 1.50C." Switzerland. www.ipcc.ch.

———. 2018b. "Summary for Policymakers." In *Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change*, edited by Valérie Masson-Delmotte, Panmao Zhai, Hans-Otto Pörtner, Debra Roberts, Jim Skea, Priyadarshi R. Shukla, Anna Pirani, et al., 32. Geneva, Switzerland.

IRGC. 2017. "Introduction to the IRGC Risk Governance Framework, Revised Version." *Lausanne: EPFL International Risk Governance Center.*

Irwin, Alan. 1995. *Citizen Science: A Study of People, Expertise and Sustainable Development.* London: Routledge.

———. 2014. "Risk, Science and Public Communication: Third-Order Thinking about Scientific Culture." In *Routledge Handbook of Public Communication of Science and Technology*, edited by Massimiano Bucchi and Brian Trench, Second Edi. London and New York: Routledge.

Jackson, Jonathan, Nick Allum, and George Gaskell. 2006. "Bridging Levels of Analysis in Risk Perception Research: The Case of the Fear of Crime." *Forum: Qualitative Social Research* 7 (1).

Johnston, David M, Mark S Bebbington, Chin-Diew Lai, Bruce F. Houghton, and Douglas Paton. 1999. "Volcanic Hazard Perceptions : Comparative Shifts in Knowledge and Risk." *Disaster Prevention and Management* 8 (2): 118–26.

Jones, Charlotte, Donald W. Hine, and Anthony D.G. Marks. 2017. "The Future Is Now: Reducing Psychological Distance to Increase Public Engagement with Climate Change." *Risk Analysis* 37 (2): 331–41. doi:10.1111/risa.12601.

Juliusson, E. Ásgeir, Niklas Karlsson, and Tommy Gärling. 2005. "Weighing the Past and the Future in Decision Making." *European Journal of Cognitive Psychology* 17 (4): 561–75. doi:10.1080/09541440440000159.

Kahan, Dan M., Ellen Peters, Maggie Wittlin, Paul Slovic, Lisa Larrimore Ouellette, Donal Braman, and Gregory N. Mandel. 2012. "The Polarizing Impact of Science Literacy and Numeracy on Perceived Climate Change Risks." *Nature Climate Change* 732.

Kahneman, Daniel, and Amos Tversky. 1984. "Choices, Values, and Frames." *American Psychologist* 39 (4): 341–50. doi:10.1037/0003-066X.39.4.341.

Keller, Carmen, Michael Siegrist, and Heinz Gutscher. 2006. "The Role of the Affect and Availability Heuristics in Risk Communication." *Risk Analysis* 26 (3): 631–39. doi:10.1111/j.1539-6924.2006.00773.x.

Kellstedt, Paul M., Sammy Zahran, and Arnold Vedlitz. 2008. "Personal Efficacy, the Information Environment, and Attitudes Toward Global Warming and Climate Change in the United States." *Risk Analysis* 28 (1): 113–26. doi:10.1111/j.1539-6924.2008.01010.x.

Kidwell, Blair, Adam Farmer, and David M. Hardesty. 2013. "Getting Liberals and Conservatives to Go Green: Political Ideology and Congruent Appeals." *Journal of Consumer Research* 40 (2): 350–67. doi:10.1086/670610.

Kievik, Milou, and Jan M. Gutteling. 2011. "Yes, We Can: Motivate Dutch Citizens to Engage in Self-Protective Behavior with Regard to Flood Risks." *Natural Hazards* 59 (3): 1475–90. doi:10.1007/s11069-011-9845-1.

Kinzig, Ann P., Paul R. Ehrlich, Lee J. Alston, Kenneth Arrow, Scott Barrett, Timothy G. Buchman, Gretchen C. Daily, et al. 2013. "Social Norms and Global Environmental Challenges: The Complex Interaction of Behaviors, Values, and Policy." *BioScience* 63 (3): 164–75. doi:10.1525/bio.2013.63.3.5.

Klasen, Stephan, Tobias Lechtenfeld, and Felix Povel. 2015. "A Feminization of Vulnerability? Female Headship, Poverty, and Vulnerability in Thailand and Vietnam." *World Development* 71: 36–53. doi:10.1016/j.worlddev.2013.11.003.

Kolb, David A. 1984. *Experiential Learning: Experience as the Source of Learning and Development*. New Jersey: Prentice-Hall.

Lakoff, George. 2010. "Why It Matters How We Frame the Environment." *Environmental Communication* 4 (1): 70–81. doi:10.1080/17524030903529749.

Lasage, R., T.I.E. Veldkamp, H. De Moel, T. C. Van, H. L. Phi, P. Vellinga, and J. C.J.H. Aerts. 2014. "Assessment of the Effectiveness of Flood Adaptation Strategies for HCMC." *Natural Hazards and Earth System Sciences* 14: 1441–57. doi:10.5194/nhess-14-1441-2014.

Lauckner, Carolyn, Sandi Smith, Michael Kotowski, Samantha Nazione, Cynthia Stohl, Abby Prestin, Jiyeon So, and Robin Nabi. 2012. "An Initial Investigation Into Naturally Occurring Loss- and Gain-Framed Memorable Breast Cancer Messages." *Communication Quarterly* 60 (1): 1–16. doi:10.1080/01463373.2012.642269.

Le, Thi Viet Hoa, Nguyen Huu Nhan, Eric Wolanski, Tran Thanh Cong, and Shigeko Haruyama. 2007. "The Combined Impact on the Flooding in Vietnam's Mekong River Delta of Local Man-Made Structures, Sea Level Rise, and Dams Upstream in the River Catchment." *Estuarine, Coastal and Shelf Science* 71 (1–2): 110–16. doi:10.1016/j.ecss.2006.08.021.

Leal Filho, Walter. 2019. "An Overview of the Challenges in Climate Change Communication Across Various Audiences." In *Addressing the Challenges in Communicating Climate Change Across Various Audiences*, edited by Walter Filho Leal, Bettina Lackner, and Henry McGhie, 1–11. Springer Nature Switzerland. doi:10.1007/978-3-319-98294-6_1.

Lebel, Louis, Bach Tan Sinh, Ngo Cong Chinh, Sakaradhorn Bonntaveeyuwat, and Ham Kimkong. 2013. "Risk Communications and Adaptation in Settlements on the Coast and in Deltas of the Mekong Region." In *Successful Adaptation to Climate Change: Linking Science and Policy in a Rapidly Changing World*, edited by Susanne C. Moser and Maxwell T Boykoff, 253–69. Oxford: Routledge Publishers.

Lee, Tien Ming, Ezra M Markowitz, Peter D Howe, Chia-ying Ko, and Anthony A Leiserowitz. 2015. "Predictors of Public Climate Change Awareness and Risk Perception around the World." *Nature Climate Change*. doi:10.1038/NCLIMATE2728.

Lehmann, Jascha, Dim Coumou, and Katja Frieler. 2015. "Increased Record-Breaking Precipitation Events under Global Warming." *Climatic Change* 132: 501–15. doi:10.1007/s10584-015-1434-y.

Leiserowitz, Anthony. 2006. "Climate Change Risk Perception and Policy Preferences: The Role of Affect, Imagery, and Values." *Climatic Change* 77 (1–2): 45–72. doi:10.1007/s10584-006-9059-9.

Leiserowitz, Anthony A. 2005. "American Risk Perceptions: Is Climate Change Dangerous?" *Risk Analysis* 25 (6): 1433–42. doi:10.1111/j.1540-6261.2005.00690.x.

Liberman, N., M. Sagristano, and Y. Trope. 2002. "The Effect of Temporal Distance on Level of Mental Construal." *Journal of Experimental Social Psychology* 38 (6): 523–34. doi:10.1016/S0022-1031(02)00535-8.

Lima, Maria Luisa, Julie Barnett, and Jorge Vala. 2005. "Risk Perception and Technological Development at a Societal Level." *Risk Analysis* 25 (5): 1229–39. doi:10.1111/j.1539-6924.2005.00664.x.

Linden, Sander van der. 2014. "Towards a New Model for Communicating Climate Change." In *Understanding and Governing Sustainable Tourism Mobility: Psychological and Behavioural Approaches*, edited by S. Cohen, P. Higham, and S. Gössling, 243–75. Routledge: Taylor and Francis Group.

———. 2015. "The Social-Psychological Determinants of Climate Change Risk Perceptions: Towards a Comprehensive Model." *Journal of Environmental Psychology* 41: 112–24. doi:10.1016/j.jenvp.2014.11.012.

Linden, Sander van der, Edward Maibach, and Anthony Leiserowitz. 2015. "Improving Public Engagement With Climate Change: Five 'Best Practice' Insights From Psychological Science." *Perspectives on Psychological Science* 10 (6): 758–63. doi:10.1177/1745691615598516.

Liverpool-Tasie, Lenis Saweda O., Awa Sanou, and Justice A. Tambo. 2019. "Climate Change Adaptation among Poultry Farmers: Evidence from Nigeria." *Climatic Change* 157 (3–4): 527–44. doi:10.1007/s10584-019-02574-8.

Lord, Kenneth R. 1994. "Motivating Recycling Behavior: A Quasiexperimental Investigation of Message and Source Strategies." *Psychology & Marketing* 11 (4): 341–58.

Lorenzoni, Irene, Sophie Nicholson-Cole, and Lorraine Whitmarsh. 2007. "Barriers Perceived to Engaging with Climate Change among the UK Public and Their Policy Implications." *Global Environmental Change* 17 (3–4): 445–59. doi:10.1016/j.gloenvcha.2007.01.004.

Lorenzoni, Irene, and Nick F. Pidgeon. 2006. "Public Views on Climate Change: European and USA Perspectives." *Climatic Change* 77 (1–2): 73–95. doi:10.1007/s10584-006-9072-z.

Lorenzoni, Irene, Nick F Pidgeon, and Robert E O'Connor. 2005. "Dangerous Climate Change: The Role for Risk Research." *Risk Analysis* 25 (6): 1387–98. doi:10.1111/j.1539-6924.2005.00686.x.

Loroz, Peggy Sue. 2007. "The Interaction of Message Frames and Reference Points in Prosocial Persuasive Appeals." *Psychology & Marketing* 24 (11): 1001–23. doi:10.1002/mar.20193.

Luo, Pingping, Dengrui Mu, Han Xue, Thanh Ngo-Duc, Kha Dang-Dinh, Kaoru Takara, Daniel Nover, and Geoffrey Schladow. 2018. "Flood Inundation Assessment for the Hanoi Central Area, Vietnam under Historical and Extreme Rainfall Conditions." *Scientific Reports* 8 (12623): 1–11. doi:10.1038/s41598-018-30024-5.

Luo, Tianyi, Andrew Maddocks, Charles Iceland, Phillip Ward, and Hessel Winsemius. 2015. "World's 15 Countries with the Most People Exposed to River Floods." 2015. https://www.wri.org/blog/2015/03/world-s-15-countries-most-people-exposed-river-floods.

Maddison, David. 2007. "The Perception of and Adaptation to Climate Change in Africa." 4308. Policy Research Working Paper.

Maibach, Edward W., Connie Roser-Renouf, and Anthony Leiserowitz. 2008. "Communication and Marketing As Climate Change-Intervention Assets. A Public Health Perspective." *American Journal of Preventive Medicine* 35 (5): 488–500. doi:10.1016/j.amepre.2008.08.016.

Maloney, Erin K., Maria K. Lapinski, and Kim Witte. 2011. "Fear Appeals and Persuasion: A Review and Update of the Extended Parallel Process Model." *Social and Personality Psychology Compass* 5 (4): 206–19. doi:10.1111/j.1751-9004.2011.00341.x.

Markowitz, Ezra M., and Meaghan L. Guckian. 2018. "Climate Change Communication: Challenges, Insights, and Opportunities." In *Psychology and Climate Change: Human Perceptions, Impacts, and Responses*, edited by Susan Clayton and Christie Manning, 312. Elsevier Inc. doi:10.1016/C2016-0-04326-7.

Mayer, Frederick, Sarah Adair, and Alex Pfaff. 2013. "Americans Think the Climate Is Changing."

McCright, Aaron M. 2010. "The Effects of Gender on Climate Change Knowledge and Concern in the American Public." *Population and Environment* 32 (1): 66–87. doi:10.1007/s11111-010-0113-1.

Mccright, Aaron M, and Riley E Dunlap. 2011. "THE POLITICIZATION OF CLIMATE CHANGE AND POLARIZATION IN THE AMERICAN PUBLIC'S VIEWS OF GLOBAL WARMING, 2001 – 2010." The *Sociological Quarterly* 52: 155–94.

MCD, and AMDI. 2016. "Baseline Survey for the Project: Youth Innovation and Synergies for Enhancing Climate Change Adaptation in the Red River Delta, Vietnam (READY)."

Meijers, Marijn H.C., Paola Remmelswaal, and Anke Wonneberger. 2019. "Using Visual Impact Metaphors to Stimulate Environmentally Friendly Behavior: The Roles of Response Efficacy and Evaluative Persuasion Knowledge." *Environmental Communication* 13 (8): 995–1088. doi:10.1080/17524032.2018.1544160.

Mendelsohn, Robert, and Ariel Dinar. 1999. "Climate Change, Agriculture, and Developing Countries: Does Adaptation Matter?" *The World Bank Research Observer* 14 (2): 277–93. doi:10.1093/wbro/14.2.277.

Menny, Claas, Daniel Osberghaus, Max Pohl, and Ute Werner. 2011. "General Knowledge about Climate Change, Factors Influencing Risk Perception and Willingness to Insure." 11–060. Discussion Paper. http://ftp.zew.de/pub/zew-docs/dp/dp11060.pdf.

Mertz, Ole, Cheikh Mbow, Anette Reenberg, and Awa Diouf. 2009. "Farmers' Perceptions of Climate Change and Agricultural Adaptation Strategies in Rural Sahel." *Environmental Management* 43 (May): 804–16. doi:10.1007/s00267-008-9197-0.

Meyerowitz, Beth E., and Shelly Chaiken. 1987. "The Effect of Message Framing on Breast Self-Examination Attitudes, Intentions, and Behavior." *Journal of Personality and Social Psychology* 52 (3): 500–510. doi:10.1037/0022-3514.52.3.500.

Milfont, Taciano L. 2012. "The Interplay Between Knowledge, Perceived Efficacy, and Concern About Global Warming and Climate Change: A One-Year Longitudinal Study." *Risk Analysis* 32 (6). doi:10.1111/j.1539-6924.2012.01800.x.

Millar, Murray G., and Karen U. Millar. 2000. "Promoting Safe Driving Behaviors: The Influence of Message Framing and Issue Involvement." *Journal of Applied Social Psychology* 30 (4): 853–66. doi:10.1111/j.1559-1816.2000.tb02827.x.

MONRE. 2010. "Viet Nam's Second National Communication to the United Nations Framework Convention on Climate Change." Ha Noi. http://library1.nida.ac.th/termpaper6/sd/2554/19755.pdf.

———. 2012. *Kịch Bản Biến Đổi Khí Hậu và Nước Biển Dâng Cho Việt Nam* [Climate Change and Sea Level Rise Scenarios for Vietnam]. Hanoi: Nhà xuất bản Tài nguyên - Môi trường và bản đồ Việt Nam.

———. 2016. *Kịch Bản Biến Đổi Khí Hậu, Nước Biển Dâng Cho Việt Nam* [Climate Change and Sea Level Rise Scenarios for Vietnam].

———. 2017. "The Second Biennial Updated Report of Vietnam to the United Nations Framework Convention on Climate Change." Ha Noi.

———. 2019. "The Third National Communication of Vietnam to the United Nations Framework Convention on Climate Change." Ha Noi, Viet Nam.

Morrison, Mark, Donald W. Hine, and Steven D'Alessandro. 2017. "Communicating about Climate Change with Farmers." *Oxford Research Encyclopedia of Climate Science*, no. October. doi:10.1093/acrefore/9780190228620.013.415.

Morton, Thomas A., Anna Rabinovich, Dan Marshall, and Pamela Bretschneider. 2011. "The Future That May (or May Not) Come: How Framing Changes Responses to Uncertainty in Climate Change Communications." *Global Environmental Change* 21 (1): 103–9. doi:10.1016/j.gloenvcha.2010.09.013.

Moser, Susanne C. 2010. "Communicating Climate Change: History, Challenges, Process and Future Directions." *WIREs Climate Change* 1 (1): 31–53. doi:10.1002/wcc.11.

———. 2016. "Reflections on Climate Change Communication Research and Practice in the Second Decade of the 21st Century: What More Is There to Say?" *WIREs Clim Change* 7 (3): 345–69. doi:10.1002/wcc.403.

Moser, Susanne C., and Lisa Dilling. 2004. "Making Climate Hot." *Environment* 46 (10): 32–46. doi:10.1080/00139150409605820.

———. 2011. "Communicating Climate Change: Closing the Science-Action Gap." In *The Oxford Handbook of Climate Change and Society*, edited by John S. Dryzek, Richard B. Norgaard, and David Schlosberg, 1st ed. Oxford: Oxford University Press. doi:10.1093/oxfordhb/9780199566600.003.0011.

Moser, Susanne C, and Lisa Dilling. 2007. "COMMUNICATING CLIMATE CHANGE: CLOSING THE SCIENCE - ACTION GAP." In *Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change*, edited by Susanne C. Moser and Lisa Dilling. Cambridge, UK: Cambridge University Press.

Nabi, Robin L., Abel Gustafson, and Risa Jensen. 2018. "Framing Climate Change: Exploring the Role of Emotion in Generating Advocacy Behavior." *Science Communication* 40 (4): 442–68. doi:10.1177/1075547018776019.

Narloch, Ulf, and Mook Bangalore. 2018. "The Multifaceted Relationship between Environmental Risks and Poverty: New Insights from Vietnam." *Environment and Development Economics* 23 (3): 298–327.

Nelkin, D. 1989. "Communicating Technological Risk: The Social Construction Of Risk Perception." *Annual Review of Public Health* 10 (1): 95–113. doi:10.1146/annurev.pu.10.050189.000523.

Nerlich, Brigitte, Nelya Koteyko, and Brian Brown. 2010. "Theory and Language of Climate Change Communication." *WIREs Climate Change* 1: 97–110. doi:10.1002/wcc.002.

Ngo, Chinh C., P. Marijn Poortvliet, and Peter H. Feindt. 2019. "Drivers of Flood and Climate Change Risk Perceptions and Intention to Adapt: An Explorative Survey in Coastal and Delta Vietnam." *Journal of Risk Research*. doi:10.1080/13669877.2019.1591484.

———. 2020. "Examining the Effectiveness of Climate Change Communication with Adolescents in Vietnam: The Role of Message Congruency." *Water (Switzerland)* 12 (11): 1–23. doi:10.3390/w12113016.

Nguyen, Thi Huong Tra, Helen Boon, and David King. 2015. "Education to Enhance Vietnamese Coastal Communities' Adaptive Capacity to Cope With Climate Change." *ETropic* 14 (1): 111–22. doi:10.25120/etropic.14.1.2015.3373.

Niles, Meredith T., Margaret Brown, and Robyn Dynes. 2016. "Farmer's Intended and Actual Adoption of Climate Change Mitigation and Adaptation Strategies." *Climatic Change* 135 (2): 277–95. doi:10.1007/s10584-015-1558-0.

Nisbet, Matthew. 2009. "Communicating Climate Change: Why Frames Matter for Public Engagement." *Environment* 51 (2): 12–25. doi:10.3200/ENVT.51.2.12-23.

Nisbet, Matthew C., and Chris Mooney. 2007. "Science and Society: Framing Science." *Science* 316 (5821): 56. doi:10.1126/science.1142030.

NOAA. 2019. "July 2019 Was Hottest Month on Record for the Planet." National Oceanic and Administrative Organisation. 2019. https://www.noaa.gov/news/july-2019-was-hottest-month-on-record-for-planet.

O'Connor, Robert E., Richard J. Bard, and Ann Fisher. 1999. "Risk Perceptions, General Environmental Beliefs, and Willingness to Address Climate Change." *Risk Analysis* 19 (3): 461–71. doi:10.1111/j.1539-6924.1999.tb00421.x.

O'Keefe, Daniel J., and Jakob D. Jensen. 2009. "The Relative Persuasiveness of Gain-Framed and Loss-Framed Messages for Encouraging Disease Detection Behaviors: A Meta-Analytic Review." *Journal of Communication* 59 (2): 296–316. doi:10.1111/j.1460-2466.2009.01417.x.

O'Keefe, Daniel J., and Xiaoli Nan. 2012. "The Relative Persuasiveness of Gain- and Loss-Framed Messages for Promoting Vaccination: A Meta-Analytic Review." *Health Communication* 27 (8): 776–83. doi:10.1080/10410236.2011.640974.

Ockwell, David, Lorraine Whitmarsh, and Saffron O'Neill. 2009a. "Forcing People to Be Green or Fostering Grass-Roots Engagement ?" *Science Communication* 30 (3): 305–27. doi:10.1177/1075547008328969.

———. 2009b. "Reorienting Climate Change Communication for Effective Mitigation: Forcing People to Be Green or Fostering Grass-Roots Engagement?" *Science Communication*, 289–301. doi:10.1177/1075547008328969.

Ojala, Maria. 2012. "How Do Children Cope with Global Climate Change? Coping Strategies, Engagement, and Well-Being." *Journal of Environmental Psychology* 32 (3): 225–33. doi:10.1016/j.jenvp.2012.02.004.

Opitz-Stapleton, Sarah. 2010. "Only Death Is Certain, Yet You Still Get Out of Bed in the Morning; Or Observations on the Use of Climate Information in Adaptation and Resilience Practice Climate Resilience in Concept and Practice: ISET Working Paper 2." Climate Resilience in Concept and Practice Working Paper Series. Boulder, Colorado.

Ouellette, Judith A., and Wendy Wood. 1998. "Habit and Intention in Everyday Life: The Multiple Processes by Which Past Behavior Predicts Future Behavior." *Psychological Bulletin* 12 (1): 54–74. doi:10.1037/0033-2909.124.1.54.

OXFAM, MCD, and AMDI. 2013. "Baseline Survey on Knowledge, Attitude and Practice (KAP) in Relation to Disaster Risk Reduction and Climate Change Adaptation."

Peacock, Walter Gillis, Samuel David Brody, and Wes Highfield. 2004. "Hurricane Risk Perceptions among Florida ' s Single Family Homeowners." *Landscape and Urban Planning.* doi:10.1016/j.landurbplan.2004.11.004.

———. 2005. "Hurricane Risk Perceptions among Florida's Single Family Homeowners." *Landscape and Urban Planning* 73 (2–3): 120–35. doi:10.1016/j.landurbplan.2004.11.004.

Peltonen-Sainio, Pirjo, Jaana Sorvali, and Janne Kaseva. 2020. "Winds of Change for Farmers: Matches and Mismatches between Experiences, Views and the Intention to Act." *Climate Risk Management* 27: 100205. doi:10.1016/j.crm.2019.100205.

Pham, Tuan Anh, and Kelly Shannon. 2020. "The Evolution of Water Management in the Red River Delta of Vietnam and a Case of Chuc Son, Hanoi City." In *Lecture Notes in Civil Engineering*, 2:373–95. Springer. doi:10.1007/978-3-030-60269-7.

Phuong, Le Thi Hong, Tran Duc Tuan, and Nguyen Thi Ngoc Phuc. 2019. "Transformative Social Learning for Agricultural Sustainability and Climate Change Adaptation in the Vietnam Mekong Delta." *Sustainability* 11 (23). doi:10.3390/su11236775.

Poortinga, Wouter, Alexa Spence, Lorraine Whitmarsh, Stuart Capstick, and Nick F. Pidgeon. 2011. "Uncertain Climate: An Investigation into Public Scepticism about Anthropogenic Climate Change." *Global Environmental Change* 21 (3): 1015–24. doi:10.1016/j.gloenvcha.2011.03.001.

Popenoe, David. 1983. *Sociology*. 7th ed. USA: Prentice-Hall.

Rahman, Md. Sadequr. 2013. "Climate Change, Disaster and Gender Vulnerability: A Study on Two Divisions of Bangladesh." *American Journal of Human Ecology* 2 (2): 72–82. doi:10.11634/216796221302315.

Rakib, M. A., Shakibul Islam, Iliopoulos Nikolaos, Md Bodrud-Doza, and Mohammad A.H. Bhuiyan. 2017. "Flood Vulnerability, Local Perception and Gender Role Judgment Using Multivariate Analysis: A Problem-Based 'Participatory Action to Future Skill Management' to Cope with Flood Impacts." *Weather and Climate Extremes* 18 (December): 29–43. doi:10.1016/j.wace.2017.10.002.

Raymond, Christopher M., and John Spoehr. 2013. "The Acceptability of Climate Change in Agricultural Communities: Comparing Responses across Variability and Change." *Journal of Environmental Management* 115: 69–77. doi:10.1016/j.jenvman.2012.11.003.

Renn, Ortwin. 1998. "Three Decades of Risk Research: Accomplishments and New Challenges." *Journal of Risk Research* 1 (1): 49–71.

———. 2008. *Risk Governance: Coping with Uncertainty in a Complex World*. London: Earthscan.

Reser, Joseph P., and Graham L. Bradley. 2017. *Fear Appeals in Climate Change Communication. Oxford Research Encyclopedia of Climate Science*. doi:10.1093/acrefore/9780190228620.013.386.

Reser, Joseph P, Graham L Bradley, A Ian Glendon, Michelle C Ellul, and Rochelle Callaghan. 2012. *Public Risk Perceptions, Understandings and Responses to Climate Change in Australia and Great Britain. National Climate Change Adaptation Research Facility*. Gold Coast.

Reyes, Daniella Dominique, and Jinky Leilanie Lu. 2015. "Gender Dimension in Disaster Situations; A Case Study of Flood Prone Women in Malabon City, Metro Manila." *International Journal of Disaster Risk Reduction* 15: 162–68. doi:10.1016/j.ijdrr.2015.11.001.

Rogers, Ronald W. 1975. "A Protection Motivation Theory of Fear Appeals and Attitude Change." *The Journal of Psychology*, 93–114.

Rohrmann, Bernd. 1992. "The Evaluation of Risk Communication Effectiveness." *Acta Psychologica* 81 (2): 169–92. doi:10.1016/0001-6918(92)90004-W.

Roser-Renouf, Connie, Edward W. Maibach, Anthony Leiserowitz, and Xiaoquan Zhao. 2014. "The Genesis of Climate Change Activism: From Key Beliefs to Political Action." *Climatic Change* 125: 163–78. doi:10.1007/s10584-014-1173-5.

Rothman, Alexander J., Roger D. Bartels, Jhon Wlaschin, and Peter Salovey. 2006. "The Strategic Use of Gain- and Loss-Framed Messages to Promote Healthy Behavior: How Theory Can Inform Practice." *Journal of Communication* 56 (SUPPL.): 202–20. doi:10.1111/j.1460-2466.2006.00290.x.

Rothman, Alexander J., and Peter Salovey. 1997. "Shaping Perceptions to Motivate Healthy Behavior: The Role of Message Framing." *Psychological Bulletin* 121 (1): 3–19. doi:10.1037/0033-2909.121.1.3.

Sala, Osvaldo E., F. Stuart Chapin III, Juan J. Armesto, Eric Berlow, Janine Bloomþeld, Rodolfo Dirzo, Elisabeth Huber-Sanwald, et al. 2000. "Global Biodiversity Scenarios for the Year 2100." *Science's Compass Review* 287 (March): 1770–75. doi:10.1126/science.287.5459.1770.

Salama, Sefat, and Khalil Aboukoura. 2018. "Role of Emotions in Climate Change Communication." In *Handbook of Climate Change Communication: Vol. 1: Theory of Climate Change Communication*, edited by Walter Leal Filho, Evangelos Manolas, Anabela Marisa Azul, Ulisses M. Azeiteiro, and Henry McGhie, 397. Springer, Cham. doi:10.1007/978-3-319-69838-0.

Sanz, María L, De Acedo Liz, María T Sanz, and De Acedo Baquedano. 2007. "Factors That Affect Decision Making : Gender and Age Differences." *International Journal of Psychology and Psychological Therapy* 7 (3): 381–91.

Schill, Caroline, John M. Anderies, Therese Lindahl, Carl Folke, Stephen Polasky, Juan Camilo Cárdenas, Anne Sophie Crépin, Marco A. Janssen, Jon Norberg, and Maja Schlüter. 2019. "A More Dynamic Understanding of Human Behaviour for the Anthropocene." *Nature Sustainability* 2 (12): 1075–82. doi:10.1038/s41893-019-0419-7.

Shaw, Rajib. 2006. "Critical Issues of Community-Based Flood Mitigation: Examples from Bangladesh and Vietnam." *Journal of Science & Culture* 72 (1–2): 1–17.

Sheeran, Paschal, Gaston Godin, Mark Conner, and Marc Germain. 2017. "Paradoxical Effects of Experience: Past Behavior Both Strengthens and Weakens the Intention-Behavior Relationship." *Journal of the Association for Consumer Research* 2 (3): 309–18. doi:10.1086/691216.

Sheffield, Perry E., and Phillip J. Landrigan. 2011. "Global Climate Change and Children's Health: Threats and Strategies for Prevention." *Environmental Health Perspectives* 119 (3): 291–98. doi:10.1289/ehp.1002233.

Sherman, David K., Mann Traci, and John A. Updegraff. 2006. "Approach/Avoidance Motivation, Message Framing, and Health Behavior: Understanding the Congruency Effect." *Motiv Emot* 30 (2): 165–69. doi:10.1007/s11031-006-9001-5.

Silva, Kushani De, and Ramanie Jayathilaka. 2014. "Gender in the Context of Disaster Risk Reduction; A Case Study of a Flood Risk Reduction Project in the Gampaha District in Sri Lanka." *Procedia Economics and Finance* 18 (September): 873–81. doi:10.1016/s2212-5671(14)01013-2.

Singh, Ajay S., Adam Zwickle, Jeremy T. Bruskotter, and Robyn Wilson. 2017. "The Perceived Psychological Distance of Climate Change Impacts and Its Influence on Support for Adaptation Policy." *Environmental Science and Policy* 73 (July): 93–99. doi:10.1016/j.envsci.2017.04.011.

Sinh, Bach Tan, Louis Lebel, and N.T. Tung. 2009. "Indigenous Knowledge and Decision-Making in Vietnam: Living with Floods in An Giang Province, Mekong Delta, Vietnam." In *Indigenous Knowledge and Disaster Risk Reduction: From Practice to Policy*, edited by R. Shaw, Sharma A., and Takeuchi Y. Nova Science Publishers, Inc.

Sjöberg, Lennart. 2000. "Factors in Risk Perception." *Risk Analysis* 20 (1).

Slimak, Michael W., and Thomas Dietz. 2006. "Personal Values, Beliefs, and Ecological Risk Perception." *Risk Analysis* 26 (6): 1689–1705. doi:10.1111/j.1539-6924.2006.00832.x.

Slovic, Paul. 1987. "Perception of Risk." *Science* 236 (4799): 280–85.

———. 1999. "Trust, Emotion, Sex, Politics, and Science: Surveying the Risk-Assessment Battlefield." *Risk Analysis* 19 (4).

Slovic, Paul, Baruch Fischhoff, and Sarah Lichtenstein. 1981a. "Facts and Fears: Societal Perception of Risk." A*dvances in Consumer Research* 8: 497–502.

———. 1981b. "Rating the Risks." In *Risk/Benefit Analysis in Water Resources Planning and Management*, edited by Yacov Y. Haimes, 193–217. Boston, MA: Springer. doi:10.1007/978-1-4899-2168-0_17.

———. 1982. "Why Study Risk Perception; Slovic, *Risk Analysis*, 1982.Pdf." Risk Analysis 2 (2): 83–93.

Smith, Rachel A., Merissa Ferrara, and Kim Witte. 2007. "Social Sides of Health Risks: Stigma and Collective Efficacy." *Health Communication* 21 (1): 55–64. doi:10.1080/10410230701283389.

So, Jiyeon. 2013. "A Further Extension of the Extended Parallel Process Model (E-EPPM): Implications of Cognitive Appraisal Theory of Emotion and Dispositional Coping Style." *Health Communication* 28 (1): 72–83. doi:10.1080/10410236.2012.708633.

Spence, Alexa, and Nick Pidgeon. 2010. "Framing and Communicating Climate Change: The Effects of Distance and Outcome Frame Manipulations." *Global Environmental Change* 20 (4): 656–67. doi:10.1016/j.gloenvcha.2010.07.002.

Spence, Alexa, Wouter Poortinga, Catherine Butler, and Nicholas Frank Pidgeon. 2011. "Perceptions of Climate Change and Willingness to Save Energy Related to Flood Experience." *Nature Climate Change* 1 (4): 46–49. doi:10.1038/nclimate1059.

Spence, Alexa, Wouter Poortinga, and Nick Pidgeon. 2012. "The Psychological Distance of Climate Change." *Risk Analysis* 32 (6): 957–72. doi:10.1111/j.1539-6924.2011.01695.x.

Stanovich, Keith E, and Richard F West. 2008. "On the Relative Independence of Thinking Biases and Cognitive Ability." *Journal of Personality and Social Psychology* 94 (4): 672–95. doi:10.1037/0022-3514.94.4.672.

Sterman, John D. 2011. "Communicating Climate Change Risks in a Skeptical World." *Climatic Change* 108 (4): 811–26. doi:10.1007/s10584-011-0189-3.

Stern, Paul C. 2000. "Toward a Coherent Theory of Environmentally Significant Behavior." *Journal of Social Issues* 56 (3): 407–24.

Stern, Paul C, and Thomas Dietz. 1994. "The Value Basis of Environmental Concern." *Journal of Social Issues* 50: 65–84.

Stevenson, Kathryn T., Tasha L. King, Kathryn R. Selm, M. Nils Peterson, and Martha C. Monroe. 2018. "Framing Climate Change Communication to Prompt Individual and Collective Action among Adolescents from Agricultural Communities." *Environmental Education Research* 24 (3): 365–77. doi:10.1080/13504622.2017.1318114.

Stevenson, Kathryn T., M. Nils Peterson, Howard D. Bondell, Susan E. Moore, and Sarah J. Carrier. 2014. "Overcoming Skepticism with Education: Interacting Influences of Worldview and Climate Change Knowledge on Perceived Climate Change Risk among Adolescents." *Climatic Change* 126 (3–4): 293–304. doi:10.1007/s10584-014-1228-7.

Sund, Björn, Mikael Svensson, and Henrik Andersson. 2015. "Demographic Determinants of Incident Experience and Risk Perception : Do High-Risk Groups Accurately Perceive Themselves as High-Risk ?" *Journal of Risk Research* 9877 (September): 1–19. doi:10.1080/13669877.2015.1042499.

Sundblad, Eva-Lotta, Anders Biel, and Tommy Garling. 2007. "Cognitive and Affective Risk Judgements Related to Climate Change." *Journal of Environmental Psychology* 27: 97–106. doi:10.1016/j.jenvp.2007.01.003.

Tatarski, Michael. 2018. "New Climate Change Report Highlights Grave Dangers for Vietnam." 2018. https://news.mongabay.com/2018/10/new-climate-change-report-highlights-grave-dangers-for-vietnam/.

Terpstra, Teun. 2011. "Emotions, Trust, and Perceived Risk: Affective and Cognitive Routes to Flood Preparedness Behavior." *Risk Analysis* 31 (10): 1658–75. doi:10.1111/j.1539-6924.2011.01616.x.

Terpstra, Teun, Michael K. Lindell, and Jan M. Gutteling. 2009. "Does Communicating (Flood) Risk Affect (Flood) Risk Perceptions? Results of a Quasi-Experimental Study." *Risk Analysis* 29 (8): 1141–55. doi:10.1111/j.1539-6924.2009.01252.x.

Tho, Pham Thi Xuan. 2011. "Tích Hợp Giáo Dục Môi Trường qua Môn Địa Lí Đô Thị [Integrating Environmental Education through Urban Geography]." *Tạp Chí Khoa Học ĐHSP TP HCM* 31.

Tran, Duc Vien. 2011. "Climate Change and Its Impact on Agriculture in Vietnam." *Journal of International Society for Southeast Asian Agricultural Sciences* 17 (1): 17–21.

Tran, Phong, Rajib Shaw, Guillaume Chantry, and John Norton. 2009. "GIS and Local Knowledge in Disaster Management : A Case Study of Flood Risk Mapping in Viet Nam." *Disasters* 33 (1): 152–69.

Trope, Yaacov, and Nira Liberman. 2003. "Temporal Construal." *Psychological Review* 110 (3): 403–21. doi:10.1037/0033-295X.110.3.403.

———. 2010. "Construal-Level Theory of Psychological Distance." Psychological Review 117 (2): 440–63. doi:10.1037/a0018963.

UBND. 2010. "Kế Hoạch Hành Động Ứng Phó Biến Đổi Khí Hậu Giai Đoạn 2010-2015 [Climate Change Action Plan 2010-2015]."

Uittenbroek, Caroline J., Leonie B. Janssen-Jansen, and Hens A.C. Runhaar. 2013. "Mainstreaming Climate Adaptation into Urban Planning: Overcoming Barriers, Seizing Opportunities and Evaluating the Results in Two Dutch Case Studies." *Regional Environmental Change* 13 (2): 399–411. doi:10.1007/s10113-012-0348-8.

UN. 2015. Paris Agreement. https://unfccc.int/sites/default/files/english_paris_agreement.pdf.

UNDP. 2007. "Human Development Report (2007-08) – Fighting Climate Changes: Human Solidarity in a Divided World."

UNEP. 2005. *Communicating Sustainability: How to Produce Effective Public Campaigns*. Environment.

UNFCCC. 2016. "Intended Nationally Determined Contribution of Viet Nam." doi:10.2214/ajr.172.4.10587147.

UNFPA-GSO. 2016. *Điều Tra Dân Số và Nhà ở Giữa Kỳ 2014: Cơ Cấu Tuổi, Giới Tính và Một Số Vấn Đề Kinh Tế Xã Hội* [2014 Midterm Census: Age Structure, Gender, and Some Socioeconomic Issues]. Hanoi: Nhà xuất bản Thông tấn.

Updegraff, John A., David K. Sherman, Faith S. Luyster, and Traci L. Mann. 2007. "The Effects of Message Quality and Congruency on Perceptions of Tailored Health Communications." *J Exp Soc Psychol* 43 (2): 249–57. doi:10.1016/j.jesp.2006.01.007.

USAID. 2016. "Greenhouse Gas Emissions in Vietnam." USAID Factsheet. doi:13/006.

USGCRP. 2018. "Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment." Vol. II. Washington, DC, USA. doi:10.7930/NCA.2018.

VietNamNet. 2018. "Hanoi's Water Drainage System Overloaded." 2018. https://english.vietnamnet.vn/fms/society/213332/hanoi-s-water-drainage-system-overloaded.html.

Völker, Marc, Songporne Tongruksawattana, Bernd Hardeweg, and Hermann Waibel. 2011. "Climate Risk Perception and Ex-Ante Mitigation Strategies of Rural Households in Thailand and Vietnam." In *Proceedings of the German Development Economics Conference*, Berlin 2011, No. 79. http://www.econstor.eu/handle/10419/48291.

Vousdoukas, Michalis I., Lorenzo Mentaschi, Evangelos Voukouvalas, Alessandra Bianchi, Francesco Dottori, and Luc Feyen. 2018. "Climatic and Socioeconomic Controls of Future Coastal Flood Risk in Europe." *Nature Climate Change* 8 (9): 776–80. doi:10.1038/s41558-018-0260-4.

Wang, Jinxia, Robert Mendelsohn, Ariel Dinar, Jikun Huang, Scott Rozelle, and Lijuan Zhang. 2009. "The Impact of Climate Change on China's Agriculture." *Agricultural Economics* 40 (3): 323–37. doi:10.1111/j.1574-0862.2009.00379.x.

WB. 2010. "Weathering the Storm : Options for Disaster Risk Financing in Vietnam." Washington, DC, USA.

———. 2011. "Vulnerability, Risk Reduction, and Adaptation to Climate Change: Vietnam Climate Risk and Adaptation Country Profile."

Weber, Elke U. 2010. "What Shapes Perceptions of Climate Change?" *Wiley Interdisciplinary Reviews: Climate Change* 1 (3): 332–42. doi:10.1002/wcc.41.

White, Katherine, Rhiannon Macdonnell, and Darren W. Dahl. 2011. "It's the Mind-Set That Matters: The Role of Construal Level and Message Framing in Influencing Consumer Efficacy and Conservation Behaviors." *Journal of Marketing Research* 48 (3): 472–85. doi:10.1509/jmkr.48.3.472.

Whitmarsh, Lorraine. 2008. "Are Flood Victims More Concerned about Climate Change than Other People? The Role of Direct Experience in Risk Perception and Behavioural Response." *Journal of Risk Research* 11 (3): 351–74. doi:10.1080/13669870701552235.

Wilson, Dawn K., Scot E. Purdon, and Kenneth A. Wallston. 1988. "Compliance to Health Recommendations: A Theoretical Overview of Message Framing." *Health Education Research* 3 (2): 161–71. doi:10.1093/her/3.2.161.

Witte, Kim. 1992. "Putting the Fear Back into Fear Appeals: The Extended Parallel Process Model." *Communication Monographs*. doi:10.1080/03637759209376276.

———. 1993. "A Theory of Cognition and Negative Affect: Extending Gudykunst and Hammer's Theory of Uncertainty and Anxiety Reduction." *International Journal of Intercultural Relations* 17 (2): 197–215. doi:10.1016/0147-1767(93)90025-4.

Witte, Kim, and Mike Allen. 2000. "A Meta-Analysis of Fear Appeals: Implications for Effective Public Health Campaigns." *Health Education and Behavior* 27 (5): 591–615. doi:10.1177/109019810002700506.

Wolf, Johanna, and Susanne C. Moser. 2011. "Individual Understandings, Perceptions, and Engagement with Climate Change: Insights from in-Depth Studies across the World." *Wiley Interdisciplinary Reviews: Climate Change* 2 (4): 547–69. doi:10.1002/wcc.120.

Wolsko, Christopher, Hector Ariceaga, and Jesse Seiden. 2016. "Journal of Experimental Social Psychology Red , White, and Blue Enough to Be Green: Effects of Moral Framing on Climate Change Attitudes and Conservation Behaviors." *Journal of Experimental Social Psychology* 65: 7–9. doi:10.1016/j.gloenvcha.2018.05.004.

World Bank. 2013. "Turn Down the Heat: Climate Extremes, Regional Impacts, and the Case for Resilience." Washington, DC, USA. http://find.shef.ac.uk/openurl/44SFD/44SFD_services_page?url_ver=Z39.88-2004&rft_val_fmt=info:ofi/fmt:kev:mtx:journal&genre=article&sid=ProQ:ProQ:lisashell&atitle=Turn+Down+the+Heat:+Climate.

———. 2017. "Toward Integrated Disaster Risk Management in Vietnam: Recommendations Based on the Drought and Saltwater Intrusion Crisis and the Case for Investing in Long-Term Resilience."

Zope, P. E., T. I. Eldho, and V. Jothiprakash. 2016. "Impacts of Land Use-Land Cover Change and Urbanization on Flooding: A Case Study of Oshiwara River Basin in Mumbai, India." Catena 145: 142–54. doi:10.1016/j.catena.2016.06.009.

Zwickle, Adam, and Robyn Wilson. 2013. "Construing Risk." In *Effective Risk Communication,* edited by Joseph Arvai and Rivers III Louie, 1–21. Taylor & Francis Group.

Summary

The context: Global warming and climate change pose serious risks for ecological and social systems worldwide. Vietnam, due to its exposed geographical location, physical characteristics and the sheer number of people living in coastal and low-lying areas, has been recognized as one of the countries that is most severely affected by climate change and its associated sea level rise. The IPCC's Fifth Assessment Report (IPCC 2014) concluded that human influence is most likely the dominant cause of the observed warming since the mid-20th century. Subsequently the UNFCCC's Conference of the Parties in Paris, France in 2015 set a target of keeping global temperature increase within 2oC in comparison to the pre-industrialized era, in order to ensure that the world climate system will not collapse and protect the earth at the same time, to ensure food security, human safety, eco-system protection and economic development (UN 2015). Addressing the consequences of global warming and its associated climate change has become a pressing need for human society that requires both mitigation and adaptation. While adaptation deals with the consequences of climate change, mitigation aims to tackle its causes. Both adaptation and mitigation involve joint individual and societal responses. Every sector and individual needs to deal with both mitigation and adaptation which covers a wide range of activities, from policy reform to reduction of greenhouse gas emissions, to livelihood diversification, to behavioural change communication.

Understanding risks associated with climate change appears to be a communication challenge in addressing the determinants of risk negligence, especially among the groups who fail to exercise appropriate responses against the anthropogenic causes expected consequences of climate change. Therefore, climate change communication is important to raise awareness, to garner support for collective initiatives and to motivate individual action. Addressing the causes of global warming and anthropogenic climate change needs joint action by both individuals and society, and various approaches from policy advocacy to communication about risk and efficacy. The starting point for this PhD thesis was to compare the extent to which the distant, complex and abstract concept of climate change exhibits different

behavioural barriers and levers in comparison with the more immediate, concrete, and experiential phenomenon of floods. Behavioural changes, therefore, are vital for responding effectively to climate change, which require collective effort by each individual and the whole of society.

Although climate change communication has gained theoretical and empirical interest for researchers in recent decades; it still lacks practical evidence to target specific audiences such as policy makers, farmers and adolescents, especially in developing countries. The information deficit model applied in many communication strategies, which simply assumes that the public at risk is lacking knowledge and if provided more or better information will produce more rational responses, will fall short in addressing complicated and highly-uncertain climate-related risks. Despite many studies on communicating climate change and its associated risks in the developed world, there are fewer studies into how to effectively communicate climate change risks in the developing world where a large portion of people will be greatly affected by climate change impacts due to widespread poverty, ineffective governments and being poorly equipped to prepare for and prevent climate change threats. Many governments have tried to raise awareness about climate change through top-down and one-way communication campaigns with limited success. In Vietnam a number of factors such as a lack of climatologists and meteorologists, the media landscape, socio-economic conditions and literacy rates impede the effectiveness of climate change communication. A thorough understanding of communicating climate change risks, better tools and sharing knowledge from different sources could provide a shared-learning and decision-making platform for discussing and implementing climate change mitigation and adaptation in coastal and delta communities in Vietnam, and could be replicated in the South East Asia region within similar contexts.

The main objectives of this thesis are to understand which factors influence flood and climate change risk perceptions and efficacy towards responding to flood and climate risks among different groups of people living in the coastal and delta communities in Vietnam. Through different experimental studies, the thesis also aims to test message framing methods to effectively

communicate flood and climate change risks for behavioural changes toward mitigation and adaptation. By understanding risk perception and analysing the effectiveness of different message framing methods for communicating risks and changing perceptions in the target stakeholder groups, predictors for behaviour change can be developed. Such research is important for developing improved climate change adaptation and mitigation in Vietnam and is likely relevant to countries in a similar context. Three key aspects will be explored in this study: content and framing of risk messages (risk perceptions and perceived efficacy); place-based specifics (i.e. Vietnam coastal and delta areas in a developing country); and predictors of behaviour change.

Research framework and data collection: In this thesis, several conceptual frameworks were developed or adapted based on existing theories around risk perceptions, efficacy, and communication, namely: climate change risk perception model (CCRPM: van der Linden 2014) construal level theory (CLT: Trope and Liberman 2010), extended parallel processing model (EPPM: Witte 1992), gender schema theory (GST: Ben 1981), theory of planned behaviour (TPB: Ajzen 1991), protection motivation theory (PMT: Rogers 1975) and prospect theory (PT: Kahneman and Tversky 1979) to explore: i) what factors influence people in understanding flood and climate change risks perceptions, efficacy and behavioural intentions to mitigate or adapt; and ii) how message framing influences the risk perception, efficacy and behavioural intentions to adapt or mitigate to flood and climate change risks.

The principle data collection method applied in all studies is quantitative with a total sample of 2299. Data was collected through face-to-face interviews by trained data collectors using pre-designed questionnaires with response scales including five-point Likert scale, multiple choice, single choice and 'yes-no' questions. Samples were specifically targeted and randomly selected among inhabitants in coastal and delta communities in Vietnam, including urban households, street vendors, farmers, and adolescents. To conduct field experiments, a 2 x 2 factorial design was applied to explore manipulation effects in message framing (gain- vs. loss-framed and concrete- vs. abstract-framed messages; information- vs. action-framed and abstract- vs. concrete-framed messages). To complement quantitative

data, a qualitative method was used when necessary to collect more in-depth information, such as focus group discussions and in-depth interviews with key informants.

Findings: The focus of the first two chapters (Chapters 2 and 3) is to explore risk perceptions among various audience groups in coastal and delta areas in Vietnam. The purpose of Chapter 2 is to enhance understanding of the factors that influence flood and climate change risk perceptions, efficacy, and intention to take adaptive measures. In Chapter 2, a conceptual framework was developed inspired by the climate change risk perception model (CCRPM) which includes indicators of the four groups of determinants of climate risk perception: cognitive factors, experiential processing, social-cultural and socio-demographic factors. Considering the available survey dataset, a simplified set of independent variables compared to the CCRPM model was constructed including: individual knowledge, past experience, frequency of community participation and socio-demographics.

The research results showed that while pairwise analyses revealed a significant association of flood and climate change risk perceptions with individual's flood experience, climate change knowledge, frequency of community participation and socio-demographic factors, it did not show the influence of most socio-demographic factors. Therefore, in the next Chapter 3, another study was conducted to explore how demographic factor (i.e. gender) influences flood risk perceptions among city residents. The reason is that women are considered particularly vulnerable and highly affected by disasters and climate change due to a variety of factors, including social roles, education, employment status, income, household finance responsibilities, access to community services and infrastructure (Rahman 2013; Fakhruddin and Rahman 2015). Previous studies highlighted the importance of considering gender responsiveness for effective disaster preparedness and for reducing disaster impacts. However, gender gaps and imbalances shaped by cultural and social structures are often ignored in risk assessment and disaster mitigation planning (De Silva and Jayathilaka 2014; Reyes and Lu 2015; Rakib et al. 2017). Most importantly, the findings were in line with previous research findings suggesting that people view climate change impacts as temporally and spatially distant and therefore

often view climate change impacts as personally relevant only after directly experiencing disrupted weather patterns. The research confirmed earlier findings that individuals' knowledge, place-specific experience and social-cultural influences are key predictors of both flood and climate change risk perceptions and intentions to take adaptive measures. And finally, the results confirm the assumption that risk perceptions are strongly influenced by knowledge about the causes and consequences of climate change.

Chapter 3 studies flood impact perceptions in urban households and how gender influences these perceptions, with the aim of assessing the most important social, economic, and environmental impacts that local communities experience during flood disasters. The community-based assessment considers and compares gender-differentiated perceptions of social, environmental, and economic impacts of floods on the city road network. To understand that a gender-differentiated framework (rooted from gender schema theory- GST) was applied to assess risk perceptions. The findings confirmed there was gender-differentiated perception on city flood impacts on people's lives. Specifically, prior, during, and following floods, women were perceived to work longer hours, and to take on additional tasks both in the household and at work. The roles of men and women in the family were also different, pre-, post-, and during floods. The most strongly perceived impacts of floods on women were economic, as their reduced daily income made it difficult to cover the higher costs for family food and living expenses during periods of flooding. Apparently as a result of these gender-differentiated impacts, women also perceived greater self-impacts to their health and greater stress than men. These findings confirmed that women are one segment of society in Vietnam that is particularly vulnerable and highly affected by flood risks due to their vulnerability characteristics, including social roles, education, employment status, income, household finance responsibilities, access to community services and infrastructure. The findings of this study form the basis for flood risk mitigation policy recommendations which take local community needs into account. This analysis will therefore offer a comprehensive understanding of flood impacts borne by communities, and complement other findings, based on the application of analytical models to assess the benefits of flood mitigation measures.

The focus of the last two chapters (Chapters 4 and 5) is on climate change risk communication. Based on the results from Studies in Chapter 2 and 3, experiments were designed to explore how risk perceptions (severity, susceptibility) and efficacy (self- and response efficacy) influence the behavioural intentions to flood and climate change mitigation/adaptation through different message framing (i.e. gain vs. loss, abstract vs. concrete, action-oriented vs. information-oriented. Chapter 4 focuses on climate change communication to foster mitigation behaviours among adolescents in vulnerable locations in the global South. The role of communication in climate change mitigation among adolescents was investigated within the Vietnamese context; a country representative of an emerging economy in the developing world with a relatively young population. The purpose of this research is to explore how perceptions of climate change risk and efficacy influence two key predictors of behavioural change: one's perceived responsibility and one's mitigation intentions regarding climate change; further, it tests how congruency in risk messages moderates this relationship.

To investigate the interaction between climate change risk perceptions and message congruency, a research framework that is rooted in the theory of planned behaviours (TPB) and the construal level theory (CLT) was proposed. In general, the framework treats threat and efficacy perceptions as independent variables that affect the perceived responsibility and the intention to adopt responsive behaviours, with message congruency as a moderating factor. From EPPM theory, perceived severity (refers to an individual's subjective perception of the magnitude of a threat or risk), perceived susceptibility (refers to a risk that entails the appraisal of one's vulnerability regarding the risk), self-efficacy (refers to an individual's subjective perception of his or her ability to successfully perform risk mitigation practices), and response efficacy (means the perceived effectiveness of the risk mitigation behaviours) to climate change as the four independent variables were adopted. The two dependent (or outcome) variables to examine the predictors of behavioural change are perceived responsibility and mitigation intentions. The influence of the moderator variable 'congruency' was investigated by testing whether the relationship

between individual perceptions on mitigation intentions and perceived responsibility is dependent on climate change message congruency. The findings confirmed that the combination of concrete and action-oriented messages coupled lively psychological experience with clear behavioural options, thus reducing barriers to act; while the combination of abstract and information-oriented messages facilitated the adoption of a more contemplative perspective, especially in the case of a long-term phenomenon like climate change. Furthermore, the research findings confirmed another hypothesis that, in line with earlier research, the strength of this relationship is moderated by congruency in risk messages; a stronger relation was observed between risk and efficacy perceptions and predictors of behavioural intentions to climate change mitigation when messages were congruent. The research findings confirmed that higher perception of risk (severity, susceptibility) and efficacy (self- and response efficacy) led to higher levels of assumed responsibility and behavioural intentions towards climate change mitigation, especially under high message congruency conditions. It was concluded that messages which are congruently designed boost the relation between risk and efficacy perceptions and the behavioural outcome variables.

Chapter 5 focuses on message framing and its applicability in changing farmers' perceptions on climate change risk efficacy and behavioural intentions. Over the past few decades, debate and conversations around climate change have taken centre stage in social, economic and political avenues. The impacts of climate change continue to affect the lives of people; especially those that depend on agriculture as a main source of income. Farming relies heavily on stable weather and seasons and instability or extremes can lead to the loss of farm crops or animals. Therefore, proper message framing would influence farmer's decisions and perceptions on adapting to or mitigating climate change impacts. It is important for farmers to learn about climate change and how it affects their lives and livelihoods. Based on psychological distance and gain versus loss message framing methods, it is expected that farmers are able to consider their response measures to adapt to or mitigate climate change. The extended parallel processing model (EPPM) was elaborated to develop a conceptual

framework that proposed a person's intention to protect oneself against a given risk depending on the perceived severity and susceptibility of the threat and the perceived self-efficacy and response efficacy. The EPPM proposes four factors: perceived severity, perceived susceptibility, self-efficacy, and response efficacy. In response to communicative messages, the audience is expected to respond with behavioural changes in terms of: (i) perceived responsibility and (ii) climate change adaptation or mitigation intention.

The research findings confirmed that when being communicated by gain-framed in combination with concrete-framed messages, the farmers cared more of what they could do to adapt to climate change now, in response to its psychological distance (temporal: present vs. future), in their community (spatial: physically close vs. far), for their household (social: self vs. others), and with less uncertainty (likely affect their crops this year or next year vs. melting of glaciers). Specifically, the research findings confirmed the hypothesis that gain-framed messages are more effective in changing farmers' risk perceptions and efficacy to climate change, as well as influencing stronger behavioural intentions. Farmers responded more positively to messages that tell them what they gain (persuasiveness) in terms of income, health, or livelihood options if they take recommended adaptive actions than the messages about what they might lose if they do not take similar actions. Furthermore, the research findings confirmed another hypothesis that farmers were more concerned about climate change adaptation (risk, efficacy) and more willing to take adaptive measures (behavioural intention to climate change adaptation) when being communicated by gain-framed in combination with concrete-framed messages in comparison with loss-framed in combination with abstract-farmed messages.

Conclusion: This thesis contributes to the evidence base on the determinants of climate change and flood risk perceptions, as well as the intentions to adopt mitigation and adaptation measures. While this thesis focused on the Vietnamese context, it also discussed implications of the findings that could be relevant to other countries with similar socio-economic or geographic contexts. Firstly this thesis explored the extent to which the distant, complex

and abstract concept of climate change exhibits different behavioural barriers and levers in comparison with the more immediate, concrete, and experiential phenomenon of floods. The thesis further examined whether the flood experience of individuals impacted their perceptions of climate risks and adaptation. Confirming previous findings, the thesis found that individuals' knowledge, place-specific experience and vulnerability-related socio-demographic factors are important predictors of both flood and climate change risk perception and intentions to take adaptive measures. In addition, the findings from Vietnam suggest the importance of combining theories of risk perception, protection motivation and the extended parallel processing model to better understand influential behavioural factors and devise more effective communications campaigns. The results also show the importance of validating this approach in other contexts and settings.

In addition to underlying factors of importance in the Vietnamese context, this research contributes to broader theoretical debates and to the global conversation on how to effectively communicate around climate change to different audiences. By highlighting the differential nature of significant factors in two different climate-impacted demographic sectors – adolescents and farmers – it highlights a need for continued research on the specific drivers of mitigation and adaptation behaviours in specific population segments. Furthermore there is a need to develop, deploy, and test more tailored climate change communications interventions to reduce vulnerability and contribute to more sustainable development pathways. Specifically, the relationship between climate change risk perceptions and knowledge about climate change, experiential processing, socio-cultural and socio-demographic factors deserve further inquiry. Ultimately, when conducting risk communication activities, both researchers and practitioners need to consider this relationship to explore effectiveness of message framing techniques for intended behavioural changes. Moreover, it is important for risk communication researchers and practitioners to explore the psychological differences between men and women for possible applications to behavioural change communication efforts. These gender differences need to be translated into specific framing of risk communications to make the framed messages more acceptable to each of the sexes.

This research also recommends that more attention is needed toward framing climate change messages more congruently to reduce climate change's psychological distance as a strategy to change the public's perceptions and behavioural intentions to climate change adaptation or mitigation. This thesis further extended the main argument by the CLT that varying levels of psychological distance affect individuals' perceptions of risks and their judgments with regards to decision-making behaviours. In the future this will be an important aspect to consider because climate change communication meets recipients with pre-existing attitudes, values, and perceptions with the aim to create behavioural changes that will reduce climate change risks. Finally, this research offers direction for climate change communication with farmers whose livelihoods are projected to be most affected by immediate and long-term climate change impacts by emphasizing the gains experienced by farmers that implement adaptive measures. Specifically, the research proves that properly-designed messages which focus on positive outcomes (gain-framed) and relate to farmers' livelihoods (psychological proximity) is the most effective framing method.

This research also addresses a gap in the literature regarding research on climate change risk communication in lower-middle income settings. Nevertheless, it also underlines the importance of pursuing additional research in other lower- and lower-middle income countries to validate these findings and further deepen our understanding of effective communications approaches in these contexts. Most importantly, the government agencies and communication practitioners need to design and implement scientific evidence-based climate change communication campaigns to raise people's awareness. This requires follow-up evaluation to measure the communication effectiveness through rates of adopting behavioural changes. At the same time, policy makers need to collaborate with scientists to formulate effective risk mitigation policies and programs to address the root causes and the anticipated consequences of climate change. Lastly, it will be critical for donors, policy makers and researchers to take up this research agenda in the coming years given the significant climate change impacts forecast for vulnerable populations in lower- and lower-middle income countries. Without a sufficiently robust evidence base, climate change mitigation and

adaptation measures in these countries are likely to continue to have only limited effectiveness, putting at risk the livelihoods of at-risk communities, the sustainable development objectives at the national scale, and the global climate change agenda.

The Paris Agreement aims at "reducing global greenhouse gas emissions so as to limit the earth's temperature increase in this century to 2 degrees Celsius above pre-industrial levels, while taking steps to limit the increase to no more than 1.5 degrees". In order to achieve this ambitious goal, countries have been laying out their Intended Nationally Determined Contributions to help cut emissions. While technological advances will provide some of the reductions, changes in a wide range of human behaviours are also critical to success. This thesis emphasizes the importance of investing in appropriate research and implementing evidence-based communication programs to determine the most effective communications strategies to drive behaviour change across different population segments around the world.

Appendixes

Appendix 2.1. Socio-demographic characteristics of population sample across all three research sites

Characteristics and categories		%
Age	<30	7.2%
	30-39	15.9%
	40-49	27.9%
	50-59	26.6%
	>=60	22.4%
Gender	Male	39.4%
	Female	60.6%
Education	Never go to school	5.3%
	Primary	29.0%
	Secondary	41.0%
	High school and above	24.7%
Vulnerable dependents (children, elderly, disabled)	No vulnerable dependents	49.8%
	Having vulnerable dependent(s)	50.2%
Main source of income	Agriculture	24.1%
	Aquaculture	11.4%
	Small traders or casual labour	39.2%
	Waged employment	25.3%
Poverty status	Non-poor	72.2%
	Poor and near poor	27.8%
Housing structure	Permanent	50.9%
	Temporary or semi-permanent	49.1%
Community organization membership	Not a member of any community organization	28.0%
	Member of Farmers' Union or Women's Union or Youth's Union or voluntary groups	72.0%
Frequency of participating in community activities	Never	25.4%
	Rarely	7.8%
	Occasionally	37.4%
	Regularly	29.4%
City of residence (location characteristics)	Quy Nhon	33.8%
	Can Tho	33.0%
	Da Nang	33.2%

Appendix 2.2. Determinants, questions and responses

Determinant	Question	Responses
Socio-demo-graphics	Province	1. Quy Nhon 2. Can Tho 3. Da Nang
	Gender	1. Male 2. Female
	Housing condition	1. Temporary 2. Semi-concrete 3. Concrete (permanent) 4. No private house, must rent
	Age	___ specify
	Education	1. Never go to school 2. Primary 3. Secondary 4. High school 5. College and above
	Economy conditions	1. Poor household 2. Near poor household 3. Average and better-off household 4. Don't know
	Income sources	A. Crop => Agriculture B. Livestock => Agriculture C. Aquaculture => Aquaculture D. Fishing => Aquaculture E. Short term work (labour work) => Small traders or casual labour F. Handicraft => Small traders or casual labour G. Small business => Small traders or casual labour H. Salary => Waged employment I. Other (specify)
Individual knowledge	What do you know about the causes and impacts of floods?	A. Heavy rain in my area B. Heavy rain in the upper-stream area C. High sea tide D. More hydropower dams built E. More concrete road built F. More houses built G. Poor drainage system H. Others (specify)

	What do you know about the impacts of climate change?	1. Nothing 2. Weather change 3. Rainfall change 4. Temperature increase 5. Seasons change 6. Disasters become more intense 7. Disasters become more frequent 8. Fish/aquaculture products grow differently 9. Crops grow differently 10. More crop pests 11. More animal diseases 12. More human diseases 13. Other (specify)
	Are you aware of causes of climate change	0. No 1. Yes
Flood experience	Did you experience a flood in your area in the last 10 year?	0. No. 1. Yes, Year ___ specify
	Do you think that the long-term trends in weather are changing?	1. Yes 2. No 3. Don't know
	Do you think that the rain occurred frequently in the dry season in the past decade or more?	1. Yes 2. No 3. Don't know
Community participation	Community organization membership	0. No 1. Yes, specify (Farmers' Union or Women's Union or Youth's Union or voluntary groups)
	Do you regularly participate in community activities?	1. Frequently 2. Occasionally 3. Rarely 4. Never
Perceived risk and vulnerability	Is your house located in area affected by flood risk?	1. It is in high risk area 2. It is potentially affected 3. It is in safe area 4. Don't know
	What do you think about the trend of flood frequency in the next decade?	1. More frequently 2. Less frequently 3. At about the same 4. Don't know
	Do you think the trend of flood to peak in the next decade will be?	1. Higher 2. Lower 3. At about the same 4. Don't know

	Do you think, in a decade or so, that the trend in floods will stay for?	1. A longer time 2. A shorter time 3. At about the same 4. Don't know
	What do you think the impact of climate change will be on your livelihood?	A. Don't know B. No impact C. Lost crops D. Lost land E. Reduced crops yield F. Most pests and diseases G. Impact of business and reduced income H. More fishes I. Increased crop yield J. More job opportunities K. Others (specify)
Perceived severity	Does flood cause negative impact on your livelihood?	1. A lot 2. Somewhat 3. A little 4. Not at all
	Are you concerned about climate change	0. Not at all 1. A little 2. Very concerned
Perceived adaptive capacity	Before flood season, do you prepare anything to cope with flood?	1. No 2. Yes, go to Q36
	How do you prepare?	A. Stockpile food B. Stockpile water C. Stockpile medicines D. Prepare safety tools E. Stockpile fuel F. Check electricity safety G. Hang value things in high place H. Evacuate livestock I. Evacuate to safe place J. Do not allow children travel to school K. Strengthen local dyke L. Strengthen house M. Other (specify)

	Do you know what can be done to adapt climate change?	A. Don't know B. Change crops C. Change cropping schedule D. Build houses in higher area E. Others (specify)
Intention to take adaptive measure	Are you doing any longer-term preparations for future flooding? What will you do?	1. No 2. Yes, go to Q39 A. Strengthen house and raise the floor higher B. Relocate household to safer place C. Purchase safety tools D. Change the crops E. Diversify crops F. Learn more about flood G. Save money H. Purchase insurance I. Others (specify)
	Are you willing to learn more about climate change including mitigation and adaptation?	1. No 2. Yes 3. Maybe

Appendix 2.3. Individual's knowledge of flood risk and climate change risk and perception of vulnerability, severity, adaptive capacity and intention to take adaptive measures

	Individual knowledge and perceptions		%
Flood			
Individual knowledge	What do you know about the causes of floods?	Don't know	12.4%
		Named at least one cause	87.6%
Flood experience	Did you experience a flood in your area in the last 10 years?	No	34.8%
		Yes	65.2%
Perceived risk and vulnerability	Is your house located in an area affected by flood risk?	Yes, high risk	45.8%
		Yes, relatively high	31.3%
		In safe area	22.9%
Perceived severity	Does flood cause negative impacts on your livelihood?	A lot	43.2%
		Somewhat	37.6%
		Little	13.7%
		Not affect	5.5%
Perceived adaptive capacity	Before flood season, what do you prepare to cope with floods?	Nothing	36.8%
		Named at least one action	63.2%
Intention to take adaptive measure	Will you prepare for coping with future flood?	Nothing	45.1%
		Named at least one action	54.9%
Climate change			
Individual knowledge	Do you know about the causes of climate change?	Don't know	40.1%
		Named at least one cause	59.9%
Climate change experience	Do you think weather is changing more drastically in recent years?	No	3.1%
		Yes, named at least one extreme event	96.9%

Perceived risk and vulnerability	What do you know the impact of climate change will be on your livelihood?	No idea	28.4%
		No impact	4.5%
		Has impact	67.1%
Perceived severity	Are you concerned about climate change?	Not at all	17.4%
		Yes a little	35.9%
		Yes a lot	46.7%
Perceived adaptive capacity	What can be done to adapt to climate change?	Don't know	82.6%
		Named at least one action	17.4%
Intention to take adaptive measure	Are you willing to learn more about climate change including mitigation and adaptation and prepare for the future?	No	11.1%
		Named some actions	88.9%

Appendix 4.1. General messages on climate change definitions

	Message #1: This is the first message about weather. Please read it carefully. After that we would like to ask you to summarize the message **in one short sentence in your own words.**	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	***Concrete:*** *present, local, self/in-group/ similar, likely*
Information-oriented: *generalized, not including behavioural perspective (some that can be done*	Weather includes factors such as precipitation, air pressure, temperature, wind, humidity and other phenomena such as typhoon and thunderstorm. It changes constantly, often from hour to hour and day to day. Today it is sunny in some parts of the world, but cloudy elsewhere, but tomorrow or next week, it may be the other way round.	Weather includes factors such as precipitation, air pressure, temperature, wind, humidity and other phenomena such as typhoon and thunderstorm, etc. It changes constantly, often from hour to hour and day to day. For example, today it is sunny or cloudy or rainy in Can Tho City. But next week it can be warmer or cooler, there can be a storm or a calm day, there can be sunshine or rain.
Action-oriented: *active, including behavioural perspective (some that can be done)*	Weather includes factors such as precipitation, air pressure, temperature, wind, humidity and other phenomena such as typhoon and thunderstorm, etc. It changes from hour to hour and day to day. Today it is snowing in the North Pole but on the same day next month, it will probably not snow at all. Humanity can prepare themselves to cope with weather by listening to the weather forecast on TV or radio. For example, when traveling to a country in the Northern Hemisphere, warm clothes are needed; for going to a tropical country, light-weight clothes are needed.	Weather includes factors such as precipitation, air pressure, temperature, wind, humidity and other phenomena such as typhoon and thunderstorm, etc. It changes constantly, often from hour to hour and day to day. For example, when it is sunny in Can Tho City, it can get so warm that you should not work hard in the sunshine during midday. Rainfall in Can Tho City during the monsoon season can be so heavy that you should stay inside. You should prepare yourself to cope with the weather by listening to the weather forecast on TV or radio. Every day when you wake up in the morning you need to check what the weather is like outside. If it is cold you wear a sweater and if it is warm, you wear a T-shirt. When you plan what to do on a weekend, you can check the weather forecast whether it will be sunny or rainy, not too hot and not too cold.

	Message #2: This is the second message, now about climate. Please read it carefully. After that we would like to ask you to highlight what you think is **the most important sentence in the text.**	
	Abstract: future, global/ polar, other/ out-group/ dissimilar, unlikely	***Concrete****: present, local, self/in-group/ similar, likely*
Information-oriented: *generalized, not including behavioural perspective (some that can be done)*	The climate is the common, average weather conditions at a particular place over a long period of time (for example, 30 years or more). In a narrow sense climate is usually defined as the 'average weather', or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. These quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state of the climate system, including a statistical description.	The climate is the common, average weather conditions at a particular place over a long period of time (for example, 30 years or more). Climate is often spoken about at the same time as weather, but it is something quite different. Climate also includes factors such as temperature, moisture, wind strength and patterns, air pressure, cloud cover and solar access. For example, Can Tho city has a hot and humid tropical monsoon climate. That means there are many warm and wet days and that there is a regular rainy season every year.

Action-oriented: *active, including behavioural perspective (some that can be done)*	The climate is the common, average weather conditions at a particular place over a long period of time (for example, 30 years). In a narrow sense climate is usually defined as the 'average weather', or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. These quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system. People can learn about different climates around the world, for example to prepare themselves for the future. For example, those who live in a hot desert need to prepare for a dry and hot climate; those live in Alaska closer to the Poles need to prepare for a cold and dry climate.	The climate is the common, average weather conditions at a particular place over a long period of time (for example, 30 years or more). Climate is very different from weather. Weather changes constantly, often from hour to hour and day to day in a small area (such as a commune, district province); while the climate is relatively stable and represents a larger area such as the North or the South of Vietnam. People here in Can Tho City have learned to live with the local climate which is hot and humid; while other people may live in Europe where the climate is temperate and cold. Climate information is important to Can Tho people, for example because farmers use climate information to invest in rice farming, aquaculture, fruit production, or livestock.

	Message #3: This is the third message, now about global warming. Please read it carefully. After that we would like to ask you to summarize the message in **one short sentence in your own words.**	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	***Concrete:*** *present, local, self/in-group/ similar, likely*
Information-oriented: *generalized, not including behavioural perspective (some that can be done)*	Global warming refers to the recent and ongoing rise in global average temperature near the Earth's surface. It is caused mostly by increasing concentrations of greenhouse gases in the atmosphere such as: carbon dioxide, methane, nitrous oxide, ozone. Global warming may affect people's lives around the world in the future.	Global warming refers to the recent and ongoing rise in global average temperature near the Earth's surface. It is caused mostly by increasing concentrations of greenhouse gases in the atmosphere such as: carbon dioxide, methane, nitrous oxide, ozone. These greenhouse gases are emitted by many human activities, for example traffic, cooking and heating, industrial production and agriculture. Global warming is causing the climate to change. Over the last years, the temperatures in Can Tho have been generally increasing; and the residents in Can Tho will very likely notice that the sea level is becoming higher and that rainfall is becoming more abnormal and unpredictable.

Action-oriented: *active, including behavioural perspective (some that can be done)*	Global warming refers to the recent and ongoing rise in global average temperature near the Earth's surface. It is caused mostly by increasing concentrations of greenhouse gases in the atmosphere such as: carbon dioxide, methane, nitrous oxide, ozone. Global warming is causing climate patterns to change, which causes changes in the temperature and rainfall, icecap melting, sea level rise and so on. Immediate actions such as reducing the use of electricity, water, fossil fuel or going to school by bicycle to reduce the global warming and impacts of climate change can be taken.	Global warming refers to the recent and ongoing rise in global average temperature near the Earth's surface. It is caused mostly by increasing concentrations of greenhouse gases in the atmosphere such as: carbon dioxide, methane, nitrous oxide, ozone. The present warming is generally attributed to an increase in the greenhouse effect, brought about by increased levels of greenhouse gases, largely due to the effects of human industry and agriculture. Global warming is causing climate patterns to change. Global warming makes the temperature in Can Tho hotter and hotter, the sea level higher which in turn causes more floods in your community and water in your rice field becomes more saline. You and your family can join community activities and school education extra curricula to learn how to cope with the changes in flood pattern, rainfall and salinity level in order to protect your livelihood, health and education. You and your peers can do some immediate actions such as reducing the use of electricity, water, fossil fuel or going to school by bicycle to reduce the global warming and impacts of climate change.

	Message #4: This is the fourth message, now about climate change. Please read it carefully. After that we would like to ask you to highlight what you think is the most important sentence in the text.	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	***Concrete:*** *present, local, self/in-group/ similar, likely*
Information-oriented: *generalized, not including behavioural perspective (some that can be done)*	Climate change refers to any significant change in the climate over an extended period of time (decades or longer). The United Nations Framework Convention on Climate Change (UNFCCC) defines 'climate change' as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'.	Climate change refers to any significant change in the climate over an extended period of time (decades or longer). Climate change includes major changes in temperature, precipitation, or wind patterns, among other effects, that occur over several decades or longer. For example, the climate in Can Tho city will very likely become warmer in the next 30 year.
Action-oriented: *active, including behavioural perspective (some that can be done)*	Climate change refers to any significant change in the climate over an extended period of time (decades or longer). The United Nations Framework Convention on Climate Change (UNFCCC) defines 'climate change' as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'. Humans can take immediate action such as reducing the use of electricity, water or fossil fuel to reduce the emission of greenhouse gases emission that contribute to global warming and climate change.	Climate change refers to any significant change in the climate over an extended period of time (decades or longer). Climate change includes major changes in temperature, precipitation, or wind patterns, among other effects, that occur over several decades or longer. For example, the climate in Can Tho city will very likely become warmer in the next 30 year. You and your family can join community activities and school education outside the curriculum to learn how to cope with the changes in flood pattern, rainfall and salinity level in order to protect your livelihood, health and education. You and your peers can do some immediate actions such as reducing the use of electricity, having shorter showers to save water, or going to school by bicycle to save fuel and reduce the global warming and impacts of climate change.

Message of climate change impacts and response (mitigation and adaptation)

	Message #5: This is the fifth message about climate change impact on increasing temperature and response. Please read it carefully. After that we would like to ask you to highlight **three key words from the text.**	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	***Concrete:*** *present, local, self/in-group/ similar, likely*
Information-oriented: *generalized, not including behavioural perspective (some that can be done)*	The phenomenon of climate change will very likely cause land and ocean surface temperatures to rise.	The phenomenon of climate change has already caused Can Tho's temperature to rise and will very likely make Can Tho's weather hotter over the next 10 years.
Action-oriented: *active, including behavioural perspective (some that can be done)*	The phenomenon of climate change will very likely cause land and ocean surface temperatures to rise. This effect can be countered by reducing deforestation and planting more trees.	The phenomenon of climate change has already caused Can Tho's average temperatures to rise and will very likely make Can Tho's weather hotter over the next 10 years. You can counter this effect indirectly by less burning of fuels by walking instead of riding motorbikes, and directly by planting more trees to offer shade to people and farm animals

	Message #6: This is the sixth message about climate change impact on sea level rise and response change impact on rainfall and response. Please read it carefully. After that we would like to ask you to highlight **three key words from the text.**	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	***Concrete:*** *present, local, self/in-group/ similar, likely*
Information-oriented: *generalized, not including behavioural perspective (some that can be done)*	The phenomenon of climate change may cause global sea levels to rise.	The phenomenon of climate change may cause parts of Can Tho to be regularly flooded, the rice farms to become more saline and river banks to be more frequently eroded.
Action-oriented: *active, including behavioural perspective (some that can be done)*	The phenomenon of climate change may cause global sea levels to rise, but this effect can be countered by less burning of fossil fuels.	The phenomenon of climate change may cause parts of Can Tho to be regularly flooded, the rice farms to become more saline and river bank to be more frequently eroded; but local people in Can Tho can counter this by changing farming practices such as planting salt tolerant rice varieties or changing from rice production to brackish water aquaculture; or by building better river bank protection against floods.

	Message #7: This is the seventh message about climate change impact on rainfall and response. Please read it carefully. After that we would like to ask you to **highlight three key words from the text.**	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	**Concrete:** *present, local, self/in-group/ similar, likely*
Information-oriented: *generalized, not including behavioural perspective (some that can be done)*	The phenomenon of climate change may cause some areas in the world have higher rainfall while in other areas less rainfall.	The phenomenon of climate change has already made more unseasonal rains in Can Tho city and will very likely change the rainfall pattern in Can Tho in the next 10 year. This rainfall change will affect Can Tho's water resources and farming practices.
Action-oriented: *active, including behavioural perspective (some that can be done)*	The phenomenon of climate change may cause some areas in the world to have higher rainfall while in other areas less rainfall. People can learn from this change to prepare themselves for adapting their livelihood such as farming with more efficiency in water use.	The phenomenon of climate change has already made more unseasonal rains in Can Tho city and will very likely change the rainfall pattern in Can Tho in the next 10 year. This rainfall change will affect Can Tho's water resources and farming practices. You, your family and other farmers in Can Tho can learn from this change to prepare for adapting your livelihood such as: farming, aquaculture or livestock raising with more efficiency in water use; or changing the seasonal calendar to avoid the loss or damage of crops due to unseasonal rain.

	Message #8: This is the eighth message about climate change impact on natural disasters and response. Please read it carefully. After that we would like to ask you to highlight three key words from the text.	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	***Concrete:*** *present, local, self/in-group/ similar, likely*
Information-oriented: *generalized, not including behavioural perspective (some that can be done)*	The phenomenon of climate change may cause more disaster events such as flood, drought, or typhoon that occurred in specific places in the world.	The phenomenon of climate change may cause more disaster events such as flood, drought, typhoon, river bank erosion, or salinity occurred in Can Tho in comparison to the past decades.
Action-oriented: *active, including behavioural perspective (some that can be done)*	The phenomenon of climate change may cause more disaster events such as flood, drought, or typhoon that occurred in specific places in the world. People can learn from this change to prepare for responding to disasters associated with climate change impact: for example, by participating in disaster training and drill; following early warning messages; moving to a safe place before disasters, etc.	The phenomenon of climate change may cause more disaster events such as flood, drought, typhoon, river bank erosion, or salinity occurred in Can Tho in comparison to the past decades. You and family can take actions to respond to annual disasters associated with climate change impacts in Can Tho city: for example, participating in community and school annual flood planning and implementation; watching daily weather forecast and following warning systems to you prepare during annual flood and typhoon season; helping your parents to move family and property to a safe ground; harvesting your crops before the typhoon and flood; etc.

	Message #9: This is the ninth message about climate change impact on health and response. Please read it carefully. After that we would like to ask you to highlight **three key words from the text.**	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	***Concrete:*** *present, local, self/in-group/ similar, likely*
Information-oriented: *generalized, not including behavioural perspective (some that can be done)*	The phenomenon of climate change may cause more health problems (epidemic) in specific places in the world.	The phenomenon of climate change may cause more health problems (epidemic) such as malaria, dengue fever, cholera to humans; or foot and mouth disease, avian influenza in livestock, or heat stroke and other bacteria in fish and shrimp in Can Tho city.
Action-oriented: *active, including behavioural perspective (some that can be done)*	The phenomenon of climate change may cause more health problems (epidemic) in specific places in the world. Humanity can learn from this change to prepare for responding to diseases related to climate change such as heat stroke, dengue fever, malaria, cholera, for example, by participating in health campaign and taking vaccination, cleaning the environment, etc.	The phenomenon of climate change may cause more health problems (epidemic) such as malaria, dengue fever, cholera to humans; or foot and mouth disease, avian influenza in livestock, or heat stroke and other bacteria in fish and shrimp in Can Tho city. You can learn from this change to prepare yourself for responding to diseases related to climate change such as heat stroke, dengue fever, cholera, for example, by participating health campaign and taking vaccination by school and local health clinic, cleaning the environment around your school and homes to kill mosquito, planting more tree around your school and home to have more shade for reducing heat, etc.

Appendix 4.2. Survey questionnaire

Manipulation checks: action/information orientation

Below we have a few questions about the messages you just read. Now we would like to ask you to what extent the questions below apply to you.

Question 1. To what extent do you think the messages provide you with practical advice on how to cope with climate change impacts?

1 2 3 4 5

Not at all Very much so

Question 2. To what extent do the messages you've read convince you that you can do something to tackle the climate change impacts?

1 2 3 4 5

Not at all Very much so

Question 3. After reading the messages, do you know what you can do yourself against the effects of climate change?

1 2 3 4 5

Not at all Very much so

Question 4. Did reading the messages provide you with practical tips that you can use yourself to prevent climate change?

1 2 3 4 5

Not at all Very much so

Manipulation checks: Construal level

Question 5. To what extent were the messages that you've read relevant to the Can Tho area?

1 2 3 4 5

Not at all Very much so

Question 6. To what extent were the messages that you've read relevant to the world?

1 2 3 4 5

Not at all Very much so

Question 7. To what extent do the messages you've read convince you that climate change is already taking place, or will take place soon?

1 2 3 4 5

Not at all Very much so

Question 8. After reading the messages, to what extent do you think that climate change is something that will happen only in the far future?

1 2 3 4 5

Not at all Very much so

Question 9. To what extent do the messages you've read convince you that climate change is something that is affecting you, your neighbourhood or that is going to affect you personally?

1 2 3 4 5

Not at all Very much so

Question 10. To what extent do the messages you've read convince you that climate change is something that will affect humanity?

1 2 3 4 5

Not at all Very much so

Question 11. To what extent do the messages you've read persuade you that it is likely that climate change is actually happening?

1 2 3 4 5

Not at all Very much so

Question 12. After reading the messages, to what extent do you feel that climate change is something unlikely and only hypothetical?

1 2 3 4 5

Not at all Very much so

Severity

Please indicate to what extent you agree with the statements below:

Question 13. I believe that climate change is severe

1 2 3 4 5

Not at all Very much so

Question 14. I believe that climate change has serious negative consequences

1 2 3 4 5

Not at all Very much so

Question 15. I believe that climate change is extremely harmful to humans and nature

1 2 3 4 5

Not at all Very much so

Question 16. Climate change is a serious threat to humans and nature

1 2 3 4 5

Not at all Very much so

Susceptibility

Question 17. It is likely that I will be affected by climate change.

1 2 3 4 5

Not at all Very much so

Question 18. I am personally at risk from the consequences of climate change.

1 2 3 4 5

Not at all Very much so

Question 19. Is it possible that I will experience the effects of climate change?

1 2 3 4 5

Not at all Very much so

Question 20. I think that experiencing the effects of climate change could happen to me personally.

1 2 3 4 5

Not at all Very much so

Self-efficacy

Question 21. I am able to reduce the use of electricity and water to mitigate climate change.

1 2 3 4 5

Not at all Very much so

Question 22. I have the capabilities to reduce the use of fuels such as coal, petrol, diesel... to mitigate climate change.

1 2 3 4 5

Not at all Very much so

Question 23. I can walk or go by bicycle/bus to school to mitigate climate change.

1 2 3 4 5

Not at all Very much so

Question 24. I am able to separate waste for recycling to mitigate climate change.

1 2 3 4 5

Not at all Very much so

Question 25. I am able to plant more trees around my house and school to mitigate climate change.

1 2 3 4 5

Not at all Very much so

Response-efficacy

Question 26. Reducing the use of electricity and water is effective in mitigating climate change.

1 2 3 4 5

Not at all Very much so

Question 27. Reducing the use of fuels such as coal, petrol, diesel...works in mitigating climate change.

1 2 3 4 5

Not at all Very much so

Question 28. Walking or going by bicycle/bus to school is effective in mitigating climate change.

1 2 3 4 5

Not at all Very much so

Question 29. Separating waste for recycling is an effective way to mitigate climate change.

1 2 3 4 5

Not at all Very much so

Question 30. Planting more trees around my house and school helps to mitigate climate change.

1 2 3 4 5

Not at all Very much so

Behavioural intentions

There are some things that can be done against climate change. Please indicate how likely it is that you personally will perform the activities mentioned below:

Question 31. You will turn off water the tap after use.

1 2 3 4 5

Not likely at all Very likely

Question 32. You will turn off the light, fan and air-conditioner after use.

1 2 3 4 5

Not likely at all Very likely

Question 33. You will go to school by bicycle.

1 2 3 4 5

Not likely at all Very likely

Question 34. You will use an electricity-saving light bulb.

1 2 3 4 5

Not likely at all Very likely

Question 35. You will use a cloth bag when shopping.

1 2 3 4 5

Not likely at all Very likely

Question 36. You will collect rainwater to use.

1 2 3 4 5

Not likely at all Very likely

Question 37. You will use leftover food for animals.

1 2 3 4 5

Not likely at all Very likely

Question 38. You will walk to school.

1 2 3 4 5

Not likely at all Very likely

Question 39. You will separate waste to recycle.

1 2 3 4 5

Not likely at all Very likely

Question 40. You will plant more trees.

1 2 3 4 5

Not likely at all Very likely

Question 41. You will clean and protect the environment around your house and school.

1 2 3 4 5

Not likely at all Very likely

Perceived responsibility

Question 42. I am jointly responsible for climate change problems.

1 2 3 4 5

Completely disagree Completely agree

Question 43. I feel jointly responsible for climate change problems.

1 2 3 4 5

Completely disagree Completely agree

Question 44. I feel personal responsibility for the increased levels of greenhouse gasses.

1 2 3 4 5

Completely disagree Completely agree

Question 45. My contribution to climate change problems is negligible.

1 2 3 4 5

Completely disagree Completely agree

Question 46. Not only the government is responsible for climate change problems, but I am too.

1 2 3 4 5

Completely disagree Completely agree

Question 47. In principle, individuals on their own cannot contribute to combating climate change problems.

1 2 3 4 5

Completely disagree Completely agree

Demographic information

School:

Respondent code (or name, but think about issue of anonymity):

Gender:

Age:

Have you ever participated in any activities related to CC? Yes/No

What means of transportation do you typically use to go to school?

a. On foot

b. Bicycle

c. Electric bicycle
d. Parents take to school by car/motorbike
e. By bus

Currently, what do you often do to protect the environment?

a. Turn off the light when you leave the room
b. Turn off the water tap after use
c. Open half of water tap when washing hand
d. Plant trees around house and school
e. Protect trees around house and school
f. Limit use of plastic bags when shopping
g. Separate waste for recycling
h. Use leftover food for animals
i. Not burn rice straw after harvest
j. Reuse water for multi-purposes (e.g. use water after washing rice, vegetable, meat, fruit for watering plants)

Appendix 5.1: General messages on climate change definitions

	Message #1: This is the first message about the weather. Please listen carefully to the audio message and you can ask the research assistant to listen again. You should use paper and pen provided by the research assistant to note down **three key words from the audio/video message.**	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	***Concrete:*** *present, local, self/in-group/ similar, likely*
Negative or Don't do anything: *loss-appeal including costs of failing to take action, alarming or scaring farmers away from addressing the issue*	Weather includes factors such as precipitation, air pressure, temperature, wind, humidity and other phenomena such as typhoon and thunderstorm. It changes constantly, often from hour to hour and day to day. For example, today it is sunny in some parts of the world, but cloudy elsewhere; tomorrow or next week it may be the other way around. If people don't follow the weather forecast, they may be caught by surprise and negatively affected by some weather events.	Weather includes factors such as precipitation, air pressure, temperature, wind, humidity and other phenomena such as typhoon and thunderstorm, etc. It changes constantly, often from hour to hour and day to day. For example, today it is sunny or cloudy or rainy in Quy Nhon City. But next week it can be warmer or cooler; there can be a storm or a calm day; there can be sunshine or rain. If you don't follow the weather forecast on national or local TVs or radios, it is more likely that you are surprised by hot or cold temperature or caught in a rain or typhoon which in turn could make you sick, unnecessarily damage your crops, property or animals, or you could even get stuck at sea during a storm.
Positive (Provide some actions or Do something): *gain-appeal*	Weather includes factors such as precipitation, air pressure, temperature, wind, humidity and other phenomena such as typhoon and thunderstorm, etc. It changes from hour to hour and day to	Weather includes factors such as precipitation, air pressure, temperature, wind, humidity and other phenomena such as typhoon and thunderstorm, etc. It changes constantly, often from hour to hour and day to day. For example, today it is sunny or cloudy or rainy in

including some recommended actions that empower farmers to do something for addressing the issue	day. For example, today it is sunny in some parts of the world, but cloudy elsewhere, but tomorrow or next week, it may be the other way around. Following the weather forecast allows people to well plan for their activities, avoid activities for which the weather is not suited and take the opportunity of upcoming good weather.	Quy Nhon City. But next week it can be warmer or cooler, there can be a storm or a calm day, there can be sunshine or rain. By following the local weather forecast for Quy Nhon, you can better plan your activities, for example your crop farming, aquaculture, going to the sea for fishing or traveling. This allows you to increase and protect your harvest or catch, and to protect your health and safety by avoiding bad weather or preparing for it.

	Message #2: This is the second message, now about climate. Please listen carefully to the audio message and you can ask the research assistant to listen again. You can use paper and pen provided by the research assistant to note down **three key words from the audio/video message.**	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	***Concrete:*** *present, local, self/in-group/ similar, likely*
Negative or Don't do anything: *loss-appeal including costs of failing to take action, alarming or scaring farmers away from addressing the issue*	The climate is the common weather conditions at a particular place over a long period of time (for example, 30 years or more). In a narrow sense, climate is usually defined as the 'average weather', or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. These quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state of the climate system, including a statistical description. If people fail to understand the climate in their living areas, they will not be able to wisely plan for their places and their livelihoods.	The climate is the common weather conditions at a particular place over a long period of time (for example, 30 years or more). Climate is very different from weather. Weather changes constantly, often from hour to hour and day to day in a small area (such as: village, district, province); while the climate is relatively stable and represents a larger area such as the North or the South of Vietnam. People here in Quy Nhon city have learned to live with the local climate which is hot and humid; while other people may live in Europe where the climate is temperate and cold. If we in Quy Nhon fail to understand the city's climate, we face losses or low yield of our crops, aquaculture and fishing and our community will not develop well, for example due to us choosing the wrong crop or animal varieties for our local climate or by building roads and dams that cannot cope with our weather events.

Positive (Provide some actions or Do something): *gain-appeal including some recommended actions that empower farmers to do something for addressing the issue*	The climate is the common weather conditions at a particular place over a long period of time (for example, 30 years or more). In a narrow sense climate is usually defined as the 'average weather', or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. These quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state of the climate system, including a statistical description. If people learn to understand the climate in their areas, they can wisely plan for their places and their livelihoods.	The climate is the common weather conditions at a particular place over a long period of time (for example, 30 years or more). Climate is very different from weather. Weather changes constantly, often from hour to hour and day to day in a small area (such as: village, district, province); while the climate is relatively stable and represents a larger area such as the North or the South of Vietnam. People here in Quy Nhon city have learned to live with the local climate which is hot and humid; while other people may live in Europe where the climate is temperate and cold. Climate information is important to Quy Nhon people, for example because farmers use climate information to invest in rice farming, aquaculture, fruit production, or livestock. If we in Quy Nhon understand the city's climate well, we can increase the yield of our crops, aquaculture and fishing and our community will thrive, for example due to us choosing the right crop or animal varieties for our local climate or by building roads and dams that cope well with our weather events.

	Message #3: This is the third message, now about global warming. Please listen carefully to the audio message and you can ask the research assistant to listen one more time. You can use paper and pen provided by the research assistant to note down **three key words from the audio/video message.**	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	***Concrete:*** *present, local, self/in-group/ similar, likely*
Negative or Don't do anything: *loss-appeal including costs of failing to take action, alarming or scaring farmers away from addressing the issue*	Global warming refers to the recent and ongoing rise in global average temperature near the Earth's surface. It is caused mostly by increasing concentrations of greenhouse gases in the atmosphere such as: carbon dioxide, methane, nitrous oxide, ozone. These greenhouse gases are emitted by many human activities, for example traffic, cooking and heating, industrial production and agriculture. Global warming is causing climate patterns to change, which causes changes in the temperature and rainfall, icecap melting, sea level rise and so on. If people across the globe fail to reduce the emission of greenhouse gases into the atmosphere, the consequence of global warming will be very serious to human's health, livelihood, business and ecosystem in the future.	Global warming refers to the recent and ongoing rise in global average temperature near the Earth's surface. It is caused mostly by increasing concentrations of greenhouse gases in the atmosphere such as: carbon dioxide, methane, nitrous oxide, ozone. These greenhouse gases are emitted by many human activities, for example traffic, cooking and heating, industrial production and agriculture. Over the last years, the temperatures in Quy Nhon have been generally increasing; the climate in Quy Nhon city will very likely become warmer in the next 30 year. The residents in Quy Nhon will very likely notice that the sea level is becoming higher and that rainfall is becoming more abnormal and unpredictable. If we in Quy Nhon don't reduce the use of fossil fuel or cut down trees or mangrove forest, or don't use of land and water resources more effectively, we will contribute to the rising levels of greenhouse gases in the atmosphere and make global warming more serious. Here in Quy Nhon, global warming will most likely result in hotter and drier months during the dried season, more heavy rains and stronger typhoons during the raining season, with consequent losses of land due to mass flooding or desertification or bad impacts on crop farming or aquaculture or fishing.

Positive (Provide some actions or Do something): *gain-appeal including some recommended actions that empower farmers to do something for addressing the issue*	Global warming refers to the recent and ongoing rise in global average temperature near the Earth's surface. It is caused mostly by increasing concentrations of greenhouse gases in the atmosphere such as: carbon dioxide, methane, nitrous oxide, ozone. These greenhouse gases are emitted by many human activities, for example traffic, cooking and heating, industrial production and agriculture. Global warming is causing climate patterns to change, which causes changes in the temperature and rainfall, icecap melting, sea level rise and so on. People across the globe can jointly reduce the emission of greenhouse gases into the atmosphere that in turn will reduce the consequence of global warming and protect human's health, livelihood, business and ecosystem in the future.	Global warming refers to the recent and ongoing rise in global average temperature near the Earth's surface. It is caused mostly by increasing concentrations of greenhouse gases in the atmosphere such as: carbon dioxide, methane, nitrous oxide, ozone. These greenhouse gases are emitted by many human activities, for example traffic, cooking and heating, industrial production and agriculture. Over the last years, the temperatures in Quy Nhon have been generally increasing; the climate in Quy Nhon city will very likely become warmer in the next 30 year. The residents in Quy Nhon will very likely notice that the sea level is becoming higher and that rainfall is becoming more abnormal and unpredictable. We in Quy Nhon can reduce the use of fossil fuel or plant trees around the house and farm, plant and protect mangrove forest, or use land and water resources more wisely. We can thereby reduce the amount of greenhouse gases that we emit into the atmosphere that cause the global warming. In return we can reduce global warming's consequent losses of land due to mass flooding or desertification or bad impacts on crop farming or aquaculture or fishing.

	Message #4: This is the fourth message, now about climate change. Please listen carefully to the audio message and you can ask the research assistant to listen one more time. You can use paper and pen provided by the research assistant to note down **three key words from the audio/video message.**	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	***Concrete:*** *present, local, self/in-group/ similar, likely*
Negative or Don't do anything: *loss-appeal including costs of failing to take action, alarming or scaring farmers away from addressing the issue*	Climate change refers to any significant change in the climate over an extended period of time (decades or longer). The United Nations Framework Convention on Climate Change (UNFCCC) defines 'climate change' as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'. If humanity fails to deeply cut emissions and that future global warming could not be limited to below 2.0 °C increase relative to the pre-industrial level, the consequences of climate change will be serious in the future. If people do not act promptly to adapt to climate change, its impacts to human's health,	Climate change refers to any significant change in the climate over an extended period of time (decades or longer). Climate change includes major changes in temperature, precipitation, or wind patterns, among other effects, that occur over several decades or longer which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time. For example, the climate in Quy Nhon city will very likely become warmer in the next 30 year. If you and your neighbours do not take some immediate actions to contribute to the global target of reducing the greenhouse emission and temperature increase limited to below 2.0 °C relative to the pre-industrial level, the

	livelihood, business and ecosystem will be very serious in the future.	consequences of climate change will be serious to your family, communities and other regions. If you also do not take some adaptation actions such as: to join community planning and communication activities; to learn how to cope with the changes in flood pattern, rainfall and salinity level; to adjust your farming calendar or changing crops, etc. the consequences of climate change will be serious.
Positive (Provide some actions or Do something): *gain-appeal including some recommended actions that empower farmers to do something for addressing the issue*	Climate change refers to any significant change in the climate over an extended period of time (decades or longer). Climate change includes major changes in temperature, precipitation, or wind patterns, among other effects, that occur over several decades or longer. The United Nations Framework Convention on Climate Change (UNFCCC) defines 'climate change' as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'.	Climate change refers to any significant change in the climate over an extended period of time (decades or longer). Climate change includes major changes in temperature, precipitation, or wind patterns, among other effects, that occur over several decades or longer which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time. For example, the climate in Quy Nhon city will very likely become warmer in the next 30 year. If you and your neighbours jointly take some immediate actions to contribute to the global target of reducing the greenhouse emission and temperature increase limited to below 2.0 °C

	If the humans deeply cut emissions and that future global warming could be limited to below 2.0°C increase relative to the pre-industrial level, the consequences of climate change will be less serious in the future. If people promptly act to adapt to climate change, its impacts to human's health, livelihood, business and ecosystem will be less serious in the future.	relative to the pre-industrial level, the consequences of climate change will be less serious to your family, communities and other regions. If you also jointly take some adaptation actions such as: to join community planning and communication activities; to learn how to cope with the changes in flood pattern, rainfall and salinity level; to adjust your farming calendar or changing crops, etc. the consequences of climate change will be less serious.

Message of climate change impacts and response (mitigation and adaptation):

	Message #5: This is the fifth message about climate change impact on increasing temperature and response. Please listen carefully to the audio message and you can ask the research assistant to listen one more time. You can use paper and pen provided by the research assistant to note down **three key words from the audio/video message.**	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	***Concrete:*** *present, local, self/in-group/ similar, likely*
Negative or Don't do anything: *loss-appeal including costs of failing to take action, alarming or scaring farmers away from addressing the issue*	Climate change will very likely cause land and ocean surface temperatures to rise which in turn will make the weather hotter in many places on earth. If humanity fails to reduce the greenhouse level in the atmosphere to reduce global warming or fails to adapt to higher temperatures, their health, livelihood and ecosystem will badly be affected in the future.	Climate change has already caused Quy Nhon's average temperature to rise and will very likely make Quy Nhon's weather hotter with more droughts over the next 30 years as well as more and stronger typhoons will hit coastal communities. This will cause serious damages to Quy Nhon people's livelihood and property, and affect people's and animal's health as well as degrade mangrove forest. If we in Quy Nhon fail to take actions to cope with increased temperature and its consequences (extreme heat wave, lack of water, desertification) by planting more trees around your house and aquaculture ponds, changing your crops, saving water, your health, crops, animal, fishery will be badly affected.

Positive (Provide some actions or Do something): *gain-appeal including some recommended actions that empower farmers to do something for addressing the issue*	Climate change will very likely cause land and ocean surface temperatures to rise which in turn will make the weather hotter in many places on earth. If humanity reduces the emission of greenhouse gases into the atmosphere to reduce impacts of global warming or takes immediate actions to adapt to higher temperature, their health, livelihood and ecosystem will less likely be affected in the future.	The phenomenon of climate change has already caused Quy Nhon's average temperatures to rise and will likely make Quy Nhon's weather hotter over the next 10 years as well as likely more and stronger typhoons will hit coastal communities. However, coastal communities can enjoy longer summers and warmer weather to develop more sea beaches to receive tourists and earn more income. We in Quy Nhon take immediate actions to cope with increased temperature and its consequences (extreme heat wave, lack of water, desertification) by planting more trees around your house and aquaculture ponds, changing your crops, saving water to protect your health, crops, animals, and fisheries.

	Message #6: This is the sixth message about climate change impact on sea level rise and response change impact on rainfall and response. Please listen carefully to the audio message and you can ask the research assistant to listen one more time. You can use paper and pen provided by the research assistant to note **down three key words from the audio/video message.**	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	***Concrete:*** *present, local, self/in-group/ similar, likely*
Negative or Don't do anything: *loss-appeal including costs of failing to take action, alarming or scaring farmers away from addressing the issue*	Climate change may cause global sea levels to rise which in turn may result in more frequent and more severe flooding and loss of land in coastal areas. If people continue emitting more greenhouse gases into the atmosphere, the temperature will further increase making the ice caps in the North and South poles as well as the glaciers in the high mountains melted which will cause the sea level further to rise and flood more coastal lands and affect ecosystems in the future. At the same time, if people fail to prepare to cope with the consequences of sea level rise such as building sea dike, dams or relocating to higher places, or changing their livelihood, they will be seriously affected in the future	The phenomenon of climate change may cause parts of coastal communities in Quy Nhon City to be submerged under sea water, the rice farms to become more saline and sea banks to be more frequently eroded. If people in Quy Nhon do not take actions to cope with increased sea level and its consequences (flooding, coastal erosion, salinity) by protecting mangrove forest, saving energy, using less fossil fuel, building dykes or dams, or relocating to higher place, changing farming practices from fresh water to brackish water, your house would be flooded or eroded into the sea due to sea level rise of coastal erosion, or your health would be badly affected due to overheat, lack of fresh water or water-borne diseases, or your crops' yield would be reduced due to salinity or prolonging droughts.

Positive (Provide some actions or Do something): *gain-appeal including some recommended actions that empower farmers to do something for addressing the issue*	The phenomenon of climate change may cause global sea levels to rise which in turn will result in mass flooding and loss of land in the coastal areas. If people successfully reduce the emission of greenhouse gases into the atmosphere, the temperature will not further increase that in turn will reduce the melting of the ice caps in the North and South poles as well as the glaciers in the high mountains; therefore it will not further increase the sea level that will not further flood coastal lands and affect ecosystem in the future. At the same time, people can start preparing now to cope with the consequences of sea level rise such as building sea dikes, dams or relocating to higher places, or even changing their livelihood.	The phenomenon of climate change may cause parts of coastal communities in Quy Nhon City to be submerged under sea water, the rice farms to become more saline and sea banks to be more frequently eroded. We in Quy Nhon can take some immediate actions to reduce the impacts of sea level rise (flooding, coastal erosion, salinity) by protecting mangrove forest, saving energy, using less fossil fuel, building dikes or dams, or relocating to higher place, changing farming practices from fresh water to brackish water, your house, health, crops.

	Message #7: This is the seventh messages about climate change impact on rainfall and response. Please listen carefully to the audio message and you can ask the research assistant to listen one more time. You can use paper and pen provided by the research assistant to note down **three key words from the audio/video message.**	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	***Concrete:*** *present, local, self/in-group/ similar, likely*
Negative or Don't do anything: *loss-appeal including costs of failing to take action, alarming or scaring farmers away from addressing the issue*	Climate change may cause some areas in the world to have more frequent and heavy rain; while in other areas there will be less frequent and less regular rain. These changes are likely to cause more floods in some areas and more droughts in other areas. If people across the globe fail to reduce the burning of fossil fuel, or to adapt with the rainfall change, the situation will very likely get worse and the rainfall change will seriously affect human's livelihood and ecosystem in the future.	Climate change has already reduced the total annual volume of rain in Quy Nhon city and will very likely reduce the rain volume in Quy Nhon in the next 30 year. This decreased rain volume will badly affect Quy Nhon's water resources and farming practices. If people in Quy Nhon fail to reduce the burning of fossil fuel or protecting their mangrove forest, or to prepare to adapt to your rice farming or aquaculture or animal raising, they will face income losses higher from year by year and degraded mangrove forest faster and faster.
Positive (Provide some actions or Do something): *gain-appeal including some recommended actions that empower farmers to do something for addressing the issue*	Climate change may cause some areas in the world to have more frequent and heavy rain; while in other areas there will be less frequent and less regular rain. These changes are likely to cause more floods in some areas and more droughts in other areas. If people across the globe can jointly reduce the burning of fossil fuel, or to adapt to the rainfall change, the situations will not get worse and they can take advantage of rainfall change to improve their livelihood or ecosystem in the future.	Climate change already reduced the total annual volume of rain in Quy Nhon and will very likely change the rainfall pattern in Quy Nhon over the next 30 years. This decreased rain volume will make some parts of Quy Nhon's water resources more saline or make some lands drier. We in Quy Nhon can take immediate actions to reduce the impacts of rainfall change due (lack of rain) in the future by less burning of fossil fuel or protecting their mangrove forest, or changing fresh water rice farming to brackish water aquaculture with higher profit.

	Message #8: This is the eighth message about climate change impact on weather-related disasters and response. Please listen carefully to the audio message and you can ask the research assistant to listen one more time. You can use paper and pen provided by the research assistant to note down **three key words from the audio/video message.**	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	***Concrete:*** *present, local, self/in-group/ similar, likely*
Negative or Don't do anything: *loss-appeal including costs of failing to take action, alarming or scaring farmers away from addressing the issue*	Climate change may cause more disaster events such as flood, drought, or typhoon that occurred in specific places in the world. These extreme events will likely cause more human and material losses in the future. If people around the world fail to prepare for responding to disasters associated with climate change impacts, they will face severe consequences in the future.	Climate change may cause more disaster events such as flood, drought, typhoon, river bank erosion, or salinity occurred in Quy Nhon in comparison to the past decades. These extreme events will likely cause mortality and damages to your family, house, animal, rice farm, or aquaculture pond. If people in Quy Nhon fail to take some preparedness actions now such as: strengthening your house, protecting and maintaining dykes and mangrove forest, or changing your harvesting time, you will face even more losses from year to year.
Positive (Provide some actions or Do something): *gain-appeal including some recommended actions that empower farmers to do something for addressing the issue*	Climate change may cause more disaster events such as flood, drought, or typhoon that occurred in specific places in the world. These extreme events will likely cause more human and material losses in the future. However, people around the world can learn from this change to prepare for responding to disasters associated with climate change impact: for example, by participating in disaster training and drill; following early warning messages; moving to a safe place before disasters, etc.	Climate change may cause more disaster events such as flood, drought, typhoon, river bank erosion, or salinity occurred in Quy Nhon in comparison to the past decades. These extreme events will likely cause mortality and damages to your family, house, animal, rice farm, or aquaculture pond. To cope with this change, we in Quy Nhon can take some immediate preparedness actions such as: strengthening your house, protecting and maintaining dykes and mangrove forest, or changing your harvesting time, to reduce the impacts of disasters associated with climate change.

	Message #9: This is the ninth message about climate change impact on health and response. Please listen carefully to the audio message and you can ask the research assistant to listen one more time. You can use paper and pen provided by the research assistant to note down **three key words from the audio/video message.**	
	Abstract: *future, global/ polar, other/ out-group/ dissimilar, unlikely*	***Concrete:*** *present, local, self/in-group/ similar, likely*
Negative or Don't do anything: *loss-appeal including costs of failing to take action, alarming or scaring farmers away from addressing the issue*	Climate change may cause more health problems in humanity, animals and crops in specific places in the world. These epidemics and pandemics will likely affect human's and animal's health and reduce crop production in the future. If humanity fails to learn about the impact of climate change such as extreme heat wave, too wet or dried season, long flooded period can make the existing or new viruses and bacteria to quickly develop or form that in turn will badly affect human's and animal's health and may cause epidemic and pandemic outbreak in the future.	Climate change may cause more health problems (epidemic) such as malaria, dengue fever, cholera to humans; or foot and mouth disease, avian influenza in livestock, or heat stroke and other bacteria in fish and shrimp in Quy Nhon city. If we in Quy Nhon do not prepare ourselves for responding to diseases related to climate change such as heat stroke, dengue fever or cholera, the consequences to our health would be getting more serious in the future. These activities include participating in health campaign and taking vaccination by school and local health clinics, cleaning the environment around your school and homes to kill mosquitoes, planting more trees around your school and home to have more shade for reducing heat, etc.

Positive (Provide some actions or Do something): *gain-appeal including some recommended actions that empower farmers to do something for addressing the issue*	Climate change may cause more health problems in humanity, animals and crops in specific places in the world. These epidemics and pandemics will likely affect human's and animal's health and reduce crop production in the future. The people can learn about the impacts of climate change to development or formation of existing or new viruses and bacteria caused by extreme heat waves, too wet or dried season, long flooded period in order to well prepare for coping with potential pandemic or epidemic in the future.	Climate change may cause more health problems (epidemic) such as malaria, dengue fever, cholera to humans; or foot and mouth disease, avian influenza in livestock, or heat stroke and other bacteria in fish and shrimp in Quy Nhon city. You can learn from this change to prepare yourself for responding to diseases related to climate change such as heat stroke, dengue fever, cholera, for example, by participating health campaign and taking vaccination by school and local health clinic, cleaning the environment around your school and homes to kill mosquito, planting more tree around your school and home to have more shade for reducing heat, etc.

Appendix 5.2: Questionnaires

Severity

Please indicate to what extent you agree with the statements below:

I believe that climate change is severe.

1 2 3 4 5

Not at all Very much so

I believe that climate change has serious negative consequences.

1 2 3 4 5

Not at all Very much so

I believe that climate change is extremely harmful to humans and nature.

1 2 3 4 5

Not at all Very much so

Climate change is a serious threat to humans and nature.

1 2 3 4 5

Not at all Very much so

Susceptibility

It is likely that I will be affected by climate change.

1 2 3 4 5

Not at all Very much so

I am personally at risk from the consequences of climate change.

1 2 3 4 5

Not at all Very much so

It is possible that I will experience the effects of climate change.

1 2 3 4 5

Not at all Very much so

I think that experiencing the effects of climate change could happen to me personally.

1 2 3 4 5

Not at all Very much so

Self-efficacy

A: Climate change mitigation

I am able to reduce the use of electricity and water to mitigate climate change.

1 2 3 4 5

Not at all Very much so

I have the capabilities to reduce the use of fuels such as coal, petrol, diesel... to mitigate climate change.

1 2 3 4 5

Not at all Very much so

I am able to plant more trees around my house and farms, ponds to mitigate climate change.

1 2 3 4 5

Not at all Very much so

B: Adaptation

I am able to follow weather warning systems to adapt to climate change.

1 2 3 4 5

Not at all Very much so

I can change my crops or aquaculture to adapt to climate change.

1 2 3 4 5

Not at all Very much so

I am capable of moving household belongings to safe places to adapt to climate change.

1 2 3 4 5

Not at all Very much so

I am able to relocate our house to a safer place to adapt to climate change.

1 2 3 4 5

Not at all Very much so

Response-efficacy

A: Climate Change mitigation

Reducing the use of electricity and water is effective in mitigating climate change.

1 2 3 4 5

Not at all Very much so

Reducing the use of fuels such as coal, petrol, diesel...works in mitigating climate change.

1 2 3 4 5

Not at all Very much so

Protecting the mangrove forest is an effective way to mitigate climate change.

1 2 3 4 5

Not at all Very much so

Planting more trees around my house, farms, or ponds helps to mitigate climate change.

1 2 3 4 5

Not at all Very much so

B: Adaptation

Following weather warning systems is effective to adapt to climate change.

1 2 3 4 5
Not at all Very much so

Changing crops or aquaculture is an effective way to adapt to climate change.

1 2 3 4 5
Not at all Very much so

Moving household belongings to safe places is an effective way to adapt to climate change.

1 2 3 4 5
Not at all Very much so

Relocating our house to a safer place works to adapt to climate change.

1 2 3 4 5
Not at all Very much so

Behavioural intentions

There are some things that can be done against climate change. Please indicate how likely it is that you personally will perform the activities mentioned below:

A: Environmental protection behaviours

You will turn off the light, fan, and TV after use.

1 2 3 4 5
Not likely at all Very likely

You will use an electricity-saving light bulb.

1 2 3 4 5
Not likely at all Very likely

You will collect rainwater to use.

1 2 3 4 5
Not likely at all Very likely

You will protect mangrove forest.

1 2 3 4 5
Not likely at all Very likely

You will plant more trees around your house, farm and ponds.

1 2 3 4 5
Not likely at all Very likely

You will clean and protect the environment around your house.

1 2 3 4 5
Not likely at all Very likely

B: Climate change adaptation behaviours

You will watch the weather forecast.

1 2 3 4 5
Not likely at all Very likely

You will follow weather warnings during the stormy season.

1 2 3 4 5
Not likely at all Very likely

You will move household belongings in case of disasters.

1 2 3 4 5
Not likely at all Very likely

You will harvest crops before disasters.

1 2 3 4 5
Not likely at all Very likely

You will participate in community activities about climate change and environmental protection.

1 2 3 4 5
Not likely at all Very likely

You will talk about what you have learnt from the messages with your family and friends.

1 2 3 4 5
Not likely at all Very likely

Perceived responsibility

I am jointly responsible for climate change problems.

1 2 3 4 5
Completely disagree Completely agree

I feel jointly responsible for climate change problems.

1 2 3 4 5
Completely disagree Completely agree

I feel personal responsibility for the increased levels of greenhouse gasses.

1 2 3 4 5
Completely disagree Completely agree

My contribution to climate change problems is negligible.

1 2 3 4 5
Completely disagree Completely agree

Not only the government is responsible for climate change problems, but I am too.

1 2 3 4 5
Completely disagree Completely agree

In principle, individuals on their own cannot contribute to combating climate change problems.

1 2 3 4 5
Completely disagree Completely agree

Demographic information

Village:

Respondent code (or name, but think about issue of anonymity):

Gender:

Age:

Education:

a. No school
b. Primary school
c. Secondary school
d. High school
e. Higher education (vocational training, college, university)

Have you ever participated in any activities related to CC?

Yes/No

What are the livelihoods that you and your family do?

a. Farming
b. Aquaculture
c. Fishing
d. Livestock
e. Work for hire
f. Handicraft
g. Others_____(specify)

Currently, what do you often do to protect the environment?

a. Turn off the light, fans, and TV when you don't use
b. Save clean water when washing, farming, livestock
c. Plant trees around house, farm, pond
d. Protect trees around house, farm, pond
e. Limit use of plastic bags when shopping
f. Separate waste for recycling
g. Use leftover food for animals
h. Not burn rice straw after harvest
i. Reuse water for multi-purposes (e.g. use water after washing rice, vegetable, meat, fruit for watering plants)

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About the author

Chinh Cong Ngo (in Vietnamese Ngô Công Chính) is from Hanoi, Vietnam. He received his Bachelor's degree from Hanoi University of Technology in 1984. In 2006, he was granted a Fulbright scholarship to complete his Master's degree of Public Policy and Administration at the Andrew Young School of Policy Studies, Georgia State University, the United States of America. In 2014, he was admitted as an external/sandwich PhD student to the Wageningen University, School of Social Science, Strategic Communication Group. His PhD focuses on climate change risk study and communication.

He has been the Director of the Centre for Disaster Risk Reduction and Climate Change as well as the Director of Asian Management and Development Institute (AMDI), a local and independent research and consultancy institute in Vietnam. He is an expert/researcher in community-based disaster risk management, disaster risk reduction, and climate change adaptation in Vietnam and the South-East Asia region. He has solid expertise and rich practical experience in conducting various disaster risk reduction and climate change projects and research, including socio-economic impacts and livelihood alternatives.

Chinh Cong Ngo has worked with the vast majority of the key stakeholders involved in the fields of disaster management and climate change in Vietnam, such as World Bank, ADB, UN agencies, USAID, the Governmental Ministries of Vietnam, international and local NGOs. His research interest is in policy advocacy, disaster and climate change risks, households' risk perception, risk communication, community-based climate change adaptation. He has led different teams including international and national experts in various projects and research. He has written and published some important legal and technical papers, book chapters, journals, reports on disaster risk management and climate change impacts.

List of publications

Chinh Cong Ngo, P. Marijn Poortvliet, and Laurens Klerkx. (submitted in November 2020 and under review). "The persuasiveness of gain vs. loss framed messages on farmers' perceptions and decisions to climate change". Climate Risk Management.

Chinh Cong Ngo, P. Marijn Poortvliet, and Peter H. Feindt. 2020. "Examining the Effectiveness of Climate Change Communication with Adolescents in Vietnam: The Role of Message Congruency." *Water* (Switzerland) 12 (11): 1–23. doi:10.3390/w12113016

Chinh Cong Ngo, P. Marijn Poortvliet, and Peter H. Feindt. 2019. "Drivers of Flood and Climate Change Risk Perceptions and Intention to Adapt: An Explorative Survey in Coastal and Delta Vietnam." *Journal of Risk Research*. doi:10.1080/13669877.2019.1591484

Maria Paola Scaparra, **Ngo Cong Chinh,** Dang Thu Phuong, Trung Hieu Tran. 2019. "Community Perceptions of Social, Economic and Environmental Impacts of Flooding in Central Districts of Hanoi, Vietnam". *Journal of the British Academy* 7(s2), 137–154. doi:10.5871/jba/007s2.137

Gustafson, Shelley, Angela Joehl Cadena, **Chinh Cong Ngo,** Ammar Kawash, Ienkate Saenghkaew, and Paul Hartman. 2018. "Merging Science into Community Adaptation Planning Processes: A Cross-Site Comparison of Four Distinct Areas of the Lower Mekong Basin." *Climatic Change* 149 (1): 91–106. doi:10.1007/s10584-016-1887-7

Chinh, N. C., Y. Clarke, N. H. Manh, L. Lebel, S. Bonntaveeyuwat, S. Sophat, B. T. Sinh, and N. T. Khiem. 2014. Communicating water-related climate change risks: Lessons from a multi-tool and multi-country study in the Mekong region. In Climate risks, regional integration, and sustainability in the Mekong region, ed. L. Lebel, C. T. Hoanh, C. Krittasudthacheewa, and R. Daniel, 183–200. Sengalor, Malaysia: First.

Lebel, Louis, Bach Tan Sinh, **Ngo Cong Chinh,** Sakaradhorn Boontaveeyuwat, and Ham Kimkong. 2013. "Risk Communication and Adaptation in Settlements on the Coast and in Deltas of the Mekong Region." In Successful Adaptation to Climate Change: Linking Science and Policy in a Rapidly Changing World, edited by Susanne C. Moser and Maxwell T. Boykoff, 253–69. Routledge.

Colophon

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