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The persuasiveness of gain vs. loss framed messages on farmers' perceptions and decisions to climate change: A case study in coastal communities of Vietnam

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ABSTRACT

Ongoing climate change results in a large increase in damaging climatic events that 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.

1. Introduction

A recent report by the Intergovernmental Panel on Climate Change (IPCC) concluded that a temperature rise of 1.5 °C in global temperature leads to a dramatic rise in climate risks (IPCC, 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

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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 (Elum et al., 2017; Gaurav and Chaudhary, 2020; Peltonen-Sainio et al., 2020). 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 et al., 2012; 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 study by Morrison et al. (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. In a study with Swedish farming group, Asplund (2018) found that farmers 'make use of multidimensional ways of judging the adequacy of various information related to climate change' due to different views on provided climate information, credible knowledge production processes (e.g. analytical vs. experience-based), and credibility of frame articulators. In summary, there exits an urgent need for development agencies – national, international, governmental and non-governmental – to increasingly engage farmers in communicating climate change risks 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 message 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 3200 km coastline (Tatarski, 2018). Proper message framing would potentially influence farmers' decisions and perceptions on adapting or mitigating climate change impacts (Arbuckle et al., 2013; Asplund, 2018; Niles et al., 2016). 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 (Arbuckle et al., 2013; Eitzinger et al., 2018; Liverpool-Tasie et al., 2019).

2. Theoretical framework

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 framing. 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 et al. (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 et al., 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 et al., 2011; Meijers et al., 2019). In environmental research, White et al. (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 et al., 2011). Therefore, it is important to focus on understanding the audience characteristics before choosing a framing method as their mindset plays a part in the final effect.

Message framing is a technique that allows for packaging 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 (Bertolotti and Catellani, 2014; Detweiler et al., 1999; Dickinson et al., 2013). 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.

2.2. *Psychological distance in climate change communication*

In this section, we review the literature on psychological distance theory, and its application in communicating climate change. 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). This distance is commonly defined on several dimensions: spatial, temporal, social, and hypothetical distance (Trope and Liberman, 2003, 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). In recent decades, a 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 (Brügger et al., 2016; Jones et al., 2017). 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 et al., 2016; Jones et al., 2017; Ngo et al., 2020a). However, Brügger et al. (2016) further concluded that 'simply proximising won't increase engagement and call for a more differentiated perspective on the effects of psychological distance in the context of climate'. Therefore, this study will look at how farmers' perceptions of climate change risk and efficacy would influence their decision to mitigate or adapt, especially in developing countries such as Vietnam.

3. Research framework and hypotheses

In this research, we will 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 Fig. 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

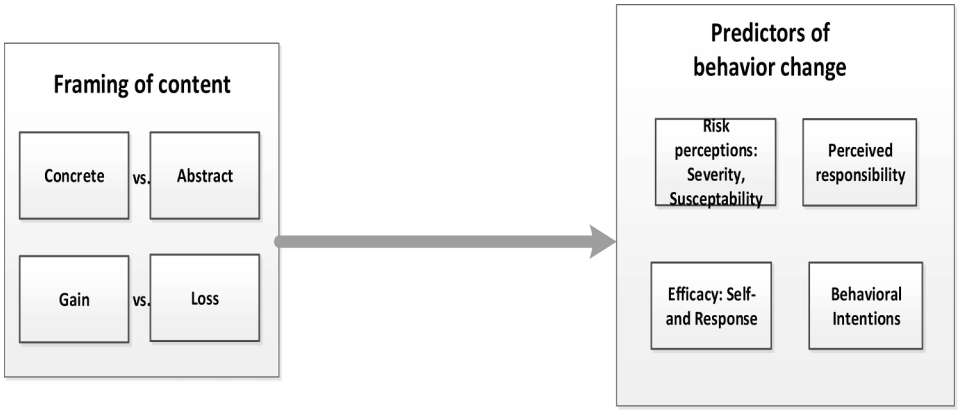

Fig. 1. Research framework.

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. Despite that EPPM is an established framework in studying health perceptions and self-protective behaviours in developed countries for several decades (Witte, 1992; Witte and Allen 2000; Maloney et al., 2011), it has just recently been applied in developing world settings, let alone in the context of climate change communication with farmers. For example, some authors in Central Asia (Shafiei and Maleksaeidi, 2020), East Asia (Wang et al., 2019) and Africa (Regasa and Akirso, 2019) examined the EPPM as a basis to identify main determinants of the farmers' pro-environmental behaviours under natural disasters and climate change impacts. These studies concluded that by considering the importance of risk perceptions and efficacy when communicating with farmers can help increase the likelihood of pro-environmental or climate change adaptation and mitigation behaviours. Thus, in this study, we adopt EPPM to explore how framing content influence key components of risk perceptions and efficacy and predict what type of behaviour change is likely to happen.

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 (Brügger et al., 2016; Jones et al., 2017; Ngo et al., 2020a,b, Trope and Liberman, 2003, 2010). We further hypothesize that the gain framing method is most effective in increasing farmers' risk perceptions and most positively influence their behavioural intentions to climate change (Bertolotti and Catellani, 2014; Dickinson et al., 2013; Meijers et al., 2019; White et al., 2011). 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 (Zwickle and Wilson, 2013; Ngo et al., 2020a). Above all is the expectation that this research will provide insights on how to effectively frame communication of a psychologically distant risk like climate change in order to catalyse behavioural changes that can reduce climate change impacts. The above leads to the following hypotheses.

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.

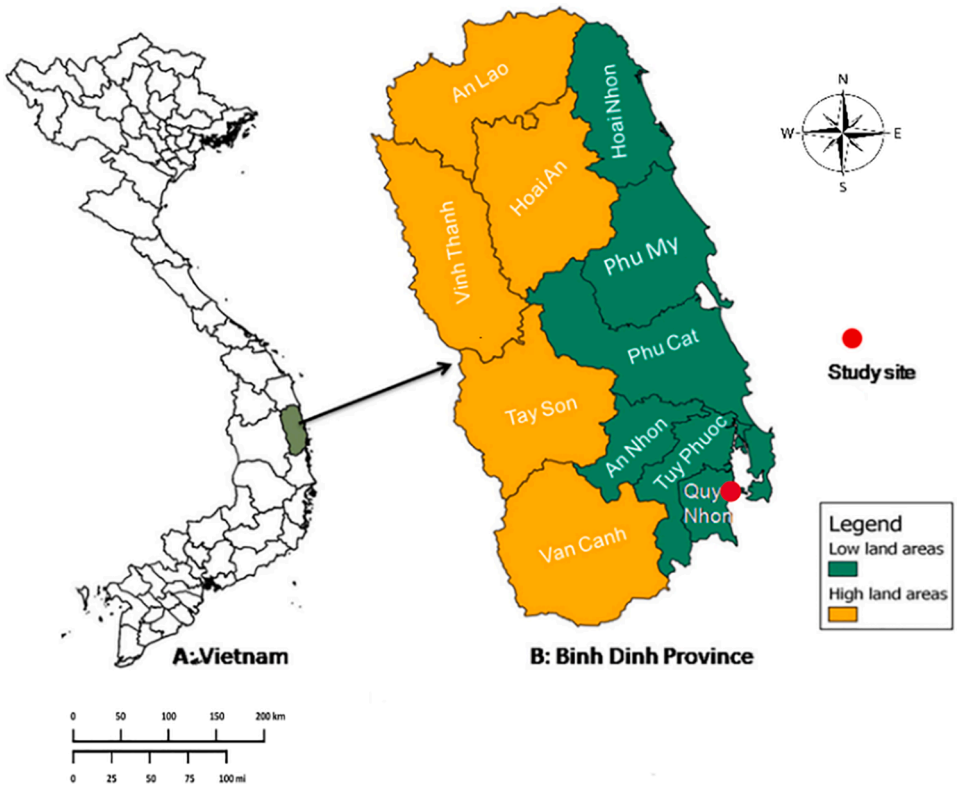

Fig. 2. Research location.

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.

4. Study context and design

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 Fig. 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.

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) $\times$ 2 (message valence: loss vs. gain) factorial design.

We recruited a 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.

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 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 and were 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 min-break, enjoyed some tea and cookies. Then they joined the experiment consisting of 30 min 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.

4.4. Measures

We developed a 41-item questionnaire with 5-point Likert scales (strongly agree - strongly disagree) (refer to Appendix 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. The complete questionnaire is attached in Appendix 2.

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.

Table 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.

5. Results

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 (M_{age} = 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.

5.2. 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 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.

5.3. 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; i.e. 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.

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 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

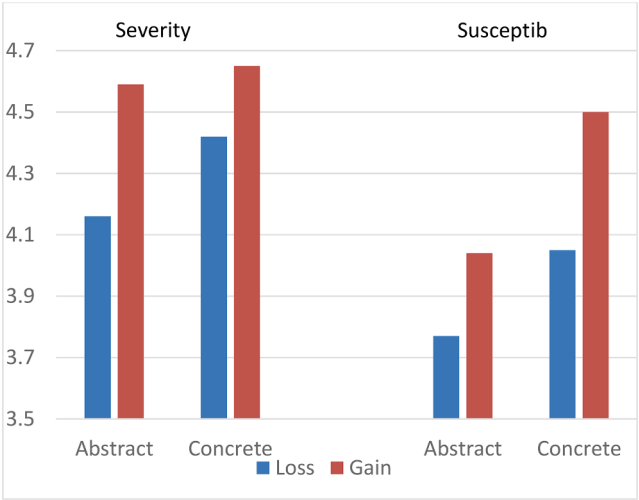

Fig. 3. Mean ratings for message framing effect on risk perceptions.

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.

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 Fig. 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, $F(1, 364) = 0.064$, *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.

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 combinations for self-efficacy to climate change adaptation ($M = 4.46$, $SD = 0.501$). However, for climate change mitigation, the strongest effect was observed with the abstract- and gain-framed message ($M = 4.51$, $SD = 0.538$) (see Fig. 4). Thus, we were not able to support hypothesis 3a but we confirmed hypothesis 3b.

Efficacy: Response efficacy to climate change mitigation and adaptation. Similarly, an ANOVA was performed on the response efficacy to the mitigation variable. It yielded a main effect of gain/loss frame, $F(1, 364) = 6.96$, $p < .01$. 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, $F(1, 364) = 6.61$, $p < .02$. 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 did not offer support for hypotheses 1a and 2a.

The ANOVA was also performed on the response efficacy to the adaptation variable. This ANOVA yielded a marginal effect of gain/loss frame, $F(1, 364) = 2.84$, $p < .10$. 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, $F(1, 364) = 8.54$, $p < .01$. 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, $F(1, 364) = 4.28$, $p < .04$. The effect of gain/loss frames was much more extreme in the concrete frame condition compared to the abstract condition. These

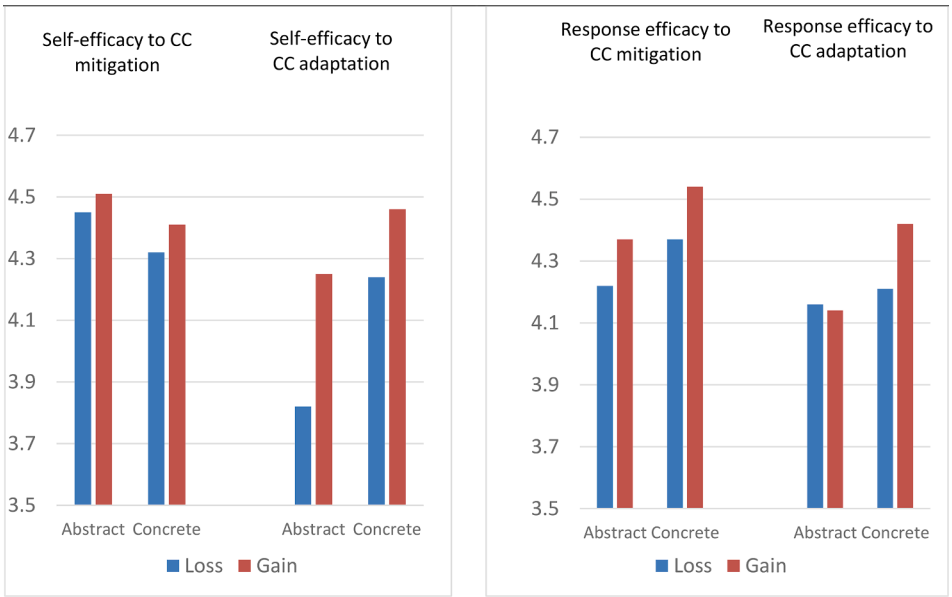

Fig. 4. Mean ratings for message framing effect on self- and response efficacy.

findings confirmed hypotheses 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 Fig. 4). These results did not support hypothesis 3a and confirmed hypothesis 3b.

Behavioural intentions to climate change mitigation and adaptation. Similarly, an ANOVA was performed on the behavioural intention to climate change mitigation variable. It yielded a main effect of gain/loss frame, $F(1, 364) = 7.52$, $p < .01$. In the loss frame condition ($M = 4.37$) lower behavioural intention for mitigation ratings was reported compared to the gain frame condition ($M = 4.52$). The ANOVA also showed a main effect of psychological distance, $F(1, 364) = 5.86$, $p < .02$. In the abstract frame condition ($M = 4.37$) higher behavioural intention for mitigation were reported relative to the concrete frame condition ($M = 4.51$). These main effects were not qualified due to non-significant interaction effect. The effect of gain/loss frames was a little extreme in the concrete frame condition compared to the abstract condition. These findings did not support hypotheses 1a and 2a.

The ANOVA was also performed on the variable that measured behavioural intention to climate change adaptation. This ANOVA yielded a main effect of gain/loss frame, $F(1, 364) = 14.12$, $p < .001$. In the loss frame condition ($M = 4.03$) lower behavioural intention for adaptation ratings were reported compared to the gain frame condition ($M = 4.29$). The ANOVA also showed a main effect of psychological distance, $F(1, 364) = 15.97$, $p < .001$. In the abstract frame condition ($M = 4.02$) lower behavioural intention for adaptation ratings was reported relative to the concrete frame condition ($M = 4.29$). These main effects were qualified by a significant interaction effect, $F(1, 364) = 4.03$, $p < .05$. The effect of gain/loss frames was much more extreme in the abstract frame condition compared to the concrete condition. These findings confirmed hypothesis 1b and 2b.

The mean ratings for gain-framed in combination with concrete-framed messages were the highest among four manipulations for behavioural intention to climate change mitigation ($M = 4.61$, $SD = 0.517$) and for behavioural intention to climate change adaptation ($M = 4.35$, $SD = 0.646$) (see Fig. 5). These results did not support hypothesis 3a and confirmed hypothesis 3b.

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 Fig. 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.

6. Discussion

In recent decades, various framing methods have been explored to communicate climate change to positively influence individuals' behaviours (Moser, 2010; Nerlich et al., 2010; Spence et al., 2012). However, existing studies confirmed that challenges remain in communicating a psychologically distant risk like climate change (Brügger et al., 2016; Jones et al., 2017; Leiserowitz, 2006).

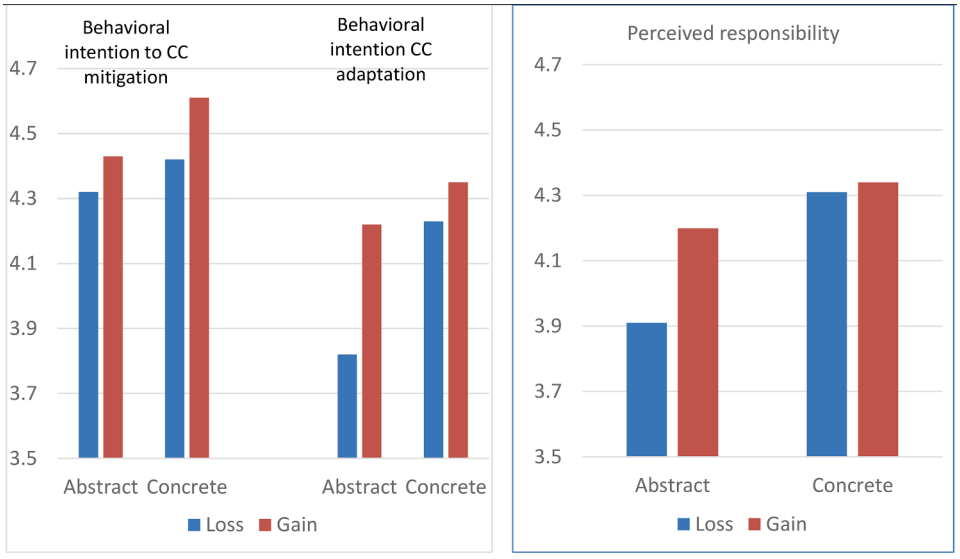

Fig. 5. Mean ratings for message framing effect on behavioural intentions and perceived responsibility.

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 more concrete 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.

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 (Dijkstra et al., 2011; Kahneman and Tversky, 1984; Rothman and Salovey, 1997). 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 (and hence did not support Hypotheses 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.

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 demonstrated in this study that messages were framed to inform the farmers of specific adaptation and mitigation actions they could take (e.g. crop farming, aquaculture, fishing, disaster preparedness, and health protection) and what gains they would receive (e.g. economic gains, health gains, general livelihood gains, and being better prepared for natural disasters) are most effective in triggering farmers' behavioural actions. For example, *"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*; or *"To cope with this more intense and unpredictable natural disasters in your community due to climate 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 1 *for details)*. It has been convincingly argued that effective behaviour change communications must be tailored to specific target audiences (Dickinson et al., 2013; DeGolia et al., 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).

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; van der Linden et al., 2015). Moreover, the concepts that defined 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 audience in varied contexts in order to explore the most effective communication strategy on climate change.

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 the 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.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.crm.2022.100409.

References

Adams, R.M., Fleming, R.A., Chang, C.-C., McCarl, B.A., Rosenzweig, C., 1995. A Reassessment of the economic effects of global climate change on U.S. Agriculture. Clim. Change 30 (2), 147–167. https://doi.org/10.1007/BF01091839.

Ahn, S.J., Fox, J., Dale, K.R., Avant, J.A., 2015. Framing virtual experiences: effects on environmental efficacy and behavior over time. Commun. Res. 42 (6), 839–863. https://doi.org/10.1177/0093650214534973.

Apanovitch, A.M., McCarthy, D., Salovey, P., 2003. Using message framing to motivate HIV testing among low-income, ethnic minority women. Health Psychol. 22 (1), 60–67. https://doi.org/10.1037/0278-6133.22.1.60.

Arbuckle, J.G., Morton, L.W., Hobbs, J., 2013. Farmer beliefs and concerns about climate change and attitudes toward adaptation and mitigation: evidence from Iowa. Clim. Change 118 (3-4), 551–563. https://doi.org/10.1007/s10584-013-0700-0.

Asplund, T., 2018. Communicating climate science: a matter of credibility-swedish farmers' perceptions of climate-change information. Int. J. Clim. Change 10 (1), 23–38. https://doi.org/10.18848/1835-7156/CGP/v10i01/23-38.

Bertolotti, M., Catellani, P., 2014. Effects of message framing in policy communication on climate change. Eur. J. Social Psychol. 44 (5), 474–486. https://doi.org/10.1002/ejsp.2033.

Brügger, A., Morton, T.A., Dessai, S., 2016. 'Proximising' climate change reconsidered: a construal level theory perspective. J. Environ. Psychol. 46, 125–142. https://doi.org/10.1016/j.jenvp.2016.04.004.

DeGolia, A.H., Hiroyasu, E.H.T., Anderson, S.E., Hewitt, J., 2019. Economic losses or environmental gains? framing effects on public support for environmental management. PLoS ONE 14 (7), e0220320. https://doi.org/10.1371/journal.pone.0220320.

Detweiler, J.B., Bedell, B.T., Salovey, P., Pronin, E., Rothman, A.J., 1999. Message framing and sunscreen use: gain-framed messages motivate beach- goers. Health Psychol. 18 (2), 189–196. https://doi.org/10.1037/0278-6133.18.2.189.

Dickinson, J.L., Crain, R., Yalowitz, S., Cherry, T.M., 2013. How framing climate change influences citizen scientists intentions to do something about it. J. Environ. Educ. 44 (3), 145–158. https://doi.org/10.1080/00958964.2012.742032.
Dijkstra, A., Rothman, A., Pietersma, S., 2011. The persuasive effects of framing messages on fruit and vegetable consumption according to regulatory focus theory. Psychol. Health 26 (8), 1036–1048. https://doi.org/10.1080/08870446.2010.526715.
EEA. 2019. Climate Change Adaptation in the Agriculture Sector in Europe. Copenhagen, Denmark. 10.2800/537176.
Eitzinger, A., Binder, C.R., Meyer, M.A., 2018. Risk perception and decision-making: do farmers consider risks from climate change? Clim. Change 151 (3–4), 507–524. https://doi.org/10.1007/s10584-018-2320-1.
Elum, Z.A., Modise, D.M., Marr, A., 2017. Farmer's perception of climate change and responsive strategies in three selected provinces of South Africa. Clim. Risk Manage. 16, 246–257. https://doi.org/10.1016/j.crm.2016.11.001.
FAO-IPCC. 2017. "FAO-IPCC Expert Meeting on Climate Change, Land Use and Food Security." Rome. 10.1038/embor.2009.27.
FAO. 2016. *2016 The State of Food and Agriculture: Climate Change, Agriculture and Food Security*. Rome: FAO. 10.1093/nq/s8-IV.94.301-a.
Gaurav, S., Chaudhary, V., 2020. Do farmers care about basis risk? evidence from a field experiment in India. Clim. Risk Manage. 27 (2019), 100201 https://doi.org/10.1016/j.crm.2019.100201.
Ipcc, 1995. In: CLIMATE CHANGE 1995 Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses. Cambridge University Press, Cambridge, UK. https://doi.org/10.1016/0009-2614(90)85169-D.
Jones, C., Hine, D.W., Marks, A.D.G., 2017. The future is now: reducing psychological distance to increase public engagement with climate change. Risk Anal. 37 (2), 331–341.
Kahneman, D., Tversky, A., 1984. Choices, values, and frames. Am. Psychol. 39 (4), 341–350. https://doi.org/10.1037/0003-066X.39.4.341.
Lauckner, C., Smith, S., Kotowski, M., Nazione, S., Stohl, C., Prestin, A., So, J., Nabi, R., 2012. An initial investigation into naturally occurring loss- and gain-framed memorable breast cancer messages. Commun. Quarterly 60 (1), 1–16. https://doi.org/10.1080/01463373.2012.642269.
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. 10.1007/978-3-319-98294-6_1.
Leiserowitz, A., 2006. Climate change risk perception and policy preferences: the role of affect, imagery, and values. Clim. Change 77 (1–2), 45–72. https://doi.org/10.1007/s10584-006-9059-9.
van der Linden, S., Maibach, E., Leiserowitz, A., 2015. Improving public engagement with climate change: five 'best practice' insights from psychological science. Perspect. Psychol. Sci. 10 (6), 758–763. https://doi.org/10.1177/1745691615598516.
Liverpool-Tasie, L.S.O., Sanou, A., Tambo, J.A., 2019. Climate change adaptation among poultry farmers: evidence from Nigeria. Clim. Change 157 (3-4), 527–544. https://doi.org/10.1007/s10584-019-02574-8.
Lord, K.R., 1994. Motivating recycling behavior: a quasiexperimental investigation of message and source strategies. Psychol. Market. 11 (4), 341–358.
Maloney, E.K., Lapinski, M.K., Witte, K., 2011. Fear appeals and persuasion: a review and update of the extended parallel process model. Soc. Pers. Psychol. Compass 5 (4), 206–219. https://doi.org/10.1111/j.1751-9004.2011.00341.x.
Meijers, M.H.C., Remmelswaal, P., Wonneberger, A., 2019. Using visual impact metaphors to stimulate environmentally friendly behavior: the roles of response efficacy and evaluative persuasion knowledge. Environ. Commun. 13 (8), 995–1088. https://doi.org/10.1080/17524032.2018.1544160.
Meyerowitz, B.E., Chaiken, S., 1987. The effect of message framing on breast self-examination attitudes, intentions, and behavior. J. Pers. Soc. Psychol. 52 (3), 500–510. https://doi.org/10.1037/0022-3514.52.3.500.
MONRE. 2016. *Kịch Bản Biến Đổi Khí Hậu, Nước Biển Dâng Cho Việt 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. 10.1093/acrefore/9780190228620.013.415.
Moser, S.C., 2010. Communicating climate change: history, challenges, process and future directions. WIREs Clim. Change 1 (1), 31–53. https://doi.org/10.1002/wcc.11.
Moser, S.C., 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), 345–369. https://doi.org/10.1002/wcc.403.
Moser, S.C., Dilling, L., 2011. Communicating climate change: closing the science-action gap. In: Dryzek, J.S., Norgaard, R.B., Schlosberg, D. (Eds.), The Oxford Handbook of Climate Change and Society, 1st ed. Oxford University Press, Oxford. 10.1093/oxfordhb/9780199566600.003.0011.
Moser, S.C., Dilling, L., 2007. Communicating climate change: closing the science - action gap. In: Moser, S.C., Dilling, L. (Eds.), Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change. Cambridge University Press, Cambridge, UK.
Nerlich, B., Koteyko, N., Brown, B., 2010. Theory and language of climate change communication. WIREs Climate Change Change 1 (1), 97–110.
Ngo, C.C., Poortvliet, P.M., Feindt, P.H., 2020a. Drivers of flood and climate change risk perceptions and intention to adapt: an explorative survey in coastal and delta Vietnam. J. Risk Res. 23 (4), 424–446. https://doi.org/10.1080/13669877.2019.1591484.
Ngo, C.C., Marijn Poortvliet, P., Feindt, P.H., 2020b. Examining the effectiveness of climate change communication with adolescents in Vietnam: the role of message congruency. Water (Switzerland) 12 (11), 1–23. https://doi.org/10.3390/w12113016.
Niles, M.T., Brown, M., Dynes, R., 2016. Farmer's intended and actual adoption of climate change mitigation and adaptation strategies. Clim. Change 135 (2), 277–295. https://doi.org/10.1007/s10584-015-1558-0.
Nisbet, M.C., Mooney, C., 2007. Science and society: framing science. Science 316 (5821), 56. https://doi.org/10.1126/science.1142030.
Peltonen-Sainio, P., Sorvali, J., Kaseva, J., 2020. Winds of change for farmers: matches and mismatches between experiences, views and the intention to act. Clim. Risk Manage. 27, 100205 https://doi.org/10.1016/j.crm.2019.100205.
Raymond, C.M., Spoehr, J., 2013. The acceptability of climate change in agricultural communities: comparing responses across variability and change. J. Environ. Manage. 115, 69–77. https://doi.org/10.1016/j.jenvman.2012.11.003.
Regasa, D.T., Akirso, N.A., 2019. Determinants of climate change mitigation and adaptation strategies: an application of protection motivation theory in Konta District, South Western Ethiopia. Eur. Rev. Appl. Sociol. 12 (19), 49–73. https://doi.org/10.1515/eras-2019-0010.
Reser, Joseph P., Graham L. Bradley. 2017. *Fear Appeals in Climate Change Communication. Oxford Research Encyclopedia of Climate Science*. 10.1093/acrefore/9780190228620.013.386.
Rothman, A.J., Salovey, P., 1997. Shaping perceptions to motivate healthy behavior: the role of message framing. Psychol. Bull. 121 (1), 3–19. https://doi.org/10.1037/0033-2909.121.1.3.
Shafiei, A., Maleksaeidi, H., 2020. Pro-environmental behavior of university students: application of protection motivation theory. Global Ecol. Conserv. 22, e00908. https://doi.org/10.1016/j.gecco.2020.e00908.
Spence, A., Pidgeon, N., 2010. Framing and communicating climate change: the effects of distance and outcome frame manipulations. Global Environ. Change 20 (4), 656–667. https://doi.org/10.1016/j.gloenvcha.2010.07.002.
Spence, A., Poortinga, W., Pidgeon, N., 2012. The psychological distance of climate change. Risk Anal. 32 (6), 957–972. https://doi.org/10.1111/j.1539-6924.2011.01695.x.
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/.
Tran, D.V., 2011. Climate change and its impact on agriculture in Vietnam. J. Int. Soc. Southeast Asian Agric. Sci. 17 (1), 17–21.
Trope, Y., Liberman, N., 2003. Temporal construal. Psychol. Rev. 110 (3), 403–421. https://doi.org/10.1037/0033-295X.110.3.403.
Trope, Y., Liberman, N., 2010. Construal-level theory of psychological distance. Psychol. Rev. 117 (2), 440–463. https://doi.org/10.1037/a0018963.
UNDP. 2007. Human Development Report (2007-08) – Fighting Climate Changes: Human Solidarity in a Divided World.

Wang, Y., Liang, J., Yang, J., Ma, X., Li, X., Jing, W.u., Yang, G., Ren, G., Feng, Y., 2019. Analysis of the environmental behavior of farmers for non-point source pollution control and management: an integration of the theory of planned behavior and the protection motivation theory. J. Environ. Manage. 237, 15–23. https://doi.org/10.1016/j.jenvman.2019.02.070.

World Bank. 2011. Vulnerability, Risk Reduction, and Adaptation to Climate Change: Vietnam Climate Risk and Adaptation Country Profile.

White, K., Macdonnell, R., Dahl, D.W., 2011. It's the mind-set that matters: the role of construal level and message framing in influencing consumer efficacy and conservation behaviors. J. Mark. Res. 48 (3), 472–485. https://doi.org/10.1509/jmkr.48.3.472.

Wilson, D.K., Purdon, S.E., Wallston, K.A., 1988. Compliance to health recommendations: a theoretical overview of message framing. Health Educ. Res. 3 (2), 161–171. https://doi.org/10.1093/her/3.2.161.

Witte, K., 1992. Putting the fear back into fear appeals: the extended parallel process model. Commun. Monographs 59 (4), 329–349. https://doi.org/10.1080/03637759209376276.

Zwickle, A., Wilson, R., 2013. Construing risk. In: Arvai, J., Louie, R.I. (Eds.), Effective Risk Communication. Taylor & Francis Group, pp. 1–21.