CLIMATE CHANGE IN THE INDIAN MIND: ROLE OF COLLECTIVE EFFICACY IN CLIMATE CHANGE ADAPTATION

by

Jagadish Thaker

A Dissertation
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A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at George Mason University

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Dedication

To climate change comrades.

Acknowledgements

It is said that those who lack economic capital rely more on social capital—the different people one knows. I was most fortunate to have some of the greatest teachers and friends who helped me achieve many of my goals. Thanks to all of them.

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To my parents, your son may not be an engineer, but he can draw graphs! Thanks for all the support and love.

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Abstract

CLIMATE CHANGE IN THE INDIAN MIND: ROLE OF COLLECTIVE EFFICACY IN CLIMATE CHANGE ADAPTATION

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Successful climate change adaptation requires behavioral and policy changes at the individual, community, and national levels. Although most research on adaptive capacity focuses on the role of the economy and technology, an increasing body of research suggests that socially shared beliefs, norms, and networks are also critical in increasing individuals' and communities' adaptive capacity. Based on Bandura's social cognitive theory, this dissertation examined the role of collective efficacy—people's shared beliefs about their group's capabilities to accomplish collective tasks—in influencing Indians' adaptive capacity to deal with drinking water supply scarcity, a condition likely to be exacerbated in the future by climate change. The hypotheses were individual-level collective efficacy perceptions will be positively associated with (1) behavioral involvement in adaptation, and (2) support for adaptation policy, and (3) community-

level collective efficacy perceptions will be positively associated with community adaptation measures.

To test these hypotheses, face-to-face interviews were conducted with 4031 randomly selected Indian respondents using a stratified random national sampling plan during December 2011 and January 2012, resulting in a response rate of 39.7%. To test these hypothesis, correlational analysis, and hierarchical regression models was used. Partial support for the first hypothesis was found: individuals' with robust collective efficacy beliefs are more likely to be involved in community activities, although the relationship is not linear. The second hypothesis was fully supported: individuals with high levels of collective efficacy beliefs are more likely to support government adaptation policies. The third hypothesis was also fully supported: communities with high collective efficacy are more likely to implement adaptation measures. These results demonstrate that collective efficacy beliefs are positively associated with individuals' and communities' capacity to successfully adapt to climate change. Taking steps to increase the collective efficacy beliefs of community members—for example, through mass media campaigns—may bolster the adaptive capacity of communities to climate change; this important possibility should be tested in future research.

1. Introduction

1.1 Scientific Evidence of Climate Change

Human induced global warming is projected to be the biggest threat to humanity in the 21st century (Campbell-Lendrum, Prüss–Ustün, & Corvalán 2003; Costello et al., 2009; Gleick, 2010, McMichael, Haines, Slooff, & Kovats, 1996; Stern, 2007; WHO, 2009). Increasing trends in temperature will increase the scale of events that have been so far termed as *natural* disasters, leading to increased deaths, disease, and injury due to increased intensity and frequency of heat and cold waves, floods, storms, fires, and droughts (see Beck, 2010). By shifting the natural variability, climate change is also projected to change patterns of water flow, species migrations, agriculture productivity, resulting on threats to food, water, and employment security. For example, crop yields are projected to decrease up to 30% in Central and South Asia by the mid-21st century due to climate change (Cruz et al., 2007, section 10.4.1.1), which in turn may decrease the calorie availability to populations in developing world by 10% relative to 2000 levels (Nelson et al., 2009). The World Health Organization's (WHO) assessment—Global Health Risks (WHO, 2009)—"Climate change was estimated to be already responsible for 3% of diarrhea, 3% of malaria and 3.8% of dengue fever deaths worldwide in 2004. Total attributable mortality was about 0.2% of deaths in 2004; of these, 85% were child deaths" (p. 24). Similarly, other studies estimate that climate change will most likely

increase deaths caused due to diarrhea by 10% in 2030 (Campbell-Lendrum, Prüss–Ustün, & Corvalán 2003).

Responding effectively to the threats associated with climate change will require unprecedented solidarity among all countries in the world—to reduce carbon emissions and adapt to new climate variability. For this reason, about 193 countries of the world annually negotiate at the United Nations Framework Convention on Climate Change (UNFCCC) to reach a globally equitable deal (Nerlich, Koteyko, & Brown, 2009). However, these annual conventions, called Conference of Parties, have been largely unsuccessful in yielding a binding emissions and adaptation agreement. Moreover, because of lag times inherent in the earth's climate system, scientists have projected that even if "all greenhouse gases and aerosols had been kept constant at year 2000 levels, a further warming of about 0.1°C per decade would be expected" (IPCC, 2007b, paragraph "Projections of Future Changes in Climate"). Although international negotiations have focused on emission cuts—the root of the global warming problem—developing countries like India, with a majority of the highly vulnerable population, cannot afford to delay adaptation to quantum shifts in climate.

While climate change is global in nature, its impacts will be disproportionally larger among communities in developing and underdeveloped countries (IPCC, 2007b, section 19.3.7). This is because individuals and communities in the less developed countries already suffer from other non-climatic stressors such as poverty, illiteracy, and lack of access to resources and institutions to adapt to climatic changes and because they have fewer economic resources that can be devoted to adaptation measures (Cruz et al.,

2007; IPCC, 2007b; WHO, 2009). As Gro Harlem Brundtland (2007, p. 1), former Director-General of World Health Organization (WHO), articulated, "Poor people are more vulnerable to climate change due to their limited adaptive capacities to a changing environment. Among them, the rural poor, and rural women and girls are the ones most immediately affected. Climate change impacts are not gender neutral."

For example, the IPCC report (Cruz et al., 2007) estimated that around 500 million people in South Asia are likely to be adversely affected by depleting Himalayan glaciers, because these populations heavily rely on glacial water melt for drinking and irrigation purposes. In India alone, nearly 40 million people inhabit the Himalayas, or about 3.8% of the total population of the country (INCCA, 2010). Rapid glacier melt due to climate change will severely affect water availability in Indus, Gages and Brahmaputra river basins, thereby affecting the populations that survive on it.

1.2 Climate Change Impacts in India: Double Exposure

India is one of the world's most vulnerable countries to climate change (Cruz, et al., 2007; INCCA, 2010), primarily due to the sensitivity of its population and economy to climatic changes, in addition to other developmental challenges. About half of Indian population is dependent on agriculture or other climate sensitive sectors (Bureau of Labor Statistics, Govt. of India, 2010) and about 76% of the population lives on less than $2 a day (World Bank, 2008). The 2010 United Nations Human Development Report (HDR, 2010) found that poverty levels in eight Indian states are as acute as those found in the twenty-six poorest African countries. These eight Indian states are home to about 421 million poor, 11 million more than the combined populations of the poor in the twenty-

six African countries. India is extremely vulnerable to temperature changes, sea level rise and extreme weather events, and will increasingly face threats to human health, water availability and food security (for a review of the potential impacts of climate change on human health, national security, and water scarcity, see Cruz, et. al., 2007; INCCA, 2010; Policy note for Indian Parliamentarians, 2010). In addition, the agriculture sector is further vulnerable to other non-climatic factors, for example, global market economy, technological innovations that require heavy use of fertilizers, and regular water supply. Therefore, some scholars have underscored the importance to understand the "double exposure" of climatic and non-climatic drivers of vulnerability (e.g., O'Brien, et al., 2004).

The mean annual minimum temperature across India has significantly increased by 0.27°C per 100 years during the period 1901-2007. It is projected that the rise in annual mean surface air temperature by the 2030s will range from 1.7°C to 2.0°C (INCCA, 2010), with a small increase in precipitation. About 12% (40 million hectares) of India is estimated to be flood prone, and 16% (51 million hectares) is drought prone (Rashtriya Barh Ayog, RBA, 1980, as cited in CWC, 2011)—increasing the exposure to shifts in climate variation. Although the number of cyclones has declined since 1970's, their intensity has increased, thereby increasing the damage caused by each extreme weather event (Cruz et al., 2007, p. 473). For example, a record 944 millimeters of rain over Mumbai on 26 to 27 July 2005, led to the loss of over 1,000 lives and to the destruction of property costing approximately $250 million (Cruz et al., 2007, p. 476). Further, droughts have affected over 1 billion people, and killed 4.25 million people in

India during 1900–2006 (Center for Research on Epidemiology of Disasters, 2006). About 20% of the population of India lives in the coastal areas that stretch more than 7,500 km, with a large percentage of these people living in coastal mega-cities, such as Mumbai, Chennai, and Kolkata. Over the last 20 years, sea level along the Indian coast has been rising at the rate of about 1.3 millimeters/year (INCCA, 2010).

Several vulnerability models that have been used to estimate the impacts of climate change on specific Indian states and sectors find that climate impacts are expected to vary regionally (e.g., O'Brien, et al., 2004). Recently, the government of India instituted the Indian Network for Climate Change Assessment (INCCA)—a network of about 220 scientists and 120 Indian institutions—to study the potential impacts of climate change in India. In its third national assessment report, INCCA (2010) projected that by the 2030s, for example, malarial transmission will be reduced on the east coast, but will spread to new places, such as the northern state of Jammu and Kashmir. The North-Eastern region of India may also experience an increase in cases of malaria infection as the number of months for disease transmission may increase from the norm of 7-9 months presently to 10-12 months in 2030's (INCCA, 2010, p.108).

Indian agriculture, which is still practiced in a traditional fashion, is highly sensitive to climate variations. Increase in temperature makes crops mature earlier, causing substantial damage to production of many crops such as mustard, peas, tomatoes, onion, garlic, and other vegetable and fruit crops. In an assessment of the impacts of climate change on agricultural sector, Kumar and Parikh (1998, as citied in Cruz et al., 2007) argued that even after controlling for existing adaptive mechanisms, the net

revenue loss will range between 9% and 25% for a temperature rise of 2°C to 3.5°C in India. Agarwal (2003) estimated that 0.5 to 1.5°C temperature rise will result in 2% to 5% decrease in yield potential of wheat and maize, and Lal (2007) estimated that for a 2.5 degree rise in temperature, non-irrigated wheat and rice loss in farm-level net revenue loss of between 9% and 25% and net-cereal production will decline by atleast 4 to 10 percentage points.

Erratic and intense monsoons, which provide about 80% of total annual rainfall in India within a period of three-four months, add to the sensitivity of both irrigated and non-irrigated agriculture areas, primarily due to water erosion leading to soil degradation, and increasing desertification (e.g., Cruz et al., 2007). Further, the mean intensity and variability of the Indian monsoons is expected to increase due to climate change (e.g., Ashrit et al., 2001; Cruz et al., 2007).

Decrease in agriculture productivity will have severe impacts on food security of Indians. India's Global Hunger Index (GHI) score is 23.7, ranking it 66th out of 88 countries (International Food Policy Research Institute, 2009). About, 39 per cent of rural women in the 15 – 49 age groups suffer from chronic energy deficiency and 58 percent are anemic (MSSRF, 2008). Although the demand for food grains is projected to increase by 30-50% by 2020 due to increasing population (Paroda & Kumar, 2000), Nelson et al., (2009) have estimated that the daily per-capita calorie availability in South Asia will decline by about 8 percentage points in 2050, compared to 2000, due to climate change impacts on cereal crop yields.

In recent years, the Indian government has recognized this threat and has stepped up domestic efforts to mitigate and adapt to climate change. In 2007, the Prime Minister instituted a council on Climate Change and mandated eight National Action Plans on Climate Change (NAPCC) to address increasing water scarcity, and decreasing energy security among other vulnerabilities due to climate change (NAPCC, 2008; INCCA, 2010). It is important to note that the NAPCC is framed as a co-benefits paradigm, also called as "mainstreaming" of climate change policies (see IPCC, 2007c.). Mainstreaming of climate change policies refers to integrating climate change adaptation measures along with existing developmental policies such as poverty reduction, water management, among other development goals: "The National Action Plan on Climate Change identifies measures that promote our development objectives while also yielding co-benefits for addressing climate change effectively. It outlines a number of steps to simultaneously advance India's development and climate change-related objectives of adaptation and mitigation" (NAPCC, 2008, *"Approach,"* p. 2).

Before the annual Conference of Parties (COP) 15 meet in Copenhagen in December 2009, the Indian government announced that it plans to cut the emissions intensity by 20-25% by the year 2020 on a 2005 reference level. Further, the Indian Prime Minister announced that the per-capita emission levels of India would never surpass that of developed economies in future, even after accounting for increasing Indian emissions trend. Recently in COP 16 in Cancun, the then Indian minister for Environment and Forests, Jairam Ramesh, stated that "all countries must take binding commitments in appropriate legal form" (PTI, 2010, para.3). His remark caused a furor

in the Indian parliament, but received accolades from international and some domestic non-governmental organizations (NGO's) and "progressive internationalists" (Dubash 2009 a, b) (that argue for increasing alignment of India's priorities with a strong climate regime). In 2009, Indian government instituted a network of scientists to assess climate impacts on different economic sectors. In 2011, India agreed to the Durban Platform for Enhanced Action that paves the way for a legally binding emission treaty among all countries which will be finalized by 2015, and implemented in 2020 (Hedegaard, 2012). Therefore, it appears that the Indian government is taking many steps to address increased domestic vulnerability to climate change impacts.

1.3. Addressing Drinking Water Scarcity in India

Reduced availability of fresh water is one of the projected impacts of climate change in India and around the world. Only about 2.5% of the water resources in the world are suitable for human consumption, and about 70% of this fresh water resource is frozen in glaciers. Changes in temperature and precipitation levels may affect the hydrological cycle with severe impacts on access to quality, and quantity of drinking water. A large proportion of the Indian population lives along these glacier fed rivers. For example, the Himalayan glaciers are often called "water towers of Asia" because they store about 12,000 km^3 of freshwater, and feed several perennial rivers such as the Indus, Ganga, and Brahmaputra. The Gangetic basin alone is home to 500 million people, or about 10% of the total human population in Asia (Parry et al., 2007). Although these glacier fed rivers will see a rise in the stream flow in short term, resulting in flooding in some instances, the total water flow will decrease with the shrinking of the glaciers. In

addition, sea level rise will increase salinity of ground water resources in coastal areas—usually the most populated areas—thereby affecting fresh water availability in the region.

Due to increasing water shortages, excessive reliance on ground water for continuous water supply has already led to rapid depletion of water tables. Rodell, Velicogna, and Famiglietti (2009) found that from "August 2002 to October 2008, groundwater depletion was equivalent to a net loss of 109 km^3 of water, which is double the capacity of India's largest surface-water reservoir" (abstract). They found that inspite of normal annual rainfall over Rajasthan, Punjab, Haryana (including Delhi); unsustainable consumption of groundwater for irrigation was the likely cause for rapid depletion of water tables. In addition, the projected decrease in precipitation in the winter will most likely affect the intensity of monsoon rainfall, causing intense floods, and increase in run-off of fresh water resources, thereby also affecting ground water recharge (Parry et al., 2007, 10.4.2).

Further, other non-climatic factors such as increasing population and industrialization are expected to act as additional stressors to water availability. For example, although the irrigation sector is the largest consumer of water in India, other sectors such as increased urbanization and industrialization will heighten demand gradually and overtake the irrigation sector, according to an exhaustive assessment of water resources for India for 2050 by Gupta and Deshpande (2004). As early as 2050, India is projected to experience water stress, with per-capita water availability dropping from 1,820 m3/year in 2001 to 1,140 m^3/year in 2050 (Gupta & Deshpande, 2004).

One of the primary objectives of the United Nations Millennium Development Goals (MDGs) is to halve the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015 (Millennium Development Goals, n.d). Similarly, many international and national conventions accept that access to good quality and quantity of drinking water is an important indicator of human wellbeing and development, and is related to a host of political, social, and health outcomes. For example, a year of drought during 2000 in Gujarat resulted in severe deficiencies in dietary intake, and food consumption. About half of the adult males, and a third of females suffered chronic energy deficiency, and about half of the preschool children were underweight (Kumar et al., 2005). Similarly, Arlappa, Venkaiah, and Brahmam (2011) found that sharp drop in consumption of vitamin A among rural pre-school children, with severe impacts on children with illiterate mothers and mothers belonging to an older age group.

Poor management and supply of water resources by the government is another non-climatic driver that adds to the Indian population's vulnerability to drinking water resources. Unlike the norm in the U.S. and most developed countries, a majority of households in any Indian city have no continuous access to water. According to the Asian Development Bank (2007) study of 20 prominent Indian cities, the average duration of water supply is only 4.3 hours per day, with cities such as Rajkot, Indore, and Vishakhapatnam receiving water for as little as one hour a day, on average. The situation is worse in rural areas, with about 20% of the rural population in India still without access to safe drinking water and about 80% without access to sanitation

(WHO/UNIEEF, 2010). Recent Indian Census (2011) estimates show that only 32% of Indian households receive tap water from a treated source, with over 80% of rural households without such access. While about half (47%) of Indian households do not have sanitation facilities on their premises, the problem is much more common in rural households (69.3%) than in urban households (18.6%).

Due to lack of access to clean drinking water, Indians often have to buy water. The poor often pay higher water costs because they lack infrastructure to store water when it is available, while many more well-to-do Indians have lower water costs because they can store water in overhead tanks when it is available (e.g., ADB, 2007). The ADB report (2007) found that "Less-than-24-hour water supply exposes consumers to high health risk from contamination entering distribution pipes during vacuum conditions created when water is absent. It makes accurate measurement of consumption impossible. There is evidence that more water is consumed with intermittent supply because people leave their taps open to fill storage, which can often then overflow to waste" (p. 11).

To provide improved access to safe drinking water, the NAPCC (2008) proposes to improve water use efficiency by 20% by 2017 through regulatory mechanism such as water pricing, recycling water in urban areas, and adopting new technologies like desalination for coastal areas among other measures as listed in Table 1.

Table 1: *Indian Central Water Commission (2011) Strategies for Increasing Water Efficiency by At Least 20%*

(a) Research in area of increasing water use efficiency and maintaining its quality in agriculture, industry and domestic sector
(b) Incentivize recycling of water including wastewater
(c) Development of eco-friendly sanitation system
(d) Improve efficiency of urban water supply system
(e) Efficiency labeling of water appliances and fixtures
(f) Promotion of water efficient techniques and technologies
(g) Undertake pilot projects for improvement in water use efficiency in collaboration with States
(h) Promote Water Regulatory Authorities for ensuring equitable water distribution and rational charges for water facilities
(i) Promote mandatory water audit including those for drinking water purposes;
(j) Adequate provision for operation and maintenance of water resources projects;
(k) Incentive through award for water conservation, and efficient use of water; and
(l) Incentivize use of efficient irrigation practices and fully utilize the created facilities.

1.4 Adaptation and Adaptive Capacity: Role of Local Actors and Institutions

There is increasing evidence that climate change has already affected many sectors in Asia, adversely affecting food, health, and employment security. In addition, the population growth, rapid urbanization, and the significant proportion of poor and

uneducated people, further add to the sensitivity of Asian countries to climate change (e.g., Cruz et al., 2007). Although several countries have committed to mitigate or reduce greenhouse gas emissions through treaties, such as the Kyoto protocol, recent studies have found that current commitments are not enough for stabilization of atmospheric greenhouse-gas concentrations (Barker et al., 2007). Further, the Working Group I Fourth Assessment Report (IPCC, 2007b, "Summary for Policymakers," p.16) argued, "Anthropogenic warming and sea level rise would continue for centuries due to the time scales associated with climate processes and feedbacks, even if greenhouse gas concentrations were to be stabilized."

Therefore, adaptation to climate change is unavoidable, and the issue of adaptation is increasingly occupying the center stage in international negotiations (e.g., Parry et al. 1998). For example, the Delhi Ministerial Declaration on Climate Change and Sustainable Development, issued at the Eighth Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) in 2002, stated that, "Adaptation to the adverse effects of climate change is of high priority for all countries. Developing countries are particularly vulnerable, especially the least developed countries and small island developing states. Adaptation requires urgent attention and action on part of all countries" (UNFCCC, 2002, p. 4).

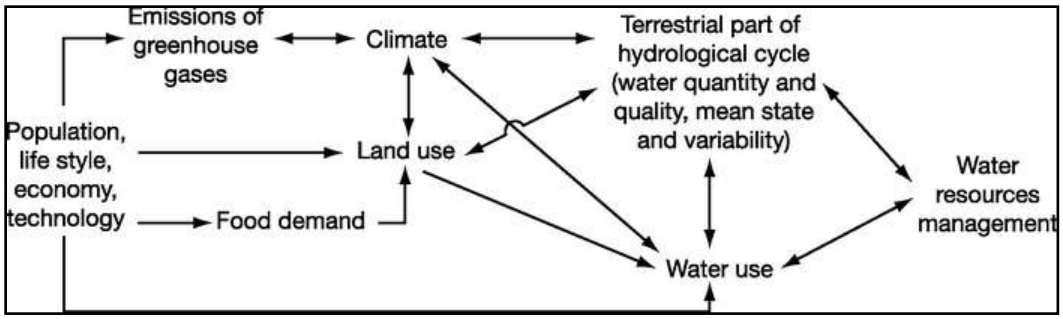

Figure 1: *Impact of Human Activities on Freshwater Resources and Their Management, with Climate Change being only one of Multiple Pressures. Source: http://www.ipcc.ch/publications_and_data/ar4/wg2/en/figure-3-1.html.*

Adaptation to climate change refers to proactive and reactive adjustments taken to reduce vulnerability or enhance resilience in response to climatic changes within and across physical, ecological, and human systems (Adger et al., 2007, section 17.2). Within human systems, it encompasses risk perceptions, and subsequent proactive or reactive measures people take to reduce their vulnerabilities to existing or projected changes. For example, rainwater harvesting, coastal embankments, use of alternative crops, and low-technology water filters are considered different adaptation practices to deal with increased water scarcity. Although humans have been adapting to different climatic changes over many centuries, the present human induced climate change is considered more devastating due to increased variability of climate that is beyond what humanity have experienced so far (Adger et al., 2009).

According to IPCC, adaptation practices can be differentiated along several dimensions: “by spatial scale (local, regional, national); by sector (water resources,

agriculture, tourism, public health, and so on); by type of action(physical, technological, investment, regulatory, market); by actor(national or local government, international donors, private sector, NGOs, local communities and individuals); by climatic zone" (Adger et al., 2007, sec. 17.2), among other dimensions. Given the nature of the impacts, multiple levels of adaptation interventions would be required to adapt to climate change and make use of any beneficial opportunities it provides. However, the system's adaptive capacity is a necessary condition for successful implementation of adaptive polices (Brooks, Adger, & Kelly, 2005).

Adaptive capacity, according to IPCC (Adger et al., 2007, section 17.3.1), "is the ability or potential of a system to respond successfully to climate variability and change, and includes adjustments in both behavior and in resources and technologies." Similarly, Brooks and Adger, (2004) defined adaptive capacity as ''the set of resources (natural, financial, institutional or human, and including access to ecosystems, information, expertise, and social networks) available for adaptation, as well as the ability or capacity of that system to use these resources effectively in the pursuit of adaptation,'' (p. 168). Although, research on adaptive capacity has been largely conducted within the vulnerability studies, Eriksen and Kelly, (2007) argued that the vulnerability indices do provide the mechanisms that can promote or constrain adaptive capacity of communities.

Further, adaptive capacities can vary within and across communities and differ by age, gender, class, education, and social status. IPCC authors argued for a comprehensive view of climate change adaptive capacity that include both generic

indicators, such as education and income levels, as well as specific indicators of impacts of floods or droughts (Adger et al., 2007).

Adaptive capacity assessments, however, have often featured biophysical, economic, or technological aspects, often ignoring the human attributes of norms and networks that social scientists have argued to be at the core of individual and community abilities to adapt to climate change impacts (e.g., Adger et al., 2007; Brooks & Adger, 2004; Grothmann & Patt, 2004). For example, O'Brien et al., (2004) in a study of adaptive capacity of India used soil conditions (quality and depth), and ground water availability as indicators of biophysical factors. District level literacy rates, degree of gender equity as indicators of human capital and social capital respectively, and percentage of workforce employed in non-agriculture settings and percentage of landless laborers in the agricultural workforce were used as indicators of socioeconomic dimensions of adaptive capacity. Finally, percentage of irrigated area to the net sown area, a composite index of facilities for transport energy, irrigation, banking, communication, education, and health at the district level were used as indicators of technology capacity. They found that the differences in climate sensitivity—dependence on monsoons and drought sensitivity—and adaptive capacity vary between states. For example, "most districts in southern Bihar have only medium sensitivity to climate change, yet are still highly vulnerable to climate change as the result of low adaptive capacity. By contrast, most districts in northern Punjab have very high sensitivity to climate change, yet are found to be only moderately vulnerable as the result of high adaptive capacity" (p. 307).

However, as IPCC report noted, along with economic development and technology factors, social factors such as risk perceptions, human capital, and local governance structures can also be important predictors of adaptive capacity (e.g., Adger et al., 2007; Brooks & Adger 2005; Eriksen & Kelly, 2007). According to Adger et al., (2007, section 17.3.1), "Although economic development may provide greater access to technology and resources to invest in adaptation, high income per capita is considered neither a necessary nor a sufficient indicator of the capacity to adapt to climate change (Moss et al., 2001)." There is increasing evidence that apart from economic and technological factors, social perceptions, norms, and networks often affect communities' adaptive capacity. Increased reliance on people-to-people network among the poorer communities have been found to substantially aid such communities to compensate for lack of other tangible resources (Adger et al., 2007). For example, informal non-monetary arrangements, strong local networks, communal responsibility, community action, local food sharing practices, among other local practices have been postulated to increase adaptive capacity of more vulnerable communities (e.g., Adger, 2001; Tompkins, 2005).

Researchers studying disaster coping have also found substantial evidence for role of community perceptions. As Aldrich (2010, 2011) argued, recovery from natural disasters is not a function of the scale of the disaster, or even the amount of maintenance or development money flowing into the crisis hit region. Instead, trust, civic engagement, and the strength of social networks within the vulnerable communities underlie recovery processes in different crisis centers. For example, Aldrich (2010)

pointed out that recovery in the state of Tamil Nadu in India, where 8,000 died and 310,000 were left homeless due to the tsunami in the Indian ocean, was relatively quick as communities "rebuilt almost all of its schools, fixed 75% of the damaged housing stock, and put most of its fishermen back to work" within a year of the disaster. However, after Hurricane Katrina in New Orleans, although less in relatively less damage was caused—1,600 killed and 250,000 left homeless—was far from the road to recovery even one year after the crisis. Residents in New Orleans had much higher per-capita income than residents in Tamil Nadu that could have helped communities recover after the disaster, but did not. Chamlee-Wright (2010) found that New Orleans' Vietnamese neighborhood communities recovered quickly in comparison due to its dense community networks and high levels of trust, which other neighborhoods lacked.

Although several researchers have recognized the importance of social perceptions and norms to affect adaptive capacity, few researchers have investigated their role in predicting adaptive capacity. Evaluating adaptive capacity purely in terms of presence or absence of resources is a major weakness as such research ignores both the subjective judgments of risk, as well the motivations that drive individuals, and communities to engage in adaptive actions. Grothmann and Patt (2005) argued that the psychological dimensions of adaptation are hardly studied: "Outside of climate change, a large literature dealing with human decision-making and action suggests that motivation and perceived abilities are important determinants of human action" (p. 208). They noted that there is "a failure of communication between different disciplines: those concerned with climate change adaptation, on the one hand, and those concerned with human

agency and social decision-making processes on the other" which has "led to a focus on financial, technical, and institutional constraints as the primary determinants of adaptive capacity" (pp. 201-202).

1.5 Cognitive Dimensions of Adaptive Capacity

Increasingly, social scientists have asserted that adaptation to climate change is a socially and psychologically mediated process. Substantial evidence from the fields of behavioral decision making, cognitive science, and social psychology suggests that people's perceptions about the climate change risks, prior beliefs and experiences, and assessments of adaptation options and related costs influence the degree to which they are willing to adapt or support adaptation actions (e.g., Adger et al., 2007; Kahneman, Slovic, & Tversky, 1982; Leiserowitz, 2006; Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007; O'Connor, Bord, & Fisher, 1998; Tversky & Kahneman, 1974; Weber, 2006; Weber & Stern, 2011). Further, even among populations that are aware of the consequences of climate change impacts, and have resources to adapt, low concern or low perceptions of adaptive capacity increases their vulnerability to climate change impacts (e.g., Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007). Therefore, one central question that social scientists have persistently asked is that despite increasing awareness and concern about climate change, why haven't individuals, and institutions showed the urgency in adapting to climate change that the issue deserves (e.g., Weber & Stern, 2011)?

Risk perceptions. Increasing public awareness and concern about risks, while important, are not sufficient to explain the complex ways that people respond to risks (e.g., O'Connor, Bord, & Fisher, 1998; Slovic 1987, 1997, 2000; Leiserowitz, 2006). The traditional information deficit or scientific illiteracy model posits that people know too little, and this limited information is the primary cause for public inaction in the face of risks that some experts believe to be imminent and need of urgent public action. Further, it suggests that scientists or other experts can trigger public action to mitigate the negative consequences of risks by increasing the amount of information available to the public. This traditional model of risk perception differentiates between expert vs. lay assessments risks, where, according to Paul Slovic (1997), "Experts are seen as purveying risk assessments, characterized as objective, analytic, wise and rational – based upon the real risks. In contrast, the public is seen to rely upon perceptions of risk that are subjective, often hypothetical, emotional, foolish, and irrational" (p. 278). The concept of risk itself is defined technically: as an assessment of probability and severity of an event.

Risk perception scholars, however, contend that people do not merely rely on information about risks. Instead, scholars have identified several "mental strategies, or heuristics, that people employ in order to make sense out of an uncertain world" (Slovic, 1997, p. 281). The primary role of such cognitive heuristics is to simply or shorten the amount to cognitive effort involved to satisfy the informational needs of an individual , in other words "simplifying heuristics" (Marx et al., 2007, p.53; Payne et al., 1992).

Leiserowitz (2006), however, argued that past research on risk perceptions has largely focused on cognitive models of risk perception, such as mental models approach (e.g., Bostrom et al., 1994; Kempton et al., 1995) ignoring the more nuanced "affect heuristics" (also see Slovic, Finucane, Peters, & MacGregor; 2004). For example, Leiserowitz (2006) found that experiential factors such as affect, imagery, and values influence Americans responses to climate change. Specifically, Leiserowitz argued that although a majority of Americans believe that climate change is real and consider it a serious problem, they tend to perceive climate change to affect distant places and people, and as a result, consider climate change to be a low priority compared to other national and environmental issues. Understanding how best to communicate risks such as climate change so that the public takes proactive adaptation actions, according to Kahan et al., (2011), is the *science* of science communication.

Another important factor that has been the focus in recent years is the cultural cognition of risk (e.g., Kahan et al., 2008; Kahan, Braman, Gastil, Slovic & Mertz 2007; Kahan, et al., 2011, Sjöberg, 2000). Scholars argue that individuals form risk perceptions that are congruent with their worldviews. Cultural cognition theorists argue that individuals with relatively hierarchical and individualistic values are predisposed to downplay social risks because they fear that such social risks often result in increased government control over individual's freedom—a value that is highly inconsistent with their value of limited government. In contrast, individuals with egalitarian and communitarian values, who often distrust private control, readily support government interventions and other regulatory policies (e.g., Wildavsky & Dake 1990). Drawing on

the work of Douglas and Wildavsky, (1982), Weber (2006) argued, "Risk perception is viewed as a collective phenomenon by which members of different cultures selectively attend to different categories of danger. Each culture selects some risks for attention and chooses to ignore others. Cultural differences in risk perceptions are explained in terms of their contribution to maintaining a particular way of life" (p.111). For example, in a survey of American respondents, Leiserowitz, Maibach, Roser-Renouf, Smith, and Dawson (2010, p.10) found that "egalitarians are inclined to perceive climate change as a serious risk, and support a variety of policies to address it. However, individualists are more likely to perceive the same risk of climate change as either a low or nonexistent risk, discounting any need for climate specific policies, especially those that involve government action." Similarly, in a nationally representative sample of Americans, Kahan, Jenkins-Smith, and Braman, (2011) found that respondents worldviews not only differed in the state of expert opinion, but also on the choice of who was be considered an "expert." More worrying, Kahan et al., (2011) found that as scientific literacy increases, the degree of cultural polarization also increases, indicating that merely having more knowledge about climate change does not necessarily reflect in either perceiving that climate change is a threat, or that scientists agree that it is a threat.

Interestingly, and more relevant to this study, perceived threat to one's society, rather than perceived threat to one's life and property, is found to be predictive of intentions for voluntary mitigation actions and support for government mitigation policies (Bord et al., 2000). In a nationally representative survey of Americans, Bord et al., (2000) found that perceived societal risk of global warming was a significant predictor of

behavioral intentions, rather than perceived personal risk. Bord et al., (2000, p. 207) argued that, "Risk research seldom makes a distinction between perceived personal risk and perceived societal risk." Risks that are beyond one's immediate control are more likely to be perceived as manageable when individuals act together as a collective, influencing collective policy choices (also see Sjöberg, 2000).

Because public risk perceptions often determine "the priorities and legislative agendas of regulatory bodies such as the Environmental Protection Agency" (Slovic, 1999, p.689), understanding how different publics perceive the threat of climate change will have a major impact on communication strategies communities and government institutions employ to increase individual adaptation actions, and support for adaptation measures at the national level.

Recently, several scholars have proposed cognitive models, primarily based on risk perceptions, to understand the public willingness to take up individual adaptation actions and support public policy (e.g., Bostrom et al., 1994; Grothmann and Patt, 2003; Krosnick, Holbrook, Lowe, & Visser, 2006; Lorenzoni, Pidgeon, & O'Connor, 2005). For example, Grothmann and Patt (2003) proposed and tested a model of private proactive adaptation to climate change. Reviewing the work of risk perceptions research and adaptive capacity research, Grothmann and Patt (2005) argued that two important cognitive dimensions of adaptive capacity are (1) people's perceptions of threats or perceived risks, and (2) their beliefs in their individual and community capacity to respond to these threats. Further, they noted several cognitive biases, as mentioned above, that affect how individuals process the risk and efficacy information related to

climate change adaptation, and what behaviors they adopt to mitigate the effects of climate change.

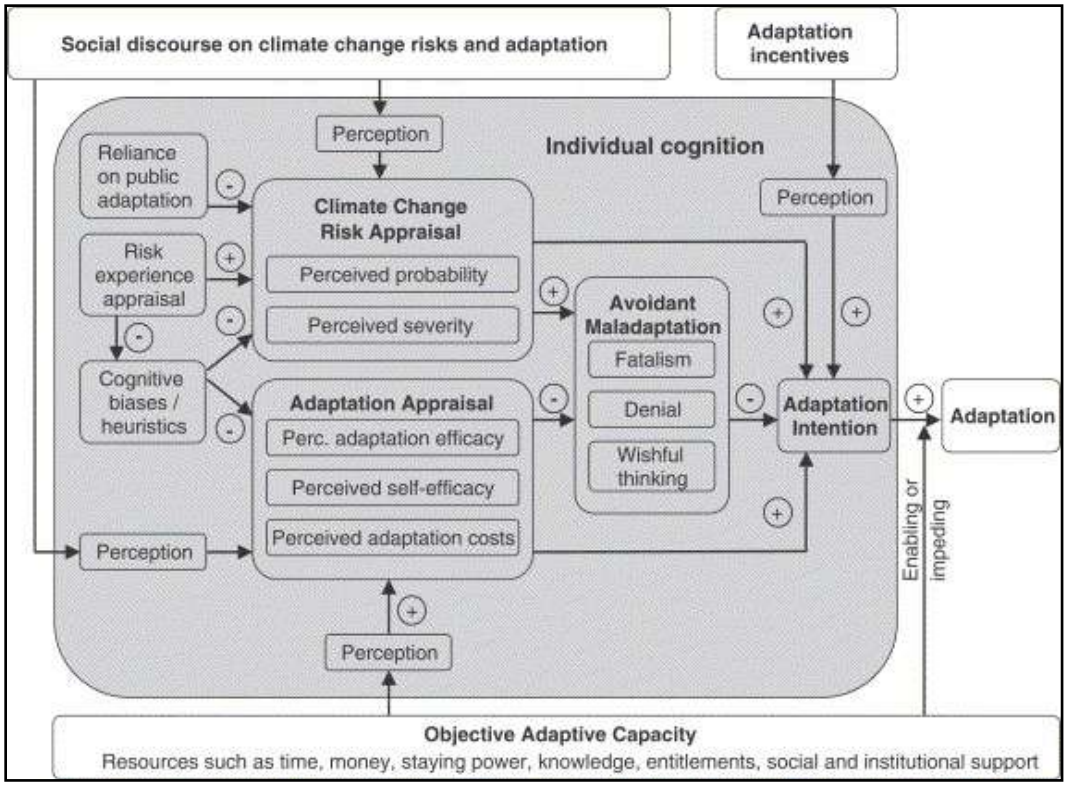

Figure 2: *Process model of private proactive adaptation to climate change. Source Grothmann and Patt, (2005).*

Efficacy perceptions. The second important dimension is perceived efficacy perceptions. According to Albert Bandura, peoples' perceptions about their own

capabilities and that of their group's capabilities are primary drivers of human behavior (Bandura, 1997; 2000). Borrowing on the work of Bandura, and Roger's Protection Motivation Theory (PMT) (Rogers, 1983; Rogers and Prentice-Dunn, 1997), Grothmann and Patt argued that adaptation appraisal consists of three dimensions— person's perceived adaptation efficacy, explained as "the belief in adaptive actions or responses to be effective in protecting oneself or others from being harmed by the threat (e.g., a judgment that changing cropping patterns would prevent damage from a drought)," perceived self-efficacy or "person's perceived ability to perform or carry out these adaptive responses," and perceived adaptation costs, that "include any costs (e.g., monetary, personal, time, effort) associated with taking the risk-reducing adaptive response" (p. 203).

High perception of risks and high adaptive capacity follow successful adaptation behaviors; high-risk perception and low perceived adaptive capacity may result in avoidance, denial, or maladaptive practices, that could, in turn, increase the vulnerability. Applying their model, Grothmann and Patt, (2003) found that among German residents in flood prone region, level of education and income did not explain any variance in proactive actions to adapt to floods, instead, subjective risk and perceived adaptive capacity were significantly predictive of proactive adaptation behaviors.

Although Grothmann and Patt (2003) agree that "people's perceptions of risk or adaptive capacity with regard to climate change are influenced and shaped by what they hear about climate change in the media, from friends, colleagues, neighbors, or public agencies" (p. 205), they largely ignore the role of social norms and beliefs that may

constrain adaptive actions taken by individuals. Moreover, people do not merely rely on their own capabilities to resolve the important issues they face. They often form groups, associations, and cooperative communities to resolve common problems, especially when they feel that the problems are beyond any individuals' capacity (Bandura, 2000). Adger (2003) pointed out that this collective action is particularly observed in "Resource-dependent communities (who) have historically acted collectively to manage weather-dependent, fluctuating, and seasonal resources, such as fish, livestock, and water resources, on which their livelihoods depend" (p. 396). One important factor that has been found to be important to predict group level performance and group success is the construct of collective efficacy.

Perceptions of collective efficacy—or a "group's shared belief in its conjoint capabilities to organize and execute the courses of action required to produce given levels of attainments" (Bandura, 1997, p. 477) —are important cognitive factors that impact collective outcomes. The collective perception of group capabilities influences the kinds of goals a group sets out to achieve, the degree of efforts the group members invest to achieve those goals, which ultimately contribute to achieving group's goals. Collective efficacy refers to "beliefs about a group's capabilities to enlist supporters and resources, to devise and carry out appropriate strategies, and to withstand failures and reprisals" (Bandura, 1986, p. 451).

Climate change is a collectively mediated risk, and adaptation to climate change will require action at the different collective levels. Building on substantial evidence about the ways in which the collective efficacy construct influences group goal setting

and achievement, this dissertation investigates if individuals with stronger perceptions of collective efficacy are more willing to take or support adaptation actions than individuals with lower collective efficacy, and communities with high collective efficacy perform more number of adaptation actions.

1.6 Statement of Purpose

Successful climate change adaptation requires behavioral and policy change at the individual, community levels. Successful adaptation to climate change impacts is not only dependent on the institutional and financial access, but also on cognitive processing of risk and efficacy information. Using data from a nationally representative sample of Indians, this dissertation will assess the relationship between collective efficacy to successfully manage conditions of drinking water scarcity and individual and community participation in—and policy support for—activities that contribute to successful local efforts to ensure water adequacy. Specifically, this dissertation will test if collective efficacy to adapt to drinking water scarcity is associated with people's behavioral involvement in community adaptation efforts and their support for government drinking water policies, and with community's actions to ensure the sufficiency of their drinking water supply.

2. Literature Review: Collective Efficacy for Climate Change Adaptation

This chapter will present the concept of collective efficacy and its significance in predicting successful adaptation to climate change impacts. The first section will provide an overview of the collective efficacy construct in the broader social-cognitive theory theoretical framework. Next, a survey of literature is presented to explicate the concept of collective efficacy in different domains of group activity. The following sections will illustrate the importance of applying the collective efficacy to encourage collective adaptive behaviors. This chapter closes with a rationale for the hypothesis about collective efficacy for climate change adaptation, specifically in the domain of managing drinking water scarcity in India.

2.1 Collective Efficacy: A Conceptual Analysis

According to Bandura (1997), human behavior is influenced by a complex interplay of personal factors, and social environmental constraints. In this triadic reciprocal relationship, the central dimension is human agency—"the essence of humanness"—defined as the capacity of individuals to exercise control over events in one's life. Bandura suggested that self-efficacy—"beliefs in one's capacity to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3)—is the foundation of human agency in Social Cognitive Theory (SCT). Self-

efficacy beliefs govern how individuals feel, think, motivate themselves, and mobilize the resources needed to succeed in their endeavors (Bandura, 1997).

Individuals, however, often act in coordination with others, pooling their resources, to attain goals that are better achievable with collective efforts. People's beliefs in their collective abilities, or their collective efficacy, "influence the types of futures they seek to achieve through collective action, how well they use their resources, how much effort they put into their group endeavor, their staying power when collective efforts fail to produce quick results or meet forcible opposition, and their vulnerability to the discouragement that can beset people taking on tough social problems" (Bandura, 2000, p. 76).

An increasing body of evidence demonstrates that collective efficacy—defined as "a group's shared belief in their conjoint capabilities to organize and execute the courses of action required to produce given levels of attainments" (Bandura, 1997, p. 476)—is an important factor in group functioning and performance (Bandura, 1997, 2006). Groups with high collective efficacy are more likely to set higher goals, mobilize better resources, coordinate and perform behaviors that increase their group's chances to succeed, and preserve inspite of initial setbacks or growing opposition. Little and Madigan (1997) observed that a group's sense of collective efficacy has "a mediating, or facilitating effect on team performance" (p. 518). Efficacy beliefs are "a cognition that mediates between knowledge and action" (Raudenbush, Rowan, & Cheong, 1992, p. 150). Further, "a high sense of efficacy promotes a pro-social orientation characterized

by cooperativeness, helpfulness, and sharing" (Bandura, 2000, p. 77; also see McAlister, Perry, & Parcel, 2008).

The importance of the collective efficacy construct has been validated across many domains including education, sports, organizations, and communities (Bandura, 1997). The strength of the collective efficacy construct has been validated both experimentally (e.g., Durham, Knight, & Locke, 1997; Earley, 1993) as well as in surveys from such diverse samples as educational systems (Bandura, 1997; Goddard, Hoy, & Hoy, 2004), athletic teams (e.g., Feltz & Lirgg, 1998), combat teams (Jex & Bliese, 1999; Lindsley, Mathieu, Heffner, & Brass, 1994), business organizations (Zellars et al., 2001; Little & Madigan, 1994, 1997), and political systems (e.g., Pollock, 1983; Seligson, 1980; Lee, 2006). Accumulated evidence from several research areas indicate that collective efficacy is an important factor in motivational process that affects the behaviors of individuals and groups outcomes (Bandura, 1997).

Bandura argued that collective efficacy functions the same way as personal efficacy beliefs (Bandura, 1997; 2000). Just as personal efficacy influences an individual's cognitive processing and behavior, collective efficacy encourages collective motivation to act. Further, because "it is people acting in concert on a shared belief not a disembodied group mind that is doing the cognising, aspiring, motivating, and regulating," Bandura argued, "there is no emergent entity that operates independently of the beliefs and actions of the individuals who make up a social system" (2002, p. 271). Nonetheless, collective efficacy is an emergent group level property—and is much more than sum of its individual parts (Gibson & Earley, 2007, p. 440).

Benight (2004) and Feltz, Short, and Sullivan (2008) have identified other constructs in the social psychological literature that are similar to collective efficacy. These include collective competence (Zaccaro, Blair, Peterson, & Zazanis, 1995), collective coping (Hallman & Wandersman, 1992), communal coping (Lyons, Mickelson, Sullivan, & Coyne, 1998), and communal mastery (Hobfoll et al., 2002). The following section illustrates critical differences and similarities between these different constructs.

Collective competence. Collective competence is congruent with the conceptual formulation of collective efficacy in that it "…represents a sense of collective competence shared among individuals when allocating, coordinating, and integrating their resources in a successful concerted response to specific situational demands" (Zaccaro, et al. 1995, p. 309). The subtle difference between the two concepts is that Zaccaro, et al. (1995) stressed the need to independently measure coordination, interaction, and integrating components of collective efficacy (e.g., Paskevich et al., 1999), whereas Bandura envelopes the components in a unitary construct (see Feltz, Short, & Sullivan, 2008). Although, Zaccaro, et al. (1995), following Bandura (1987), contended that collective efficacy is an aggregate group level property, according to Feltz, Short, and Sullivan (2008), proponents of Zaccaro, et al., (1995), such as Paskevich et al., (1999), suggest measurement of collective competence as an aggregate score of individual's estimates about "*their team's beliefs* in its capacity rather than *their belief in their team capacities"* (p. 128, original emphasis). Most of the research on collective efficacy, however, has often followed Bandura's conceptualization of collective efficacy.

Communal mastery. According to Hobfoll and colleagues (2002), communal mastery is ‘‘a sense that individuals can overcome life challenges and obstacles through and because of their being interwoven in a close, social network’’ (p. 856). Hobfoll et al., (2002, p. 856) argued, “being part of a closely knit social fabric in itself generates successful confrontation with life problems (i.e., ‘I succeed because I am part of a social group that values me’; Kitayama et al., 1997.)” In other words, one’s sense of mastery is based on the deep networks within a group.

The critical difference between collective efficacy and communal mastery is that communal mastery reflects individual’s benefits just by merely being part of a cohesive group. However, being part of cohesive groups does not mean they will necessary perform more actions for the benefits of the group. For example, according to Benight (2004)

> It is important to differentiate that collective efficacy and communal mastery focus on perceptions of a group’s ability to respond, whereas communal and collective coping focus on social coping behaviors. Collective efficacy may be differentiated from communal mastery in that collective efficacy emphasizes the group’s perception of its ability to meet environmental demands through a variety of targeted mechanisms including coordination of resources, solving community conflicts, and setting strategic goals. Comparatively, communal mastery emphasizes deep social ties within the community in order to meet environmental challenges. One could conceive of a community with strong social ties

> through maladaptive behaviors (e.g., alcohol consumption) with poor perceived collective efficacy. Undoubtedly, however, strong social cohesion with positive coping responses would enhance the collective ability to respond. (pp. 402-403)

Further, Hobfoll et al. (2002) argued that the construct is specifically important with reference to collective cultures, in contrast to individualist cultures. For example, they theorized and found that self-mastery—defined in a manner similar to self-efficacy—is a better predictor of lower depressive mood and anger than communal-mastery among European Americans, in contrast to collectivist Native Americans where collective mastery is a better predictor than self-mastery. Although acknowledging that role of culture in shaping how efficacy beliefs are developed, Bandura (2000, p.77) noted "Perceived personal efficacy contributes to productive functioning by members of collectivistic cultures just as it contributes to functioning by people raised in individualistic cultures (Earley, 1994)." Further, Bandura argued that, "A collectivist society populated with members who are consumed by self-doubts about their capabilities and anticipate the futility of any effort to shape their future would be condemned to a dismal existence" (1995, p. 34).

Communal coping. Lyons, Mickelson, Sullivan, and Coyne (1998) defined communal coping as "pooling of resources and efforts of several individuals (e.g. couples, families, or communities) to confront adversity." That is, individuals when faced with common social stressors ("our problem"), share a communal action orientation to manage those stressors ("our responsibility"). Further, Lyons et al., (1998) clarified

that they use the phrase "communal" rather than "collective" coping to indicate that motives for communal coping may be both individualistic and collectivist, whereas, *collective* coping may refer to purely collectivist functions such as welfare of a group. Benight (2004) argued that communal coping focus was on social coping behaviors, whereas collective efficacy is the perceptions of abilities to perform such behaviors. Further, the construct of collective efficacy encompasses not merely the performance of the behavior, but persistence in the face of obstacles, that increases the chances of achieving success "in-group" endeavors.

Collective coping. Hallman and Wandersman, (1992) defined collective coping as responses for dealing with environmental threats involving family, friends, and colleagues. Similar to the conceptualization of communal coping, collective coping refers to behaviors of using such social ties, rather than a judgment of group ability of collectively cope with environmental threats (Benight, 2004).

Group potency. In the organizational research domain, researchers define group potency as the perceived ability of the group to overcome "any task or demand (a group) may confront" (Zaccaro et al., 1995, p. 314). However, there is a clear distinction between group potency, which refers to an overarching or generalized evaluation of group competence (e.g., "No task is too tough for this team"; Guzzo et al., 1993, p. 98), and collective efficacy, which refers to evaluations of group competence in specific domains of activity (Bandura, 1997). Stajkovic, Lee, and Nyberg (2009), in their meta-analysis, found higher average correlation between collective efficacy and group performance than between group potency and group performance. Further, they found

that collective efficacy mediates the effects of group potency on group performance, consistent with conceptualization of collective efficacy that refers to domain specific beliefs.

Outcome expectancies. Bandura (1997) identified a clear distinction between collective efficacy and outcome expectations—which he defined as beliefs about the positive and negative outcomes, including physical, social, and self-evaluative outcomes that are anticipated as a result of performing a certain behavior. According to Bandura, efficacy beliefs, in part, govern outcome expectations: "one cannot conjure up outcomes without giving thought to what one is doing and how well one is doing it" (Bandura, 1984, p. 232). Further, Bandura clarified that "Expected outcomes contribute to motivation independently of self-efficacy beliefs when outcomes are not completely controlled by quality of performance. This occurs when extraneous factors also affect outcomes, or outcomes are socially tied to a minimum level of performance so that some variations in quality of performance above and below the standard do not produce differential outcomes" (1989, p. 1180). However, the critical factor in a group's success has been theorized and found to be the shared beliefs about group's ability to apply those strategies (i.e., collective efficacy) (Bandura, 1997). This study follows Bandura's conceptualization of collective efficacy where "changes in perceived efficacy result from cognitive processing of the diagnostic information that performances convey about capability rather than the performances per se" (1997, p. 81). People's efficacy beliefs may, in fact, not be based in accurate judgments (Goddard, Hoy, & Hoy, 2004). Nevertheless, the strength with which such beliefs are held can determine the amount of

skills and motivation one generates to resolve one's problems and generate new opportunities.

Domain specific nature of efficacy beliefs. People with same set of skills may differ in their efficacy judgments, which in turn, can influence the level of goals they set for themselves, and the motivation they display in attaining those goals, especially after initial setbacks. There is evidence that this relationship also holds true for groups. For example, Fernández-Ballestero, Díez-Nicolás, Caprara, Barbaranelli, and Bandura (2002), in a survey of Spaniards, found that individual perceive different levels of collective efficacy in different domains of collective activity. They found that people believe their community can play a stronger part in reducing crime than altering economic crises or curbing terrorism. Bandura argued that domain-linked indices of perceived efficacy have greater explanatory and predictive value than do generalized efficacy beliefs (Bandura, 1997).

Degree of interdependence. In addition, Bandura theorized that collective efficacy for a particular action is influenced by the degree of interdependence between members of a group: group goal attainment is most likely under conditions of high collective efficacy and high group interdependence (e.g., Gully, Incalcaterra, Joshi, & Beaubien, 2002). Small groups are more likely to have a strong sense of collective efficacy because it is easier to coordinate the actions of a small group rather than a large group (Zaccaro et al., 1995). For example, in team sports, an individual's assessment of his/her team's capability depends on the collective assessments of other team member's abilities to execute their roles individually, and in coordination with each other (Bandura,

2000). Similarly, the collective efficacy assessments can also depend on key or important teammates capabilities (Bandura, 2000), and leadership traits such as the effectiveness of the group's leader (Watson, Chemers, & Preiser, 2001).

Social cohesion and informal social control. Sociological research on crime in neighborhoods has often conceptualized collective efficacy as involving two features—perceived social cohesion, and social control (e.g., Sampson et al., 1997). This conceptualization of collective efficacy – and the resulting operationalization – is sufficiently distinct from that proposed by Bandura (1997) to conclude that this line of research is examining an entirely separate construct.

For example, social cohesion is often measured with items such as "people around here are willing to help their neighbors," "this is a close -knit neighborhood," "people in this neighborhood can be trusted," "people in this neighborhood generally don't get along with each other," and "people in this neighborhood do not share the same values" Sampson Raudenbush, and Earls (1997, p. 920). Similarly, social control is measured by items which assess "monitoring of spontaneous play groups among children, willingness to intervene to prevent acts such as truancy and street corner "hanging" by teenage peer groups, and the confrontation of persons who are exploiting or disturbing public space" (Sampson, Raudenbush, & Earls, 1997, p. 918).

Collective efficacy, however, represents the cognitive assessment of group competencies, which may be influenced by the degree of cohesion, and will be manifested in behavior—through formal and informal social control. Further, cohesion and collective efficacy are often considered as separate constructs in several other

domains such as sports domains. For example, Kozub and McDonnell (2000) found that when team members perceived the team to be working together in common pursuit of goals (cohesion), the more confident they were about their team's ability to succeed. Further, Carroll and Reese (2003) found that collective efficacy is positively correlated with both belonging and more importantly with activism—measured with three items "In comparison with others you know, how active and involved are you in your local community?", "In the past three months, I have spent a lot of time working with others in my local community to solve problems of concerns to us.", and "I frequently participate in community activities."

2.2 Operational Analysis

Bandura has described three different approaches to measuring collective efficacy. One approach is to aggregate the self-efficacy assessments of all members of the group. In this approach, responses to "I" referent statement (e.g., "I can do…") are averaged to access the collective efficacy at the group level (Bandura, 2000; Goddard, et al., 2004). Bandura argued that such operationalization of collective efficacy is not robust because it ignores the "coordinative and interactive aspects operating within groups" (Bandura, 2000, p. 76). A better method to measure collective efficacy is to aggregate measures to responses to "we" referent statements (e.g., "We—my neighbors and I—can work together to do…"). That is, collective efficacy is measured as an aggregate of members' appraisals of their group capabilities as a whole. Bandura (1997) conceptualized that "perceived collective efficacy is an emergent group-level attribute rather than simply the sum of members' perceived personal efficacies" (p. 478).

Empirical evidence also suggests that collective efficacy measured at the aggregate or collective level is a better predictor of group performance than the aggregate of individual self-efficacy perceptions. For example, Goddard (2003) found individual perceptions of self-capability varied less than 5% between groups. In sharp contrast, individual perceptions of their respective group's capability varied more than 40% among groups. Similarly, Feltz and Lirgg (1998), examining aggregated self-efficacy and aggregated collective efficacy of six teams for 32 competitions played over 16 weekends, found that aggregated collective efficacy was a better predictor of team performance than was aggregated self-efficacy, within teams and across games.

A third approach to measuring collective efficacy is to ask group members to discuss group capabilities and reach a consensus about the group's collective efficacy (Bandura, 2000; Goddard, et al., 2004; Guzzo, Yost, Campbell, & Shea, 1993). However, Bandura (1997) argued that group consensus approach is susceptible to social desirability bias, as well as ignoring within-group differences of collective efficacy beliefs: "Forming a consensual judgment of a group's efficacy via group discussion is subject to the distorting vagaries of social persuasion by individuals who command power and by pressures for conformity. Assessment by constructed consensus may itself change the efficacy beliefs. Moreover, a social system is not a monolith. A forced consensus masks the variability in efficacy beliefs among factions within a system" (Bandura, 2000, p.76). For example, Goddard tested a variant of group consensus approach by measuring collective efficacy as the amount of agreement among members in their assessment of collective efficacy (Goddard, 2001). Although their study found

that the level of agreement did vary across schools, it was a non-significant predictor of school success. Instead, they found that the aggregate measure of perceived collective efficacy—i.e., the school's mean score—to be a strong positive predictor of student achievement. In other words, the group consensus measured as "amount of agreement" did not add any explanatory value.

Given the different domains in which the construct of collective efficacy has been applied, there is considerable homogeneity in the manner in which scholars have operationalized the construct. Collective efficacy in families, neighborhoods, sports teams, educational institutions, and other groups is measured as individual's perceptions about their group's abilities.

2.3 Antecedents of Collective Efficacy

Bandura (1997) postulated four main forms of influences on efficacy assessments: mastery experience, vicarious experience, social persuasion, and affective state.

Prior experience of success is one of the most important determinants of efficacy beliefs as personal experiences provide the most credible evidence for individuals to assess their abilities. Past success can enhance perceived efficacy, whereas failure can undermine the efficacy beliefs. However, Bandura (1995) cautions that self-efficacy does not merely refer to adopting ready-made habits. Rather, personal experience of overcoming difficult obstacles with perseverant efforts—that requires "acquiring the cognitive, behavioral, and self-regulatory tools" (p. 3)—are far more powerful influences on efficacy. A similar affect is expected for collective efficacy as well. For example**,** Goddard (2001) found that prior school reading achievement was a significant positive

predictor of teacher's perceptions of collective efficacy among schools. Similarly, prior team performance has found to be significant predictor as well as a byproduct of subsequent aggregated collective efficacy (e.g., Feltz & Lirgg, 1998; Myers, Feltz, & Short, 2004; Watson, Chemers, & Preiser, 2001).

Observing people who are similar to oneself succeed provides another source for efficacy beliefs (Bandura, 1997). People and groups are adept at learning vicariously through observation of the performances of others, especially others who are perceived by observers as being similar to themselves in social characteristics or personality dispositions. Such vicarious learning influences subsequent actions, in part, through its influence on efficacy perceptions (Maibach, 1990). Beyond the actual skills learned, Bandura (1995) argued that the efficacy beliefs of vicarious learners can be strengthened through observing the determined attitudes of behavioral models: "Undaunted attitudes exhibited by perseverant models as they cope with obstacles repeatedly thrown in their path can be more enabling to others than the particular skills being modeled" (p.4).

A third source of efficacy beliefs is the verbal persuasion given by trusted others – such as teachers, coaches, opinion leaders, and accomplished peers. According to Goddard, Hoy, and Hoy (2004, p. 6), "Collective efficacy perceptions serve as normative expectations for goal attainment. A robust sense of group capability establishes a strong press for collective performance. Teachers new to a given school are socialized by the organization (Hoy & Woolfolk, 1990) and quickly learn about this aspect of their school's culture in interactions with other teachers and administrators. In schools possessed by a high degree of perceived collective efficacy, new teachers learn that extra

effort and educational success are the norm. In turn, these high expectations for action create a normative press that encourages all teachers to do what it takes to excel and discourages them from giving up when faced with difficult obstacles."

Individual's affective states also affect the judgment of their competence. Positive moods increase perceived efficacy, whereas sad moods diminish it (Bandura, 1997). In a similar fashion, Goddard, Hoy, and Hoy (2004) argued that "Organizations with strong beliefs in group capability can tolerate pressure and crises and continue to function without debilitating consequences; indeed, such organizations learn to rise to the challenge when confronted with disruptive forces. Less efficacious organizations, however, are more likely to react dysfunctional, which, in turn, increases the likelihood of failure. Thus, affective states may influence how organizations interpret and react to the myriad challenges they face" (p. 6).

Above all, Bandura argued that degree of obstacles, effort, and perseverance, and success or failures are subjective interpretations: "changes in perceived efficacy result from cognitive processing of the diagnostic information that performances convey about capability rather than the performances per se" (1997, p. 81).

2.4 Consequences of Collective Efficacy

Bandura (1997) argued that collective efficacy beliefs regulate human behavior through four major processes: cognitive, motivational, emotional, and decisional. Research on collective efficacy across many domains of group activities has been consistently found be associated with individual and group level outcomes (e.g., Bandura, 2000; Perkins, Brown, & Taylor, 1996). Bandura (2000, p. 78) argued, "higher the

perceived collective efficacy, the higher the groups' motivational investment in their under-takings, the stronger their staying power in the face of impediments and setbacks, and the greater their performance accomplishments." Elaborating the link between collective efficacy beliefs and group achievement, Goddard, Hoy and Hoy (2004) pointed out that a robust sense of group capability establishes social expectations for success that fosters organizational members to resiliently work towards group objectives. The following sections elaborate the effect of collective efficacy in different domains of group activities.

Collective efficacy and student achievement. Perceived collective efficacy among teachers has been found to be a robust and powerful predictor of student performance and school achievement (Bandura, 1997), even when factors such as traditional social and economic factors, and students' prior achievement are included or taken into account (e.g., Goddard, 2001). In the domain of education research, collective efficacy "*refers to the perceptions of teachers in a school that the faculty as a whole can organize and execute the courses of action required to have a positive effect on students*" (Goddard & Goddard, 2001, p. 809, original emphasis). For example, Goddard and Goddard (2001) found that collective efficacy, when tested as a single predictor, explained about 75% of between school variance in teachers' efficacy. Adding important traditional determinants such as socio-economic status of students, proportion of minority students, size, and prior-achievement in the final model, explained only an additional 5% of variance. Further, only collective efficacy remained as the significant relationship with teacher efficacy in the presence of other factors—indicating that collective efficacy

predicts substantial variation in teacher efficacy beliefs in different schools, over and above other traditional socio-economic factors.

Collective efficacy and health outcomes. Collective efficacy has been found to be associated with positive health outcomes (e.g., Campbell & Jovchelovitch, 2000; Chung et al., 2009; Cohen, Finch, Bower, & Sastry, 2006; McAlister, Perry, & Parcel, 2008; Smith, Ferrara, & Witte, 2007). Smith, Ferrara, and Witte (2007), reviewing the literature of collective efficacy on individual and collective health outcomes, summarized that "Members of communities with high collective efficacy versus low collective efficacy participate more in their sociocultural environments, secure and access more community resources, develop stronger networks of social support, and feel more personal empowerment (Baum, 1999; Dutta-Bergman, 2003; Rappaport, 1987; Repucci, Woolard, & Fried, 1999)" (p. 58). For example, Chung et al., (2009) found that individual's with high levels of collective efficacy are most engaged with their communities endeavors to reduce the incidence of depression. Similarly, in a survey of Namibian health care workers and households, Smith Ferrara, and Witte (2007) found collective efficacy to be associated with willingness to adopt AIDS orphans.

Collective efficacy and organizational success. Within the organizational context, collective efficacy has been shown to be positively associated with group problem solving, group learning, and group performance (e.g., Gully, Incalcaterra, Joshi, & Beaubien, 2002; Little & Madigan, 1994, 1997). Gully, et al. (2002), in a meta-analysis involving 2042 teams, found a significant average correlation of .41 between collective efficacy and group performance. In a more recent meta-analysis, Stajkovic,

Lee, Nyberg (2009) found a significant average correlation of .35 between collective efficacy and group performance.

Similarly, collective efficacy has been found to be positively associated with employee job satisfaction, regardless of work-load (Jex & Bliese 1999; Jex et al., 2001; Walumbwa et al., 2004; Zellars et al., 2001). In a survey of healthcare professionals in elder care centers in 35 Danish municipalities, Jensen and colleagues (2011) found that employees who feel that they work in a group with high collective efficacy expressed less intention to leave their job inspite of high levels of physical workload, whereas employees who feel they work in groups with lower collective efficacy expressed stronger intensions to quit the job.

The level of task interdependence among group members—the extent to which a task requires group members to interact (Thompson, 1967)—has been argued to exert significant influence on the relationship between collective efficacy and group performance. In organizational settings with minimum interdependence, where work is produced largely independent of each other, the success in such organizational endeavors has been argued to be largely dependent on individual competencies. Conversely, in highly interdependent settings which require coordinated efforts of different group members, collective efficacy has been found to have much more significant effect on group performance (e.g., Stajkovic, Lee, & Nyberg, 2009). Stajkovic, Lee, and Nyberg, (2009) found collective efficacy to be a significant predictor of group performance across all levels of task interdependence, although the relationship is stronger at higher levels of task interdependence: the correlation of collective efficacy and task independence at high,

medium, and low levels of task interdependence were $r = .45$, $p < .01$; $r = .25$, $p < .01$; $r = .10$, $p < .05$, respectively.

Collective efficacy and sports team performance. In sports research, Watson, Chemers, and Preiser (2001) found that basketball teams with higher average collective efficacy at the beginning of a season were placed at better standings at the season's end. Similarly, in a longitudinal study of college 10 football teams in 8 consecutive games, Myers, Feltz and Short (2004) found that aggregated collective efficacy prior to performance was a positive predictor of subsequent offensive performance, and previous offensive performance was a positive predictor of subsequent aggregated collective efficacy, within weeks and across games—emphasizing the reciprocal effects of efficacy beliefs and group performance (Bandura, 2000).

2.5 Individual-Level Collective Efficacy and Behavioral Invovlement in Climate Change-Relevant Adaptation Activities

Bandura, in conceptualizing collective efficacy, often refers to environmental problems to explain the powerful influence of human behavior in creating and addressing global environmental problems. Bandura pointed out the "vastly enhanced human power to transform the environment (that) can have pervasive effects not only on current life, but on how future generations live out their lives" (Bandura, 1995, p. 1). However, he also indicated the need for—and the power of—people working together "to realize the shared destiny they desire and to preserve a habitable environment for generations to come" (Bandura, 1995, p. 2).

Bandura noted that "collective efficacy represents a sense of collective competence shared among individuals when allocating, coordinating, and integrating their resources in a successful concerted response to specific situational demands" (Bandura, 1986, p.447). People who are more convinced that their community can accomplish valued objectives are more likely to become involved with their community, and high performing communities are more likely to engage their members in contributing to the group goals. Bandura (1997, 2000) refers to this as a sphere of reciprocal causality (see Carroll & Reese, 2003; Carroll, Rosson, & Zhou, 2005).

Recently, social scientists have suggested that collective efficacy is a potentially important construct in understanding individual and group level behaviors relevant to climate change (e.g., Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007; Maibach, Roser-Renouf, & Leiserowitz, 2008; Roser-Renouf & Nisbet, 2008). Mitigation of—and even more so, adaptation to—climate change requires coordinated actions among community members.

Evidence from the field of development communication indicates that a community's sense of collective efficacy can be increased through various media channels, and increases in collective efficacy, in turn, influence individual participation in community activities. Over time, communities that are highly efficacious are found to be associated with better health outcomes such as reduced disease rates (e.g., Papa et al., 2000; Papa & Singhal, 2009; Singhal & Rogers, 1999)

Bandura argued "if people are to make decisions supportive of sustained development, they need to be informed of the ecological costs of their consummatory

practices and enabled and motivated to turn enlightened concern into constructive courses of action. This is best achieved through multiple modes of communication (Singhal & Rogers, 1999)" (Bandura, 2002, p.18). Papa et al. (2000, p. 45) recounting the effects of radio program *Yeh Kahan Aa Gaye Hum* (Where Have We Arrived?) on collective action, mentioned that,

> The members of the listeners' club listened to the program collectively and discussed the content, charting new courses for environmental action in Lutsaan. For example, they persuaded other villagers to build pit latrines to improve sanitation and launched a tree-planting campaign to beautify the environment and to produce fruits for home consumption and sale. Members of the listeners' club also went on a bicycle tour in order to educate surrounding villages about fuel conservation to reduce pollution…encountering several drivers of auto-rickshaws who were allowing their engines to idle at a railroad crossing while waiting for a train to pass. The club members explained to the drivers that they were polluting the environment, and persuaded them to switch off their engines. Finally, members of the listeners club approached villages who smoke cigarettes, sparking conversations about potential health hazards and problems of air pollution. Thus, this organized group of listeners took responsibility for orchestrating collective efforts to improve the lives of others in Lutsaan. These examples show how conversations sparked by

entertainment-education programs may inspire people to engage in collective action to address social problems.

Collective efficacy and natural disaster management. Increased prevalence and severity of weather-related natural disasters are one of the mechanisms by which climate change harms human well-being. Therefore, the literature on natural disaster management is relevant to climate change adaptation. Natural disasters pose significant individual and social risks, and often require coordinated action to mitigate the risks. For example, Benight (2004) found that collective efficacy and perceived social support buffer the effects of disaster on psychological distress of communities. Further, Benight (2004) found that when resource loss was high, individuals with low perceived collective efficacy experienced higher distress than individuals with high collective efficacy. Increasing a community's resilience immediately after a disaster, Benight (2004) argued, would help rebuild social support systems and increase collective efficacy beliefs, thereby helping the communities to bounce back. Similarly, collective efficacy has also been found to positively influence people's intentions to adapt to earthquake threats (Paton 2008; Paton et al., 2010). Further, Solberg, Rossetto, and Joffe, (2010) argued, "collective efficacy has a positive effect on empowerment and empowerment tends to have a positive influence on adjustment intention, if relations between communities and authorities are trusting and respectful" (p. 1673).

Collective efficacy and behavioral involvement in community actions. People's beliefs about their groups collective abilities is found to positively affect their degree of involvement in collective tasks across several domains of group activities

(Chung et al., 2009; Jex & Bliese 1999; Jex et al., 2001; Lee, 2006; Walumbwa et al., 2004; Zellars et al., 2001). For example, Chung et al., (2009) found that individual's with high levels of collective efficacy are most engaged with their communities endeavors to reduce the incidence of depression. Reviewing the literature on collective efficacy and health outcomes, Goddard and Salloum (2011, p. 11) argued, "Collective efficacy beliefs may thus foster decisions to gather health-related resources, eliminate environmental hazards to health, and promote communication among neighbors, each of which in turn could facilitate dissemination of health information, prevent disease, and increase the likelihood of treatment." Similarly, in organizational domain, individual's with high levels of collective efficacy are found to persist even under difficult circumstances. They also display more job satisfaction, and express weak intentions to quit the team even when experiencing high degrees of stress and strain (Jex & Gudanowski ,1992; Riggs, 1989; Zellars et al., 2001). Further, Lee (2005) found a positive association between collective efficacy and intentions to participate in political protests in support of more democratic reforms in Hong Kong.

Because "social reforms are typically the product of an efficacious and highly committed minority of people who invest themselves in shaping a better future," (Bandura, 1997, p. 489), individuals with a resilient sense of collective efficacy are critical in initial group organizing process. Individuals with higher levels of collective efficacy within a group are more likely to be committed to the group goals, participate more often in group tasks, enlist greater resources, and provide encouragement to others in the team during tough times than individuals with low levels of collective, that affects

the outcomes of such group efforts. According to Bandura, "belief in collective efficacy rests on the expectation that social reforms are achievable by a critical mass of activists rather than requiring universal participation" (Bandura, 1997, p. 489). Further, Bandura (1997, p. 480) argued "when a key function for group success is performed by a highly efficacious individual, members will have a higher opinion of their group's capability than of their own individual capabilities." In other words, high collective efficacy individuals, by performing more numerous community behaviors, can provide valuable sources of collective efficacy to other members of the community through vicarious learning opportunities, socially persuade other members of the group to take similar tasks, and create a positive atmosphere for collective action—three of the four sources of influence of collective efficacy (Bandura, 1997; Goddard, Hoy, & Hoy, 2004). Because groups with high levels of collective efficacy often achieve their group goals, being part of a successful group and doing things that successful team members do provides the most important source of collective efficacy—mastery experience (Bandura, 1997, Goddard, Hoy, & Hoy, 2004).

In a survey of respondents from Kiribati—a region in Pacific that suffers from severe water stress due to population density— Kuruppu and Liverman (2011) found that individuals follow distinct cognitive routes to assess and adapt to different climate change impacts such as increasing water scarcity, sea level rise among others. People have stronger perceptions of efficacy if they have prior experience with dealing those risks—such as adaptation to drinking water scarcity. In contrast, if people do not have any prior experience with risk events, such as sea level rise, they tend to have low efficacy

perceptions. The higher the efficacy perceptions, Kuruppu and Liverman (2011) found, the higher the individual's intentions to take up adaptation actions in the future. Although Kuruppu and Liverman (2011) referred to self-efficacy beliefs, it is expected that individuals', when they perceive about their group's ability, would follow similar distinct cognitive processes about different collective tasks. As Bandura (2000) noted, perceptions of collective efficacy "serve functions similar to those of personal efficacy beliefs and operate through similar processes" (p. 76) and are domain specific. Moreover, as adaptation to climate change require coordinated action by most if not all members of a community, they may want to act together, as a unified force, to increase their chances to succeed. This study extends the findings of Kuruppu and Liverman (2011) in that it measures the influence of collective efficacy and behavioral involvement in one domain of climate change adaptation—behavioral involvement in community activities to address drinking water scarcity.

Hypothesis 1: Individuals' collective efficacy regarding their community's capacity to ensure the adequacy of its drinking water supply will be positively associated with participation in community activities to address drinking water scarcity.

2.6 Collective Efficacy and Support for Government policies

Referring to the influence of collective efficacy on participation in political activity, Bandura (2000, p 78) argued:

> The conjoint influence of perceived collective political efficacy and trust in the governmental system predicts the form and level of people's political activity (Bandura, 1997). People who believe they can achieve

> desired changes through their collective voice, and who view their governmental systems as trustworthy, are active participants in conventional political activities. Those who believe they can accomplish social changes by perseverant collective action, but view the governing systems and office-holders as untrustworthy, favor more confrontive and coercive tactics outside the traditional political channels. The politically apathetic have little faith that they can influence governmental functioning through collective initiatives, and are disaffected from the political system, believing it ignores their interests.

Prior studies have found collective efficacy to be significant predictor protest participation and movement's success (Lee, 2006, 2010; Mummendey et al. 1999, Van Zomeren, Postmes, & Spears, 2008). For example, Lee (2006, 2010) found that collective efficacy had a significant effect on Hong Kong citizens' intention to participate in the pro-democracy protests and support for more democratic reforms. Specifically, Lee (2010) found that people's perceptions of civic competence of fellow citizens, perception of representativeness of political system, and perceptions of news media positively affect collective efficacy, which in turn, affects political participation. Lee (2010, p.406) concluded that "people's collective political efficacy beliefs are inferences people make based on their perceptions of the political environment and their understandings of the political process." Further, Lee found that Hong Kong residents had higher perceptions of collective efficacy to bring about political change than in their own individual abilities. As Lee (2006, p. 300) argued, "Citizens may recognize that

only the citizenry acting collectively, rather than individuals acting separately, can help to accomplish the task."

Borrowing on work of Albert Bandura, Mummendey and colleagues (1999) argued that group efficacy would play a "central role in theories that explain collective actions" (p. 243). Reviewing the literature on collective action, specifically to resource mobilization theory, Van Zomeren, Postmes, and Spears (2008, p. 506) argued, "social protest constitutes a set of rational collective actions by groups to advance their goals and interests, pressurizing those in power to submit to the demands of the disadvantaged. In this perspective, collective action is a strategic and political enterprise…." Specific to climate change policy support measures, Lubell, Zahran and Vedlitz (2007, p. 394) argued that global warming activism will be a function of group efficacy that they defined as probability that the group will be successful, apart from other variables (expected value of participation, marginal influence of the individual's contribution on the probability of success or personal influence, value of collective good, selective cost of participation and selective benefits available from participation). According to Lubell, Zahran and Vedlitz (2007), perception of "group efficacy" is an important predictor of individual participation in collective action because "rational" individuals are less likely to contribute in a group that they perceive to be ineffective. Further, they argued that individuals who support government policies that are congruent with their own preferences "receive psychological benefits from expressing their preferences through global warming activism, or enjoy the social benefits of participating with like-minded citizens. The importance of expressive or ideological benefits is well-established in

empirical studies on traditional forms of political participation (Leighey, 1995; Whiteley, 1995)" (p. 398).

Government policies, on one hand, by providing financial and other resources to local government bodies, can constrain or enhance a community's ability to take up adaptation actions. On the other hand, individuals can form powerful collectives to influence the kinds of policies their government can formulate and implement. Individuals with strong sense of their group's capabilities may support government policies that they perceive can enhance their own community's ability to adapt to climate change impacts. For example, reviewing the work on collective efficacy and health outcomes, Bandura (1998, p. 22) noted, "A comprehensive approach to health must provide people with the knowledge, skills and sense of collective efficacy to mount social and policy initiatives that affect human health. Such social efforts are aimed at raising public awareness of health hazards, educating and influencing policymakers, mobilizing public support for policy initiatives, and devising effective strategies for improving health conditions. Knowledge on how to develop and exercise collective efficacy can provide the guidelines for moving us further in the enhancement of human health."

Based on the above literature, the following hypothesis is proposed:

Hypothesis 2: Individuals' collective efficacy regarding their community's capacity to ensure the adequacy of its drinking water supply will be positively associated with their support for government policies to ensure the adequacy of its drinking water supply.

2.7 Community-Level Collective Efficacy and Community Drinking Water Adaptation

Collective efficacy has been found to be a robust indicator of group performance and group goal attainments. Elaborating the link between high collective efficacy and goal attainment, Goddard, Hoy and Hoy (2004) argued that collective efficacy perceptions serve as normative expectations for group goal attainment. High collective efficacy establishes a strong normative influence of the group that affect "the diligence and resolve with which groups choose to pursue their goals" (Goddard, Hoy, & Hoy, 2004, p. 8). Further, they argued that collective efficacy establishes a social norm where "collective efficacy beliefs serve to encourage certain actions and constrain others" (p.8). Social norms, according to Coleman (1987, 1988, 1994) help a community govern the behavior of its members. Similarly, Ostrom (2000, pp. 143-144) defined social norms as "shared understandings about actions that are obligatory, permitted, or forbidden (Crawford & Ostrom, 1995)." In other words, social norms refer to a set of socially sanctioned individual behaviors of a group. For example, referring to the effect of collective efficacy on new faculty recruits, Goddard, Hoy, and Hoy (2004) argued, "Organizational socialization involves the communication of influential normative expectations for achievement. Indeed, the research analyzed here suggests that a strong sense of collective efficacy enhances teachers' self-efficacy beliefs while weak collective efficacy beliefs undermine teachers' sense of efficacy, and vice versa. This mutual influence relationship helps explain the consistent finding that perceived collective efficacy is a significant factor in the attainment of organizational goals" (p.10).

Increasing evidence from the field of community water management projects suggests that communities with prior experience of successful interventions are more likely to seek and find opportunities to help their community members adapt to drinking water scarcity (e.g., Eakin, 2005; Manikutty, 1998; Murtinho, 2010, Narayan, 1992, also see Cohen & Uphoff, 1980). Experience of successful management of resources in the past, or such mastery experience in coordinating with internal stakeholders and external agencies, is an important source of efficacy information for community members. By cultivating a resilient sense of collective achievement, a community is more likely enhance the ability of its community members to pool their resources together and work ardently towards group goal achievements. In addition, communities with high perceptions of collective efficacy are more likely to form more powerful collectives and put more pressure on external agencies to provide necessary resources to help their community members adapt to local vulnerabilities. For example, Murtinho (2010), in a study of Water User Associations—community based organizations to manage water resources—found that communities with good organizing abilities are successful in requesting, and receiving external funding.

Based on the above findings, the following hypothesis is proposed:

Hypothesis 3: Aggregate community-level perceptions of collective efficacy regarding the community's ability to ensure the adequacy of its drinking water supply will be positively associated with community responses.

Control variables. Past research suggests that socioeconomic factors also influence collective efficacy and participation in community activities. For example

women, who often face social and cultural barriers for equitable access and participation (e.g., Bussey & Bandura, 1999), often perceive themselves to be less efficacious compared to men about their ability to impact on social or political circumstances. Low representation of women in many spheres also influences the gap between perceptions of collective efficacy perceptions. Similarly, Bandura and colleagues (Fernández-Ballesteros et al., 2002) found that age has distinct effects on collective efficacy beliefs. Although younger respondents generally report high individual efficacy in effecting social change compared to older counterparts, however, both the younger and older respondents do not differ in their perceived efficacy to do so collectively. Explaining this finding, Fernández-Ballesteros et al., (2002) argued that younger respondents collective efficacy primarily stems from their personal efficacy beliefs to bring about social change because of their age cycle that is dominated by a new world of opportunities. In contrast, older respondent's judgments are a result of "lifetime wrenching sociopolitical changes" (p. 121) that often undermines personal efficacy but enhances beliefs about collective abilities. Further, more educated and higher income individuals report high collective efficacy because of their ability to command resources and influence actions through wider social ties (Fernández-Ballesteros et al., 2002). Further, respondents living in cohesive communities (e.g., Carroll, & Resse, 2002), and respondents living in the houses they own (e.g., Sampson, 1997) are found to have stronger collective efficacy beliefs, probably due to the many opportunities to work together and build their collective efficacy beliefs. Based on the empirical findings, the construct of collective efficacy

used in this study is validated using correlational analysis and *t*-tests with socioeconomic characteristics of the respondents.

As mentioned earlier, substantial body of research suggests that people's risk perceptions—in its various dimensions—can affect their behavioral involvement in more climate positive activities (e.g., Bord et al., 2000; Lorenzoni, Nicholson-Cole, & Whitmarsh 2007; Lorenzoni, Pidgeon, & O'Connor, 2005; Lubell, Zahran, & Vedlitz, 2007; O'Connor, Bord, & Fisher, 1999). For example O'Connor, Bord, and Fisher (1999) who found that risk perceptions retained its significance even after adding environmental belief's to the model, argued, "Risk perceptions are not a surrogate for general environmental beliefs, but have their own power to account for behavioral intentions" (p. 469). In an interesting study, Zahran, Brody, Vedlitz, Grover and Miller (2008) found that US localities that saw higher number of people getting killed and injured due to extreme weather events and climatic changes were more likely to be part of Cities for Climate Protection (CCP) campaign, a program that involves 675 municipalities worldwide to take up provocative risk-mitigation steps for climate change impacts.

Apart from risk perceptions, other studies have also found that socioeconomic characteristics can also influence the outcome measures of this study—behavioral involvement in climate change adaptation activities and policy support (e.g., O'Connor, Bord, & Fisher, 1999; Semenza et al., 2008). For example, O'Connor, Bord, and Fisher, (1999) found that women have higher intensions to take up voluntary actions than men, a finding that is consistent across other studies (e.g., Slovic, 1997). Similarly, Semenza et

al., (2008) found that respondents with higher level of education, those belonging to younger age groups were more likely to have performed climate friendly behaviors. Similarly, at the collective-level, the socioeconomic characteristics of the group, such as number of educated people in the group, also affect how different groups access to resources that may constrain their ability to implement community wide adaptation actions (Bandura, 1997). Groups whose membership consists of highly educated and more wealthy individuals often command more resources and influence social outcomes because of their deep entrenched networks with similar other powerful groups, and the government agencies. In short, empirical evidence suggests that risk perceptions and socioeconomic characteristics may have a prior association with the outcome variables of behavioral involvement and policy support. To identify the unique relationship between collective efficacy and the outcome measures, relationship between the risk perceptions and socioeconomic characteristics are statistically controlled in this study.

2.8 Summary

The role of collective efficacy in climate change adaptation is an important research topic because community actions facilitate or constrain adaptive capacity. The global nature of climate change can leave people feeling helpless, concluding that they are powerless to affect the scale of the problem. Adaptation, however, is an inherently local affair; local action can have a profound positive impact on the wellbeing of people in the community. Research that illuminates peoples' perceptions of their community's ability to take to such actions, and reveals how such perceptions in turn can influence individual and collective actions, has the potential to make a significant contribution to

the academic literature—in the social sciences in general, and in climate change studies in particular—and to the adaptive capacity of communities worldwide. This study, therefore, tests if there is a significant association between individuals' and communities' collective efficacy beliefs and their actions taken – and their support for policies – that contribute to the public wellbeing.

3. Methods

This dissertation tests the role of collective efficacy in increasing Indian community's capacity to adapt to drinking water scarcity using data from a national sample survey. The first section will present an overview of the formative research to develop the survey instrument and the sampling plan. Next, the constructs used in this study for analysis are presented. Finally, the data reduction and data analysis strategies used for hypothesis testing are presented.

3.1 Formative Research

In December 2010 and January 2011, 25 interviews were conducted with Indian experts on climate change and other sustainable development issues to gauge the broader context of the climate change discourse(s) in India. The semi-structured interviews began by exploring the climate related work of the interviewees, their perceptions of the state of public and policymakers' awareness, beliefs, attitudes, and policy support for climate change. Most of the interviewees agreed that a majority of Indians may be unaware of "climate change" or "global warming" terms, nevertheless, may have experienced localized impacts of climate change such as increasing water scarcity for human consumption and agriculture purposes, and increasing intensity and frequency of extreme weather events such as floods, droughts, and heat waves. Finally, the interviewees were also urged to suggest questions for the national survey. These

suggestions—and other information gleaned from the interviews—provided important context that was used in developing the survey instrument (see Thaker & Leiserowitz, 2012).

3.2 Sampling and Data Collection

To assess Indians' beliefs, attitudes, and policy preferences about climate change, Dr. Anthony Leiserowitz and the author of this study developed approximately 70 survey items for inclusion on a questionnaire. The survey items were derived from the formative research as discussed above, from prior public opinion surveys in India (e.g., "State of India's Environment Survey," CSDS, 2008), and most prominently, from the Climate Change in the American Mind survey series (see Leiserowitz et al., 2012). Approval for primary data collection was received from Human Subjects Review Board at Yale University. Approval for the secondary data analysis conducted in this study was sought and received from Human Subjects Review Board at George Mason University.

This survey was designed to be nationally representative, and to be administered face-to-face in the homes of randomly selected respondents. Conducting national surveys in developing countries such as India presents several challenges (e.g., Bulmer & Warwick, 1993; Heath, Fisher, & Smith, 2005; Inglehart, 1997, Karandikar, Payne, & Yadav, 2002). India is a vast country that encompasses several geographical regions and is home to diverse ethnic and linguistic groups. Mountainous terrain, such as North-Eastern Himalayan region, and lack of regular transportation facilities in sparsely populated rural regions make it difficult for survey researchers to access and represent such socio-demographic diversity. Further, a large proportion of the population does not

own telephones, thereby ruling out the possibility of a telephone-based survey. Moreover, due to high proportion of illiterates in the country, survey researchers could ill-afford to ask questions whose terms may not be familiar to the respondents (see Karandikar, Payne, & Yadav, 2002; Sen, 2002). These limitations tend to inflate several systematic and non-systematic sampling biases. One way to decrease such systematic biases, such as non-coverage of respondents, is to use a multiple level stratified random sampling method (e.g., Frey, Botan & Kreps, 2000).

The target population for this survey was all adults in the country (more than 18 years of age), drawn from urban, semi-urban communities and rural communities. The urban communities were classified as Tier 1 mega-cities (e.g., New Delhi, Mumbai, Kolkata, etc.), Tier 2 cities (e.g., Lucknow, Jaipur, Kochi, etc.), and Tier 3 cities (e.g., Jorhat, Tirupur, Udhampur, etc.) based on their level of economic development. Further, a separate random sample of rural India was also used to boost the response rate of such communities. The four different stages of drawing the sample are as follows:

Stage one. The primary institution of parliamentary democracy in India is the Lok Sabha, the "lower house" or "house of representatives," whose members who are directly elected by the voters. Parliamentary Constituencies refer to these federal government level electoral units, which served as primary sampling units. Parliamentary Constituencies were randomly selected with probability proportional to population size.

Stage two. Similar to a Parliamentary Constituency at the central government level, Assembly Constituencies are basic electoral unit for state-level legislative assemblies. All state-level Assembly Constituencies are clustered to form the federal-

level Parliamentary Constituencies. In the second stage of sampling, Assembly Constituencies were randomly selected.

Stage three. After selecting an Assembly Constituency, polling locations (or polling stations) within the assembly constituency were randomly selected.

Stage four. From each of the randomly selected polling stations, 30 respondents were randomly selected from a polling location electoral roll (or list) provided by the Election Commission. Out of the 30 selected respondents, a maximum of 10 interviews per polling station was conducted, without replacement for those respondents who were not present at home or who refused to participate in the survey. The electoral rolls provided by the Election Commission are considered robust because the Commission largely operates without governmental oversight, and the Constitution of India mandates Election Commission to maintain and publish regular electoral rolls (Election Commission, 1993).

To increase the size of the non-urban sample, a separate random sample of 1000 rural respondents was surveyed, composed of people residing in rural areas in all major states of India. The first three steps of the rural sampling plan are similar to the urban sampling plan mentioned above. However, in the fourth step—after randomly selecting polling stations-- only the first individual is randomly selected. After selecting the first respondent, every tenth respondent on the electoral list is selected. That is, in urban sample, 30 respondents were randomly selected with the aim to secure 10 complete interviews, but in rural areas only the first respondent is randomly selected, and then every 10^{th} respondent is selected with the aim to secure a maximum of 10 interviews per

polling station. In rural areas, a researcher would start with the first randomly selected respondent and then proceed to interview every tenth respondent on the list, until he/she covered a maximum of 10 interviews per polling station. If the respondent was unavailable or unwilling to answer the survey, the researcher proceeded to the next tenth person on the list, and no further attempts were made to reach the respondents who were not found at home during the first contact.

In all, the survey included 138 urban and rural communities in 21 of the 35 states and union territories in India, covering 98 percent of the Indian population. Respondents were selected from four types of communities: 2,094 were interviewed in Tier 1 mega-cities, 459 respondents in Tier 2 cities, 517 in Tier 3 cities and 961 rural respondents, as mentioned above. Globescan, a marketing research firm, was contracted to conduct the survey. The interviews were conducted in November and December 2011 by C-Voter and Markelytics. Interviews were conducted in Hindi, Marathi, Punjabi, Bengali, Tamil, Telugu, Urdu, Kannada, English, Malayalam, Oriya, Assamese, and Gujarati.

The survey was administered fact-to-face at the home of the selected respondents, and took approximately 45 minutes to complete. A total of 4,031 respondents completed the survey, resulting in a response rate of 40%. The margin of error is calculated to be 1.54%. The final data were weighted to match the age, gender, religious and regional distribution of the target population—adults 18 and above, using Census parameters. The demographic characteristics of the sample are listed in Table 3 below.

Table 2: *Descriptive Statistics (Data weighted to match target sample characteristics for age, gender, religion, and region.)*

Variable		*n*	*%*	*Census 2001*
		4000		1,028,737,436
Gender	Male	2090	52	52
	Female	1910	48	48
Age groups	18-24 years	791	20	
	25-34	1015	25	
	35-44	880	22	*
	45-54	569	14	
	55-64	410	10	
	65+	331	8	
Caste groups	Scheduled Tribe	301	8	8
	Scheduled Caste	729	19	16
	Other Backward Classes	1204	32	*
	Upper Caste	1515	40	*
Religion	Hindu	3204	81	81
	Muslim	541	14	13
	Christian	69	2	2
	Other response categories	150	4	4
Education levels	Not literate	405	10	
	Literate up to Primary schooling	550	14	*
	Literate up to secondary schooling	1025	26	
	Higher secondary	932	24	
	College and higher	998	26	
Geographic Location				
Urban	Tier 1	1810	45	28
	Tier 2	1076	27	
	Tier 3	338	8	
Rural		776	18	72

Note: Percentages do not always add up to 100% because of missing values. * indicates data not available.

3.3 Measures

Prior public opinion polls in India suggest low levels of climate change awareness

(e.g., Ray & Pugliese, 2011). Therefore, so as not to disqualify participants who had no awareness of global warming or climate change, the measures used in this dissertation did not refer to "climate change" or "global warming." Instead, the measures used in this research referred to water related problems—such as scarcity and flooding—which are part of the common experience of all Indians, and which are projected to become worse as a result of the changing climate.

Collective efficacy to ensure drinking water adequacy. Two items were used to assess individuals' perceptions about their community's abilities in the domain of drinking water adaption using a four-point scale ("not at all confident" to "very confident"): (1) "How confident are you that your community can work together to make sure that everyone has enough safe drinking water even during difficult times like floods or droughts" and (2) "How confident are you that your community can work together to increase the amount of safe drinking water." The items were added to compute an eight-point collective efficacy to ensure drinking water adequacy scale, henceforth refereed as the collective efficacy scale (M = 5.22, SD = 1.76). The two collective efficacy items were highly correlated at r =.63, $p < .001$, as listed in Table 4 below. The Cronbach's Alpha for the two item index was $\alpha = 0.77$. *"Don't know"* responses were treated as missing data.

Table 3: *Collective Efficacy to Ensure Drinking Water Adequacy Scale*

	Mean	*SD*	*Correlation coefficient*
Collective Efficacy to Ensure Drinking Water Adequacy scale (collective efficacy)	5.22	1.76	$r = .63$, $p < .001$
1. How confident are you that your community can work together to increase access to safe drinking water?	2.63	0.98	
2. How confident are you that your community can work together to make sure that everyone has enough safe drinking water even during difficult times like floods or droughts?	2.57	0.96	
Note: n = 3481			

Sixty percent of the respondents were somewhat or very confident about their community's capabilities to increase access to safe drinking water, and slightly less, 54% were somewhat or very confident about their community's abilities to ensure safe drinking water even during tough times such as droughts and floods. Over half of the sample perceived some degree of collective efficacy to ensure drinking water adequacy.

Behavioral involvement in ensuring drinking water adequacy. Four items were used to assess behavioral involvement using a two-point scale ("no" and "yes")**:** Have you: (1) "Encouraged other members of your community to waste less water," (2) "Participated in community activities to increase the amount of safe drinking water," (3) "Demanded that your community leaders or government officials improve the amount of safe drinking water for your community?" (4) "Participated in social demonstrations –

such as ‘gheroas, rasta rokos, bands’—to demand more safe drinking water for your community.” All four items were summed to create an index of behavioral involvement such that the outcome measure represented the number of behaviors each individual performed ranging from 0 to all 4 behaviors. As listed in Table 5, all four behavior items were moderately correlated with each other: $r > .30$, $p < .01$.

Table 4: *Correlations table of Behavioral Involvement in Ensuring Drinking Water Adequacy Scale*

	1	2	3	4	*BICAR Index*
1. Encouraged other members of your community to waste less water	1				
2. Participated in community activities to increase the amount of safe drinking water	.52**	1			
3. Demanded that your community leaders or government officials improve the amount of safe drinking water for your community?	.37**	.44**	1		
4. Participated in social demonstrations – such as “gheroas, rasta rokos, bands” -- to demand more safe drinking water for your community?	.31**	.39**	.40**	1	
Mean	0.54	0.42	0.42	0.28	1.65
SD	0.50	0.49	0.49	0.45	1.46
Alpha if item deleted	0.68	0.64	0.69	0.72	
Alpha					0.74

Note: n = 3528, *** p < .001,** p < .01, * p < .05

More than half (54%) of the respondents stated they had encouraged other members of their community to waste less water. Fewer than half (42%) indicated that they participated in community activities to increase the amount of safe drinking water, and demanded community and government officials to improve the amount of clean drinking water for their community. About one-quarter (28%) of the respondents agreed that they have participated in social demonstrations.

Policy support for government actions. The Indian government has proposed several policy measures to improve the efficiency of water use by 20% (see Table 1); these include increasing the price of water, recycling of wastewater in urban areas, and empowerment of communities to promote local water conservation efforts (CWC, 2011). The above three policy measures were developed into questions to assess policy support in the survey.

Three items were used to assess policy support using a four point Likert-type scale ("strongly oppose" to "strongly favor"): Please tell me how much would you favor or oppose India taking each of the following steps to help deal with environmental problems (1) "Encouraging households and industry to waste less water by increasing the price of water," (2) "Requiring new buildings to waste less water and energy, even if this increases their cost," and (3) "Encouraging local communities to build check dams to increase local water supplies." The three items were added to create an index of policy support. Higher scores on the scale represent more support for proposed government policies. The three items were moderately correlated with each other. Again, "don't

know" responses were treated as missing data. Table 7 lists the descriptive statistics and correlations between the four behavioral involvement measures.

Table 5: *Descriptive Statistics and Correlations table of Policy Support*

	1	2	3	*Policy support scale*
1. Encouraging households and industry to waste less water by increasing the price of water	1			
2. Requiring new buildings to waste less water and energy, even if this increases their cost	.44**	1		
3. Encouraging local communities to build check dams to increase local water supplies?	.29**	.44**	1	
Mean	2.77	2.82	3.16	8.79
SD	1.08	1.02	0.94	2.32
Alpha if item deleted	0.61	0.45	0.6	
Alpha				0.65
Note: n = 3562, ** p < .01				

Over sixty percent of the sample supported the above government policies, with the highest support, 77%, for the third policy measure—encouraging local communities

to build check dams to increase local water supplies. Further, principal component analysis identified only one factor, which accounted for 57% of the variance. The Cronbach's Alpha of the scale was $\alpha = .74$, indicating satisfactory internal congruity between the three policy measures. Again, "don't know" responses were treated as missing data.

Community-level collective efficacy and community adaptation responses. To compute community-level constructs, respondents' assembly was used as the unit of aggregation for individual scores. An assembly constituency is a basic political unit at the state level, with one member representing a constituency at the state Legislative Assemblies. According to the Indian government's Delimitation Commission, which is established to draw the boundaries of state assembly seats, the primary aim is to draw assembly boundaries that have more or less equal number of people across all the assembly constituencies.

Using the assembly segment as the aggregating variable, the community level collective efficacy was computed as the aggregate mean of individuals' perceptions about their community's abilities. Similarly, the measure of community level adaptation responses was computed as the aggregate mean of individuals' perceived community adaptation responses. Likewise, community perceived risk was computed as the mean of individuals' perceived risk scores in a community.

Community adaptation responses. At the individual level, two items were used to measure perceived community adaptation responses using a dichotomous scale ("no" and "yes"): Over the past one year, has your community (1) "Taken steps to help people

waste less water at home," and (2) "Taken steps to increase the amount of safe drinking water for the community?" Both the items were summed to create an individual's perceived community adaptation response as listed in Table 8. The two items were moderately correlated at $r = .57$, $p < .01$. As mentioned above, the mean of individual items in their respective groups were computed to create community-level adaptation responses measure.

Table 6: *Correlations table of Perceived Community Adaptation Responses*

	Mean	*SD*	*Correlation coefficient*
CAR scale (sum of two items, 0-2 point scale)	.97	.88	$r = 0.57$, $p < .01$
Taken steps to help people waste less water at home?	.55	.50	
Taken steps to increase the amount of safe drinking water for the community?	.43	.50	

Note: n = 3422

3.4 Control Variables

Demographic variables were used as control variables to examine the unique variance in the outcome variable that can be attributed to the important variable(s) that is being investigated (e.g., Cohen et al., 2003; Hayes, 2005). Four demographic variables were used as control variables in this study: respondent's sex, age, income levels, educational attainment, caste groups, and perceived risk.

For sex, dummy codes were used such that female was the reference category, coded as 0, compared to male, coded as 1. Caste was measured using five categories—Upper Castes (37.9%), Other Backward Castes (30.1%), Scheduled Castes (18.2%), Scheduled Tribes (7.5%), with the fifth category "other" (6.3%) treated as missing data. The caste variable was dummy coded into three categories—comparing upper-castes with other lower castes. Income was measured using eight categories ("up to 1000 rupees a month" to "more than 20000 rupees a month") and education was measured using ten categories ("illiterate" to "post-graduate and above"). For easy of interpretation, income, and age groups were treated as continuous or interval variables. The descriptive analysis of the demographic variables is presented in Table 9.

Table 7: *Descriptive Statistics Demographic Variables*

	Mean	*SD*	*Minimum*	*Maximum*	*N*
Gender	.52	.500	0	1	4000
Age groups	2.95	1.531	1	6	3996
Education attainments	6.12	2.637	1	10	3910
Monthly income	5.62	1.927	1	8	3434

To build community-level socio-demographic profiles, three variables were adopted from the Census 2011 figures: sex-ratio (number of females per 1000 males), literacy rate, and population density at the district level as listed in Table 10. The Indian Census bureau maintains exhaustive administrative level data, with the most recent census estimates at the district level released in early 2012. Although district is a higher level administrative unit, whereas an assembly segment—the unit of aggregation for community adaptation and community collective efficacy in the dataset as mentioned above—is a state-level electoral unit, for the purposes of this study, an assembly constituency is assumed to be more or less representative of the district characteristics. While matching assembly constituencies in the dataset to their respective districts data from Census 2011, eight pairs of assembly constituencies were found to have the same district name, indicating a minor non-independence of observations.

Table 8: *Descriptive Statistics for Measures adopted from Census 2011*

	Mean	*SD*	*Minimum*	*Maximum*	*N*
Sex ratio	938.47	58.64	788	1123	137
Literacy rate	74.88	9.23	51	96	137
Population density	1380.55	3822.53	41	26903	137

Perceived risk of drinking water scarcity. About 12% (40 million hectares) of India is estimated to be flood prone, and 16% (51 million hectares) is drought prone (Rashtriya Barh Ayog, RBA, 1980, as cited in CWC, 2011), and climate change is expected to increase the risks of floods and droughts (Kundzewicz, 2007). To measure Indians perceptions of drinking water scarcity, two questions on a four-point scale ("no impact at all," "a small impact", "a medium impact," and "a large impact,") were used. The first question referred to drought vulnerability: "If a 1 year-long severe drought happened in your local area, how big of an impact would it have on your household's drinking water supply?" The second question referred to perceived vulnerability to floods: "Would you say a 1 year-long severe flood would have a ("no impact at all," "a small impact", "a medium impact," and "a large impact,") on your household's drinking water supply?" As listed in Table 11, both the items were summed to create a risk perception scale as they correlated moderately with each other at $r = .60$, $p < .01$.

Table 9: *Risk Perceptions Scale*

	Mean	*SD*	*Correlation coefficient*
Risk Perceptions (sum of two items, 2-8 point scale)	6.07	1.93	$r = 0.60$, $p < .01$.
1. If a 1 year-long severe drought happened in your local area, how big of an impact would it have on your household's drinking water supply?	3.03	1.06	
2. Would you say a 1 year-long severe flood would have a large impact, a medium impact, a small impact, or no impact at all on your household's drinking water supply	3.02	1.06	

Note: n = 3629

3.5 Analysis

A variety of statistical tests were used to test the construct validity of collective efficacy measure and examine the hypothesis. Correlational analysis, *t*-tests, analysis of variance (ANOVA), and hierarchical multiple regression models were used to examine the hypothesis.

Psychometric analysis of collective efficacy. First, psychometric analyses were performed to examine the construct validity of collective efficacy measure used in the study. Based on prior research, correlational analysis and *t*-tests were performed to analyze the collective efficacy construct with demographic variables (e.g., Fernández-

Ballesteros et al., 2002), perceived community cohesion (e.g., Carroll, & Resse, 2002), and home ownership (e.g., Sampson, 1997). Bandura and his colleagues theorized and found that individuals from high socio-economic status have higher collective efficacy perceptions probably due to greater access to resources that helps them succeed (Fernández-Ballesteros et al., 2002). Based on prior theoretical and empirical findings, it is expected that collective efficacy will be higher for male compared to females, higher for individuals with higher education, more income, and from those belonging to upper castes compared to other castes. Further, respondents living in cohesive communities (e.g., Carroll, & Resse, 2002), and respondents living in the houses they own (e.g., Sampson, 1997) are expected to have stronger collective efficacy beliefs.

Test of Hypothesis 1. Initial examination of the bivariate scatter plots between the predictors and the outcome variable suggested a curvilinear relationship between behavioral involvement and predictor variables of age and collective efficacy, which was examined in regression models as discussed below. The curvilinear relationship between collective efficacy and behavioral involvement is presented in Figure 3.

As bivariate scatterplot graph between behavioral involvement and collective efficacy indicated a potential curvilinear relationship, the seven-point scale of collective efficacy was dummy coded so that lowest collective efficacy category was compared with consecutive higher levels of collective efficacy, resulting in six dummy categories. Dummy coding a scale into individual categories to examine a better fit than a linear model, instead of using a squared term, is a standard practice in multiple regression methods (e.g., Allison, 1999; Hayes, 2005; Field, 2009). Using the dummy categories

does not force a particular pattern on the data such as quadratic or cubic relationship (e.g., Allison, 1999, pp. 162-166).

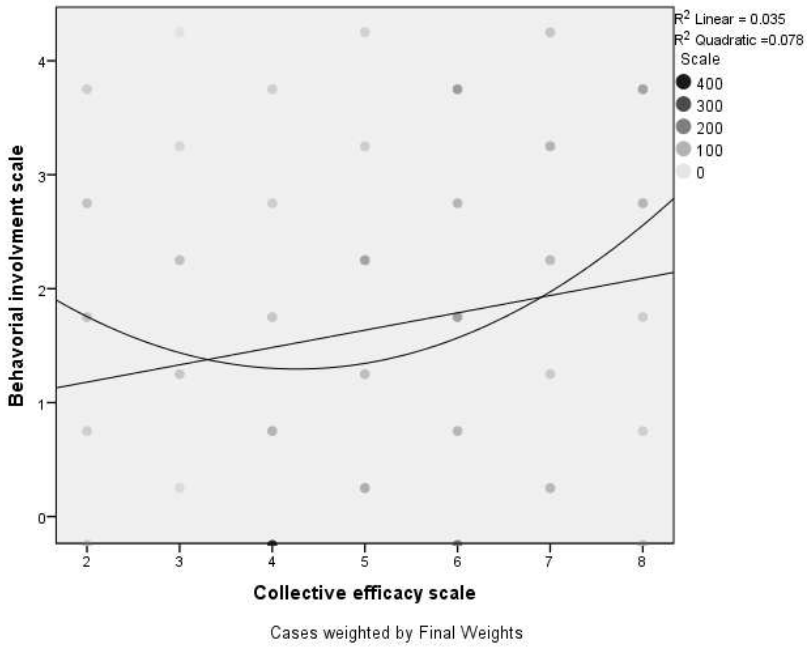

Figure 3: *Curvilinear Relationship between Collective Efficacy and Behavioral Involvement*

In addition, to test the consistency of this curvilinear relationship, instead of using the collective efficacy scale composed of two items, individual collective efficacy items

were used as the third block in hierarchical model. The results were consistent with the above curvilinear pattern (not reported). Based on the bivariate scatterplot, it appears that respondents with moderate levels of collective efficacy performed fewer adaptation behaviors that respondents who have low collective efficacy; however, individuals' with high collective efficacy perform more adaptive behaviors than people at any other level of collective efficacy.

To test the first hypothesis, hierarchical regression models were built with demographic variables entered as first block in the model because differences in gender, age, income, education and caste categories represent fairly stable features. A single measure of risk perceptions scale was entered as a second block in the regression model. The third block contained only a single variable of collective efficacy scale. In addition, diagnostic analysis did not reveal any multicollinearity in the regression models, except for the dummy variables of caste, and collective efficacy, which is to be expected (see Hayes, 2009).

As mentioned earlier, socio-economic status affects people's efficacy perceptions, and this difference in efficacy perceptions is hypothesized to be positively associated with the behavioral involvement. In addition, differences in outcome variables can also be attributed to differences in personal demographic characteristics and risk perceptions. Therefore, hierarchical regression models were used to explain the unique variance that can be attributed to collective efficacy to predict the outcome measures, after statistically controlling for the effect of demographic and risk perceptions variables.

Hierarchical regression models help examine the additional amount of variance in the outcome variable, after controlling for potentially confounding variables, such as demographic characteristics, that may also have prior association with the outcome variable. Variables are entered in blocks containing similar other variables. The variables that are entered first in the hierarchical regression model represent stable features of respondents such as the socio-demographic characteristics and of less interest to the researchers. These variables are given the "first opportunity" to explain the variance in the outcome variable. Variables entered in subsequent blocks explain the additional variance accounted in the outcome variable, after controlling for variance explained by the prior blocks of variables. A critical difference between hierarchical regression model and other multiple regression models, such as "simultaneous" regression models, is the focus on incremental change in the variance explained of the dependent measure, using the change in coefficient of determination, ΔR^2 statistic (see Cohen et al., 2003; Petrocelli, 2003). In contrast, simultaneous regression model focus on the degree of change in the outcome measure for every one unit in the predictor measure, holding all other variables in the model constant or at their mean levels. In other words, hierarchical regression models help us explain the unique variance in the outcome measures that can be attributed to the important construct in the study.

Test of Hypothesis 2. To test the second hypothesis, a hierarchical regression model was built—similar to the one described above—with demographic variables entered as the first block, perceived risk variable as the second block, and the collective efficacy scale as the third block of variables.

Test of Hypothesis 3. To test the third hypothesis—similar to the above analysis—a hierarchical multiple regression was used with communities socioeconomic characteristics (sex ratio, percentage of literates, and population density derived from Census 2011) entered in the first block, perceived community risk in the second block and community collective efficacy in the third block.

4. Results

4.1 Psychometric Analysis

To verify the construct validity of collective efficacy used in this study, the following psychometric analysis were performed. Contrary to expectations, the *t*-tests between sex and collective efficacy scale indicated no significant difference in collective efficacy perceptions between male (M = 5.17, SE = .04) and female (M = 5.27, SE = .04), t = 1.73, p = .08. Further, a one-way analysis of variance (ANOVA) was conducted to compare the differences in collective efficacy perceptions among the four caste groups. As expected, there was a statistically significant difference between caste groups on collective efficacy, (F (3, 3280) = 4.22, $p < .01$). Post hoc comparisons using the Gabriel's procedure test for different group sizes (see Field, 2009) indicated that the mean collective efficacy for the upper castes (M = 5.37, SD = 1.72) was significantly higher than that of other backward castes (M = 5.16, SD = 1.83), and scheduled castes (M = 5.12, SD = 1.78). However, there was no statistically significant difference between collective efficacy perceptions of upper castes and scheduled tribes. The results partially suggest that collective efficacy perceptions differ between caste groups, as expected. As expected, individuals' who own their houses (M =5.27, SE =.03) have significantly stronger perceived collective efficacy beliefs than people who live in rented houses (M = 5.01, SE = .08), t (3404) = -3.01, $p < .01$. As anticipated, there is a positive association

between perceived community cohesion and collective efficacy, $r = .13$, $p < .01$. Contrary to what was expected, collective efficacy was not significantly associated with two other variables such as age, and monthly income indicating a more conservative, nuanced interpretation of the results using the construct.

In addition, both the collective items were moderately correlated ($r = .63$, $p < .01$), indicating internal consistency between the two items. Overall, partial support was found for construct validity of collective efficacy used in this study.

Table 10: *Correlations between Collective Efficacy, Socioeconomic Status, and Perceived Community Characteristics*

	1	2	3	4	5	6
Collective efficacy scale	1					
Gender	0	1				
Age Groups	-.03	.00	1			
Education	.07**	.13**	-.20**	1		
Monthly income	-.02	.07**	.07**	.37**	1	
Perceived community cohesion	.13**	.01	-.05*	.11**	.09**	1

Note: $n = 2712$, ** $p < 0.01$ level, * $p < 0.05$, two-tailed, listwise deletion of missing cases

4.1 Hypothesis 1: The Relationship Between Collective Efficacy and and Behavioral Involvement

Hypothesis 1 states that individual's collective efficacy will be positively associated with their behavioral involvement in community efforts, controlling for variance already attributed to difference in age, sex, educational attainments, caste, and risk perceptions. Correlational analysis and hierarchical multiple regression models were used to test the hypothesis.

The correlations between the measures, as presented in Table 13, indicate that behavioral involvement and collective efficacy correlate positively and significantly at a modest level, $r = .17$, $p < .01$. As expected, higher collective efficacy is associated with more behavioral involvement. The relatively low size of the correlation coefficient is probably due to the curvilinear relationship between collective efficacy and behavioral involvement, as reported earlier.

Contrary to what was expected, income ($r = -.19$, $p < .01$) and perceived risk ($r = -.16$, $p < .01$) were negatively associated with behavioral involvement; with increasing income and perceived risk levels, individuals' appear to be *less* involved in community adaptation activities. The significant correlations of behavioral involvement with other control measures of the study further suggest the use of hierarchical regression model to be an appropriate choice for the hypothesis testing.

Hierarchical regression model results are presented in Table 14. As discussed in the methods section, inspection of scatterplots revealed that the relationship between age, and collective efficacy with the outcome measure was not always completely linear,

therefore squared term of age and dummy coded categories for collective efficacy were used in the following analysis (see Allison, 1999).

In the first block, demographic control variables of sex, age, squared term of age, income, education and caste variables significantly explained 7% of variance in the outcome variable of behavioral involvement. The first model suggests that except sex, all other demographic variables—age, education, income, and caste—are significantly associated with the outcome variable, behavioral involvement. Specifically, behavioral involvement was positively associated with education levels ($\beta = 0.08$, $p < .001$), and negatively associated with income levels ($\beta = -0.16$, $p < .001$). In addition, individuals from lower castes such as other backward castes ($\beta = 0.43$, $p < .001$), and scheduled castes (SC's) ($\beta = 0.32$, $p < .01$) compared to upper castes, are found to be significantly more involved in activities to increase their community's drinking water adequacy. Further, the squared term for age was significant and positive in the model, indicating the amount of upward curvature in the relationship between age and behavioral involvement ($\beta = 0.04$, $p < .01$) (see Hayes, 2005, p. 353). Examination of bivariate graphs between age and behavioral involvement indicate that young and older respondents were more likely to be involved in community activities than the middle-aged group respondents.

The second block with only one variable of risk perceptions increased the variance by additional 2% beyond what had been accounted for by demographic variables. Contrary to expectations, higher risk perceptions ($\beta = - 0.12$, $p < .001$) was associated with lower behavioral involvement.

Adding collective efficacy as the third and final block explained an additional 8% of variance. As described above, dummy codes of collective efficacy were used to assess the curvilinear relationship. The results, presented in Table 14, indicate that at the low-moderate levels, collective efficacy is negatively associated with behavioral involvement, and at moderate to high levels, collective efficacy is positively associated with behavioral involvement. In other words, individuals with low-moderate levels of collective efficacy perform *fewer*, not more, adaptation behaviors compared to lowest collective efficacy individuals. However, individuals with highest collective efficacy compared to the lowest collective efficacy individuals, had performed more behaviors.

These results partially support Hypothesis 1. The curvilinear relationship between collective efficacy and behavioral performance, however, was not anticipated and is difficult to interpret. This issue is examined in detail in the Discussion section.

Table 11: *Correlations Between Number of Community Behaviors and Other Variables*

	1	2	3	4	5	6	7
Number of Community behaviors	1						
Gender	.00	1					
Age Groups	-.07**	-.01	1				
Education levels	.04*	.14**	-.20**	1			
Income levels	-.19**	.05**	.08**	.36**	1		
Perceived Risk scale	-.16**	.05*	-.03	.01	-.01	1	
Perceived Collective Efficacy scale	.16**	-.04	-.02	.07**	-.03	.13**	1

Note: $n = 2488$, ** $p < 0.01$ level, * $p < 0.05$, two-tailed.

Table 12: *Hierarchical Regression Model Predicting Behavioral Involvement*

	Block 1		Block2		Block 3	
	B	*Std. B*	*B*	*Std. B*	*B*	*Std. B*
(Constant)	2.26		3.1		3.15	
Male	-0.04	-0.01	-0.02	-.01	0.02	.01
Age	-0.27	-0.28**	-0.27	-.28**	-0.21	-.22*
Age Squared	0.04	0.27**	0.04	.26**	0.03	.21*
Education	0.08	0.13***	0.08	.13***	0.06	.10***
Monthly income	-0.16	-0.21***	-0.17	-.22***	-0.14	-.19***
ST vs. Uppercaste	-0.09	-0.02	-0.14	-0.03	-0.09	-.02
SC vs. Uppercaste	0.32	0.09**	0.25	.07**	0.22	.06*
OBC vs. Uppercaste	0.43	0.14***	0.39	.13***	0.37	.12***
Risk Perceptions			-0.12	-.16***	-0.12	-.16***
CE 3 vs. Lowest CE					-0.31	-.05*
CE 4 vs. Lowest CE					-0.87	-.24***
CE 5 vs. Lowest CE					-0.33	-.08**
CE 6 vs. Lowest CE					-0.08	-.02
CE 7 vs. Lowest CE					0.07	.02
CE 8 vs. Lowest CE					0.48	.11***
R^2 *change*	.08***		.02***		.08***	
Adjusted R^2 *square*	0.07		0.01		0.17	

Note: n = 2396, *** p < .001,** p < .01, * p < .05

4.3 Hypothesis 2: The Relationship Between Collective Efficacy and Policy Support

Correlations between the outcome measure of policy support and collective efficacy, as presented in Table 15, indicate a moderate positive relationship, $r = .22$, $p < .01$. This finding indicates that as collective efficacy increases, so does the degree of support for government policies to adapt to drinking water scarcity, as anticipated.

Table 13: *Correlations Between Policy Support and Other Variables*

	1	2	3	4	5	6	7
Policy support scale	1						
Gender	-.02	1					
Age Groups	-.11**	-.02	1				
Education	.13**	.13**	-.23**	1			
Monthly income	.02	.05**	.07**	.34**	1		
Perceived risk scale	.27**	.03	-.03	.01	-.03	1	
Perceived collective efficacy	.22**	-.04	-.03	.06**	-.04	.16**	1

Note: n = 2503, ** p < 0.01 level, * p < 0.05, two-tailed.

Similarly, there was a positive correlation between perceived risk, $r = .27$, $p < .01$, and education levels, $r = .13$, $p < .01$ with policy support. These results indicate that

individuals with higher risk perceptions, and higher educational qualifications are more likely to support government policies. Age was negatively correlated with policy support, $r = -.11$, $p < .01$, which suggests that younger respondents, compared to older respondents, are more supportive of government policies.

In the hierarchical regression model, the first block of demographic control variables explained 4% of variance in policy support scale. Upper castes compared to scheduled castes ($\beta = -0.66$, $p < .001$), younger respondents compared to older respondents ($\beta = -0.14$, $p < .001$), and more educated respondents ($\beta = 0.09$, $p < .001$) were also more likely to support government policies, as predicted.

Adding the second block of risk perceptions variable significantly increased the variance by 7% after accounting for variance explained by earlier block of demographic variables. Higher risk perception was associated with stronger policy support ($\beta = 0.31$, $p < .001$).

Collective efficacy was entered as the third and final block and it explained an additional 3% of variance in predicting the outcome variable of policy support, presented in Table 16. As hypothesized, controlling for variance already accounted by demographic and risk perceptions variables, individuals' with high collective efficacy are more likely to strongly support government policies ($\beta = 0.23$, $p < .001$). Thus, the second hypothesis is fully supported.

Table 14: *Hierarchical Multiple Regression Predicting Policy Support*

	Block 1		Block2		Block 3	
	B	*Std. B*	*B*	*Std. B*	*B*	*Std. B*
(Constant)	9.27		7.09		6.07	
Gender	-0.13	-.03	-0.17	-.04	-0.13	-.03
Age	-0.14	-.09***	-0.12	-.08***	-0.12	-.08***
Education	0.09	.10***	0.09	.10***	0.08	.09***
Monthly income	-0.03	-.02	-0.01	-.01	0.00	.01
ST vs. Uppercaste	-0.34	-.04	-0.20	-.02	-0.17	-.02
SC vs. Uppercaste	-0.66	-.11***	-0.46	-.08***	-0.46	-.08***
OBC vs. Uppercaste	-0.18	-.04	-0.03	-.01	-0.01	0.01
Perceived risk scale			0.31	.26***	0.28	.23***
Perceived collective efficacy					0.23	.17***
R^2 *Change*	.04***		.07***		.03***	
Adjusted R^2	0.03		0.1		0.13	

Note: n = 2406, *** $p < 0.001$ level

4.4 Hypothesis 3: The Relationship Between Community Collective Efficacy and Community Adaptation Responses

Correlational analyses are presented in Table 17. As expected, collective efficacy was positively correlated with community adaptation responses: $r = .37$, $p < .01$. Further, communities' population density and literacy rate were also correlated, perhaps indicative of urban centers that have higher population and more number of educational institutions to access. Community risk had a moderate negative relationship with population density.

Hierarchical multiple regression models, as listed in Table 18, were built to test the third hypothesis. Demographics, the first block of variables entered into the modal did not significant explain any variance in the community adaptation responses variable (ΔR^2 = .04, p = .19). Perceived community risk, the second block entered into the model, also did not account for a significant amount of variation in the outcome variable (ΔR^2 = .01, p = .19).

Only community collective efficacy, entered in the third block, was significantly associated with community adaptation responses in the model: the complete model accounted for 15% of variance in the perceived community adaptation responses. The results indicate that, controlling for variance due to other differences, community collective efficacy is significantly and positively associated with perceived community adaptation responses. These results support Hypothesis 3.

Table 15: *Correlations Between Community Adaptation Responses and Census 2011 data*

	1	2	3	4	5	6
Community action	1					
Sex- Ratio (Number of Females per 1000 Males)	-0.11	1				
Literacy rate	0.15	-0.02	1			
Population density per sq. km	-0.01	-0.14	.28**	1		
Community risk	-0.04	-0.11	-0.09	-.19*	1	
Community collective efficacy	.37**	0.04	0.09	-0.05	0.15	1

Note: n = 124 communities, listwise deletion **$p < .01$, * $p < .05$. Literacy rate is percentage of literates to population aged 7 years and above

Table 16: *Hierarchical Multiple Regression Predicting Community Adaptation Responses*

	Block 1		Block2		Block 3	
	B	*Std. B*	*B*	*Std. B*	*B*	*Std. B*
(Constant)	1.29		1.56		1.01	
Sex- Ratio (Number of Females per 1000 Males)	0	-.12	0	-.12	0	-.14
Literacy rate	0.01	.17	0.01	.16	0.01	.12
Population density per sq. km	0	-.07	0	-.08	0	-.06
Community Risk			-0.03	-.06	-0.06	-.12
Community Collective Efficacy					0.23	.38***
R^2 Change	0.04		0.01		.14***	
Adjusted R^2	0.01		0.01		0.15	

Note: *n* =124 communities, ****p* < *.001*

5. Discussion

The results presented in Chapter 4 suggest that collective efficacy is an important dimension to understand Indian community's adaptive capacity to drinking water scarcity. Three hypotheses about the potential influence of collective efficacy—derived from Bandura's Social Cognitive Theory (e.g., Bandura, 1997)—were tested. Partial support was found for the first hypothesis: collective efficacy is significantly and positively associated with behavioral involvement in ensuring drinking water adequacy, although the relationship is not linear, with respondents with low-moderate levels of collective efficacy were found to have less behavioral involvement than respondents with the lowest levels of collective efficacy. The second hypothesis was fully supported: collective efficacy is significantly and positively associated with support for government policy. The third hypothesis was also fully supported: community-level collective efficacy is significantly and positively associated with community adaptation responses. To fully understand these results, it is important to first highlight the limitations of the study.

5.1 Psychometric Properties of Collective Efficacy

The measure of collective efficacy used in this research was found to be partially valid. Specifically, as expected, collective efficacy is positively associated with education levels, and socioeconomic status (e.g., Fernández-Ballesteros et al., 2004) such

as Upper Castes have higher levels of collective efficacy perceptions compared to Other Backward Castes and Scheduled Castes. Individuals' who live in the houses they own and who perceive greater community cohesion also perceive that their communities can successfully address drinking water adequacy issues, consistent with prior findings (e.g., Carroll, Rosson, & Zhou, 2005). In addition, the two collective efficacy measures used in this study were moderately correlated ($r = .63$, $p < .01$), indicating internal consistency between the two items. Contrary to what was expected, collective efficacy was not significantly associated with gender, age or monthly income, which may potentially threaten the construct validity of collective efficacy measures used in this study.

However, it is also important to note that Bandura theorized efficacy beliefs to be domain specific (Bandura, 1997). In the domain of drinking water adequacy issues in India, it appears plausible that some traditional socioeconomic factors can play a different role than expected. For example, women are expected to have lower levels of collective efficacy because they are often denied equal access to economic and political prospects, and they have few opportunities to practice their skills and develop a resilient sense of collective efficacy beliefs (e.g., Bandura, 1997; Fernández-Ballesteros et al., 2004). In India, however, women are often responsible to search and collect drinking water for their households, thereby providing them with many avenues to build their group capabilities to deal with an issue they face everyday. According to the United Nations Children's Fund (UNICEF, n. d) estimates, only 13% of adult men in India are found to be responsible for collecting drinking water for their households, whereas women were most often burdened with the responsibility of collecting water, apart from other

domestic responsibilities. Further, the insignificant correlation between collective efficacy and income could be probably for the reason that individuals with higher income levels may not face the problem of water scarcity as acutely as individuals' in low-income groups. Moreover, individuals' from high-income groups may feel more efficacious to personally deal with the issue of water scarcity, and may rely less on their community to resolve such water crisis. In contrast, individuals from low-income groups may lack the financial and social capital resources to individually deal with the issue of drinking water scarcity, and may rely more on other members of the community to address the issue. Finally, perceptions of collective efficacy did not significantly vary among different age groups, probably because all age-groups may have had similar opportunities to participate and build a sense of collective efficacy beliefs in the domain of drinking water adaptation actions in India. Future research in the domain of adaptation to drinking water in India can provide more evidence to validate these speculations.

5.2 Collective Efficacy and Behavioral Involvement in Community Adaptation Responses

Partial support was found for the first hypothesis. On the basis of theory and previous empirical studies, a positive linear relationship was predicted between collective efficacy and behavioral involvement with water scarcity management behaviors, however, a non-linear relationship was found. While moderate to high levels of collective efficacy are indeed positively associated with behavioral involvement, low to moderate levels of collective efficacy are negatively associated with behavioral involvement, in comparison with the lowest possible level of collective efficacy.

Interpreting such a finding is difficult in that it is largely inconsistent with theory and other empirical findings. Before providing possible explanations for the curvilinear relationship, it is important to note several potential limitations associated with this study before advancing such speculations. Although the following limitations apply to all the results of this study—which are explored at the end of this chapter—these limitations become more important to note when the results are inconsistent with theory and prior empirical research.

First, it is important to acknowledge that self-reported survey measurements suffer from potential biases that could affect the validity and reliability of findings from a single study. Those include sampling bias, biases due to face-to-face interview techniques, and respondent's ability to understand the questions, among others. Second, misspecification of scales could be another possible source of error. For example, the behavioral involvement scale is a *count* of the number of community behaviors, such that more number of behaviors indicates higher behavioral involvement. Treating this ordinal variable as a continuous dependent in the regression model can violate the assumptions of the model. For example, one-third (33%) of the sample said they did not perform any of the four behaviors; thus the outcome measure is skewed to the right. Further, collective efficacy is a group level construct that is likely to have a significant degree of inter-class correlation—that is, individual's perceptions about their groups ability should be correlated with the perceptions of other members in their group, therefore accounting for the inter-class correlation might yield a different result. Third, there could be other *third* variables that affect the relationship between behavioral involvement and collective

efficacy that have not been accounted in this study (see Hayes, 2005). For example, residential stability and perceived cohesion could be the third factors that affect how collective efficacy is associated with behavioral involvement that was not accounted for in this study. Finally, it could also be a sampling issue, such that, this curvilinear effect is observed in an Indian sample, and in absence of any prior studies in this domain or in India to compare, cannot be ruled out to be a peculiar Indian sample effect.

Although there are several difficulties in interpreting the curvilinear effect, the critical finding of this study is that the individuals with high levels of collective efficacy are more likely than the least efficacious individuals' to be involved in community adaptation responses. It is plausible that only the highest degree of efficacy beliefs can overcome the social friction to encourage other members of a community to take positive actions, engage the community leaders and government officials, and participate in protests to demand more water access. In other words, the results suggest that high doses of collective efficacy can affect an individual's behavioral involvement to take up community actions to address drinking water scarcity. Future research in other domains of climate change adaptation, such as community engagement with flood control, and drought proofing could better explore the consistency of these findings.

5.3 Collective Efficacy and Support for Government Policy

As hypothesized, people with a robust sense of collective efficacy showed higher degree of support for proposed government adaptation policies. This finding is consistent with other studies. For example, Lee (2006, 2010) found that individual's perceptions of collective efficacy was positively related with support for democratization and political

involvement in Honk Kong. This finding is particularly important as only few prior studies have examined the relationship between collective efficacy and support for political policies and processes, even in the field of political communication studies (see Lee, 2006).

Governments, Bandura (2000) argued, serve as proxy agencies for citizens in country where citizens acting together can transform their collective aspirations into a set national and local policies. A nation is conceived as an "imagined political community," (Anderson, 1983, p. 6) driven by the aspirations of its citizens. In a representative democracy, people participate in such imagined community conversations and activities through various actions, primary among them is voicing their opinion about issues they care about. Citizens participate in the political process through various means such as identifying with political parties, form political pressure groups, and participate in political process to achieve political and social aspirations that they perceive are far more feasible with concerted collective action rather than individual efforts. In fact, Lee (2006, p.307) found that people in Hong Kong have higher perceptions of collective efficacy to deal with the process of democratization in the country, than in their own individual abilities to bring about the political changes. As Lee (2006, p.307) stated, "Hong Kong people's support for democratization is driven by a sense of the ability of the public as a collective actor more than by a sense of the individual himself or herself as a competent actor in the public arena."

However, there is a critical difference in operationalization of the collective efficacy construct used in this study compared to that used by Lee (2006). The measures

of *collective* efficacy in this study referred to a community's abilities whereas in political science literature the *collective* refers to all the people in a nation. For example, Lee measured collective efficacy with two items: "the collective actions of Hong Kong people have much influence on public affairs," and "the collective actions of Hong Kong people can improve the society" on a five point likert scale ("*strongly disagree"* to "*strongly agree*"). Future research can examine collective efficacy beliefs with reference to the country as a whole, in addition to efficacy beliefs about their respective communities. One can hypothesize that if the relevant policies are local, such as the third measure in the policy support scale in this study ("Encouraging local communities to build check dams to increase local water supplies"), perceived community collective efficacy will be a better predictor of policy support, and when relevant policies are at the national level, such as the first two measures outcome measures of this study, perceived national-level collective efficacy will be a better predictor of such national-level policies.

This study ignored the role of trust in government institutions in predicting policy support. Trust plays an important part in how people interact and engage with the institutions. High trust in government coupled with high collective efficacy, Bandura (2000) argued, could result in adoption of convention political pressure tactics such as lobbying. High collective efficacy and low trust would result in more confrontationist approaches such as protests and strikes against the government institutions. Future research could examine the conjoint influence of trust and collective efficacy on policy support.

5.4 Collective Efficacy and Perceived Community Adaptation Responses

As hypothesized, aggregate community-level perceptions of collective efficacy is positively associated with community adaptation actions. Consistent with other results in educational, sports, and public health research domains, this study also found that communities with higher levels of collective efficacy accomplished more adaptation activities, even after controlling for traditional factors such as poverty (e.g., Bandura, 2000; Cohen, Finch, Bower, & Sastry 2006; Feltz & Lirgg, 1998 Goddard, Hoy, & Hoy, 2004; Watson, Chemers, & Preiser, 2001), minority caste concentration, and low levels of literacy. Communities with high levels of collective efficacy—where positive normative influence is likely to cultivate high degree of efficacious beliefs among its members (e.g., Goddard et al., 2004)—are more likely to foster community organizing activities that may result in more successful adaptation activities. Future researchers can explore other domains of climate change adaptation, such as energy conservation, to extend the findings of this study.

Overall, the findings of this study indicate that people who are most convinced of their community's ability to adapt to drinking water scarcity are both more likely to be involved in community actions, and more likely to support government adaptation policies. Furthermore, communities that foster robust perceptions of collective capabilities among its members are more likely to organize actions that help community members adapt to increasing drinking water scarcity.

5.5 Theoretical Implications

To this author's knowledge, this study is the first to provide evidence that at the individual and collective-levels, high levels of collective efficacy has the potential to increase the adaptive capacity of communities to address drinking water adequacy in countries such as India. Bandura (2000) argued that perceived collective efficacy is "not a monolithic group attribute"—it varies across members in a group, and across activities performed by the group members (Bandura, 1997, p. 479). That is, all group tasks have to be performed individually by group members, but in coordination with each other, pooling their different resources to overcome common obstacles to achieve their collective goals. Further, Bandura (1997) pointed out that "perceived personal and collective efficacy differ in the unit of agency, but in both forms efficacy beliefs have similar sources, serve similar functions, and operate through similar processes" (p. 478). In other words, just as individuals with high levels of self-efficacy perform behaviors that increase their chances of individual goal attainment, individuals with high levels of collective efficacy are more likely to be the most motivated members in a group and are more likely to perform more number of activities, thereby increasing the odds of group goal attainment. Further, Bandura (1997, p. 480) argued, "when a key function for group success is performed by a highly efficacious individual, members will have a higher opinion of their group's capability than of their own individual capabilities." Individuals with higher levels of collective efficacy, by performing more numerous community behaviors, can provide valuable sources of collective efficacy to other members of the community through vicarious learning opportunities—one of the primary sources of

efficacy perceptions. They may also socially persuade other members of the group to perfrom similar tasks, and create a positive atmosphere for collective action—two other sources of collective efficacy beliefs (Bandura, 1997, Goddard, Hoy, & Hoy, 2004). Because groups with high levels of collective efficacy often achieve their group goals, being part of a successful group and doing things that successful team members do provides the most important source of collective efficacy—mastery experience (Bandura, 1997, Goddard, Hoy, & Hoy, 2004).

The second theoretical implication of this study is that it extends the domain of collective efficacy research to climate change adaptation. Efficacy beliefs are domain specific constructs and people's efficacy beliefs vary in different domains of activity (water scarcity adaptation versus saving energy) and at different levels of activity (individual versus collective). While most of the research on collective efficacy has often featured academic, sport, and organizational settings, scholars have argued a need to identify the role of collective efficacy to help explain behaviors and policy preferences at the individual and community level of analysis (e.g., Roser-Renouf, & Nisbet, 2008). This study provides evidence that high levels of collective efficacy is associated with greater individual behavioral involvement in community activities, although the relationship is not always linear.

The third implication of the study, and more original finding, is that high levels of collective efficacy is also associated with greater support for government policies, even at the cost of some individual sacrifices. The policy support measures used in this study were directly adopted from the proposed government policies to increase drinking water

efficiency by 20% as part of National Action Plan on Climate Change (NAPCC, 2008). Two of the three items used to measure policy support require some degree of personal sacrifice: paying a higher price for water for domestic and industrial consumption, and higher prices for buildings to make them water efficient.

Representative democracies—particular the kind of multi-party system in India with over eight national political parties and over hundreds of parties at the state-level—offer a potential role for governments to be perceived as "proxy agency" by citizens to channelize their aspirations. To seek social and political change in such a democratic setup, people align with various political unions, groups and parties to see their aspirations turn into political and social reality. As Bandura (2003, p. 172) noted, "In many spheres of functioning, people do not have direct control over conditions that affect their lives. In such instances, they turn to proxy agency by influencing others who have the resources, knowledge, and means to act on their behalf to secure the outcomes they desire." To tackle global issues such as climate change, individuals may look up to government to take the lead, and set up appropriate policies to deal with large-scale climate change impacts (e.g., Ockwell, Whitmash, & O'Neill, 2009; Moser, 2010). As Moser (2010) pointed out, in countries such as United Kingdom, "it is culturally more readily accepted that government plays a role in fostering individual behavior change" (p. 37). Some citizens, who perceive government to be the right agency to take up policies, may tend to wait for such policies to be implemented rather than proactively adapt to the impacts of climate change (e.g., Lorenzoni et al., 2007; Ockwell, Whitmash, & O'Neill, 2009). It is also important to note that 193 governments play the principal role in

international negotiations on climate change mitigation and adaptation (Nerlich, Koteyko, & Brown, 2009). In addition, as government legislation is more likely to distribute the burden of increased costs more or less equally among its various constituencies, and "It might also address the 'free-rider' effect - if everyone is playing by the same rules, they will be more willing to see their action as part of a concerted effort to address climate change. In addition, it could override the attitude-behavior gap (people have to change their behavior no matter what they think), as well as overcoming intractable un-green opinions and social norms. Forced behavior change might also have more chance of delivering emissions cuts within the time the science suggests is necessary" (Ockwell, Whitmash, & O'Neill, 2009, p. 4). Taken together, the results suggest that increasing collective efficacy has potential role for governments and other agencies to gain the public support for climate positive "austerity measures."

Perhaps the most promising communication research question to arise from this study is if collective efficacy increases adaptive capacity, how can we use mass communication interventions to help increase a community's collective efficacy perceptions?

Barriers to communicate climate change adaptation in India. In a largely underdeveloped country like India, there are many inherent challenges in communicating about climate change in general, much less communicating in a manner that promotes collective efficacy. Perhaps the most important problem is the challenge of reaching the most vulnerable populations—often the rural poor—who may not have access to conventional mass medium channels. Less than 1% of rural Indian households have

computer with internet connection, with only about 30% of rural Indians have television sets, with 45% without access to electricity (Census, 2011).

An important finding from the current survey is that over 40% of Indians have not heard or do not know much about climate change, but when provided a mere three-line definition of global warming, 72% of respondents agreed that their lived experience matched with the explanation of the scientific phenomenon called global warming (Leiserowitz & Thaker, forthcoming). Therefore, it appears quite appropriate that one of the core features of Indian Prime Minister's National Action Plan on Climate Change (NAPCC, 2008) is to build public awareness about climate change impacts. Increasing public awareness about climate change impacts is an important objective, but without also raising people's efficacy beliefs to act on that knowledge—to act, for example, by performing more climate adaptation actions—little change is likely to occur. For example, public opinion surveys in the U.K and U.S often find that a majority of respondents are aware of climate change but are not engaged in practices necessary to advance adaptation and mitigation objectives (e.g., Gifford, 2011; Kollmuss & Agyeman, 2002; Leiserowitz, 2006; Lorenzoni et al., 2007; Ockwell, Whitmash, & O'Neill, 2009; Whitmarsh, 2009; Whitmarsh & Lorenzoni, 2010; also see Witte, 1992).

Mass media, which is the primary source of information on climate change for most of the people, reports climate change most often in context of natural disasters or is generally saturated with "catastrophe" connotations for climate change impacts (e.g., Carvalho & Burgess, 2005; Doulton & Brown, 2009; Hulme, 2007; Sampei, & Aoyagi-Usui, 2009), skepticism about climate science (e.g., Boykoff, 2008; Boykoff & Boykoff,

2004), and skepticism about the collective will to address the issue (e.g., Gavin & Marshall, 2011). Such fearful portrayals of climate change are less likely to motivate positive personal engagement with the issue (e.g., Moser & Dilling, 2004; O'Neill & Nicholson-Cole, 2009). A large and substantial body of literature on fear appeals attests that "an individual's perceived sense of action effectiveness and the individual's perceived sense of self-efficacy are imperative for a fear appeal to be successful" (O'Neill & Nicholson-Cole, 2009, p. 361; also see Hastings, Stead, & Webb, 2004; Moser & Dilling, 2004; Witte,1992). People with access to mass media may be exposed to higher doses of risk information about climate change impacts without equally high doses of efficacy information to adapt to those impacts. High doses of risk information about catastrophic climate change effects may raise risk perceptions about the effects of climate change, but without information about ways and means to adapt, is more likely to result in maladaptive behaviors such as denial, fatalism, or wishful thinking (e.g., Grothmann and Patt, 2003).

Merely communicating the risks of climate change impacts without also communicating efficacy perceptions to manage those risks may be counterproductive to enhance behavioral involvement in community's adaptation responses. One of the unanticipated findings of this study—the negative correlation between perceived risk and behavioral involvement—is consistent with Protection Motivation Theory (Rogers, 1983; Rogers & Prentice-Dunn, 1997) , and fear appeals literature (e.g., Witte,1992), that suggests merely perceiving high degree of threat alone will not increase positive behavioral shifts. Increasing self and collective efficacy perceptions, for example

through mass communication campaigns, can potentially enhance perceived collective efficacy perceptions that may result in more behavioral involvement in community adaptation actions.

5.6 Practical Implications: Communicating Collective Efficacy to Increase Indian Communities Adaptive Capacity

A large body of research documents effects of mass communication interventions to change individual and social behaviors. The primary finding from such studies is that mass communication intervention affects some individuals, some of the time (e.g., Abroms & Maibach, 2008; Bertrand et al., 2006; Hornik, 2002; Noar, 2006; Snyder et al., 2004; Snyder, 2007). To increase the effect of communication campaigns, some scholars have urged using a more ecological approach—involving individual, social-network, community, and place-based communication targets—as a means of promoting population behavior change (Abroms, & Maibach, 2008). According to Maibach and Priest (2009) "because of the inherent limits of communication in improving people's knowledge of any complex issue, communication planners must make every possible effort to identify the information most worth knowing and focus their communication outreach accordingly. Having less knowledge, if what is known is more worth knowing, can have greater individual and societal value than having more knowledge that is less worth knowing" (pp. 302-202). This section seeks to address the question—what is most worth knowing if the communication objective is to promote a robust sense of collective efficacy for climate change adaptive capacity in Indian communities?

What this study suggests is that increasing collective efficacy beliefs does have the potential to increase individual's community adaptation behaviors, as well as to increase their support for climate positive public policies. According to Bandura (2002, p.18), "people should be made aware of their consummatory practices as well as motivated to take constructive action. Doing so would require use of multiple channels of communication (Singhal & Rogers, 1999)."

Collective efficacy and the potential for entertainment-education programs for climate change adaptation. Social Cognitive Theory makes clear that primary among the cognitive assessments that drive human behavior are individuals' perceptions about their own abilities (self-efficacy), and that of the collective abilities of one's group (collective efficacy). As mentioned earlier, social cognitive theory specifies four sources of efficacy information: mastery experience, social modeling, social persuasion, and affective states. Having found that collective efficacy is most likely to affect individual and group level community behaviors, the next sections turns to research that has successfully increased efficacy beliefs through communication interventions.

Growing parallel to the research on social cognitive theory was the development of television dramatic serials to promote social change, popularly known as entertainment-education programs that promoted issues as diverse as family planning, women's equality, environment preservation among other social issues with remarkable success (e.g., Bandura, 2002). Several entertainment-education intervention studies have found substantial support that mass media can enhance individual and collective efficacy levels, with substantial benefits for communities (Baker, 2011; Bandura, 2002, Papa et

al., 2000; Papa & Singhal, 2009; Sabido, 2011; Singhal & Rogers, 1999; Singhal et al., 2004).

Entertainment-education is defined as "the process of purposely designing and implementing a media message to both entertain and educate, in order to increase audience members' knowledge about an educational issue, create favorable attitudes, shift social norms, and change overt behavior" (Papa & Singhal, 2009, p. 187; also see Singhal & Rogers, 1999). Briefly, communication interventions often take effect as a serial drama (or soap operas) on television or on radio, where characters and storylines are picked to reflect targeted audience groups and specific issues they face every day. As the story develops, the characters face common obstacles as faced by the audience members. Over the course of serial drama, the characters develop the core skills that were initially set as too difficult to surmount, through constant support and encouragement from other characters. Characters that perform positive behaviors are shown to achieve their goals, whereas members of the group admonish detrimental behaviors.

For example, the first year-long television drama that Sabido created, *Ven Conmigo* ("Come with Me"), dealt with the issue of illiteracy in Mexico. Formative research identified many barriers for people to enroll in self-study groups to increase their literacy levels, primary among them was lack of efficacy beliefs to master the necessary skills. The main characters of the serial were representative of the primary target of illiterate population—housewives and young people—with the lead character of the instructor in the group performed by a popular Mexican television actor. Initially, the

characters were shown to have great difficulty in mastering new skills, but through persuasion and perseverance, they finally master the skills and are awarded degrees at the end of the program (Sabido, 2011).

A day after the program urged its audience members to enroll in the program and form self-study groups, about 25,000 people waited for their turn to register to the literacy program in Mexico City (Bandura, 2002). By the end of the serial drama, literacy program witnessed a jump in membership by 750%, with about 250,000 people registered for literacy program. Similarly, another serial drama declined the population growth rate in Mexico by 34percentage during the decade of broadcasts from 1977-1986 (Sabido, 2011).

Following the enormous success in Mexico, the next country that applied the Sabido methodology was India, with enormous success in facilitating social change. For example, Law and Singhal (1999) investigated the effects of entertainment-education programs on audience members efficacy beliefs through letters written in response to a radio drama serial called *Tinka Tinka Sukh* ("Happiness Lies in Small Things"). The serial was broadcast during 1996-97 in seven Indian states and it tackled issues of gender empowerment and small family size. With an estimated listenership of 36-40 million, All India Radio—the primary broadcasting agency—received about 150,000 letters in response to the one-year long program. Among them, one was poster sized sheet singed by 184 members from a village in Uttar Pradesh who stated they will not participate in social evils like accepting dowry (money for marriage), and strongly support and encourage female literacy and small family norm.

Most of the letters not only suggested increased perceptions of efficacy to be able to change one's life and that of one's community, but also documented intentions to perform behaviors consistent with their heightened efficacy perceptions (Law & Singhal, 1999). For example, one listener wrote that the program influence was so powerful that recent weddings in the village did not even see anybody raising the issue of dowry—a social evil that has been deeply entrenched in Indian society. Other letters documented how after listening to the program, listeners had organized, among other things, a women's collective, community pledge-taking ceremonies, and forming several self-help groups. In 1992, another program called *Hum Raahi* dealt with early marriage of female child. The story begins with death of a servant girl who was married early, and dies during child birth when she is only 15. This episode sparks a debate among the characters in the story who show that they are determined to stop such practices and take up collective efforts to make it a group norm. A post-survey funded by Rockefeller foundation found that viewers of the program showed positive attitudes towards marrying girls in older ages, and more acceptability of women in the work place (Poindexter, 2011).

A recent publication by Population Media Center (2011)—an international non-profit organization that promotes use of effective communication strategies to promote behavior change with reference to population growth—attests to the significant research that documents the application of entertainment-education programs for successful behavior change by raising efficacy beliefs across the world, and for different issues. In

other words, the entertainment-education programs, by facilitating a shift in the social norms, have a greater impact than merely addressing individual behaviors.

Climate change adaptation requires a behavior change in a critical mass of humanity, if not all. Communication managers have to deal with not only with socio-psychological barriers to individual adaptation behaviors, but also to more functional barriers with communication channels—such as access, and frequency, two other important variables found to foster behavior change through mass media campaigns (Abroms & Maibach, 2008). Moreover, as noted above, some of the most vulnerable population may not even be reached through traditional mass campaign channels such as television even today.

Entertainment-education research provides evidence and potential resource to foster mass behavior change using multiple communication channels. As mentioned above, entertainment education programs targets to change social norms that will sustain the behavior change across the community members. In recent years, the arena of entertainment education is not only limited to serial dramas but has expanded to single film shows, online videos, use of various local forms of performance such as street theatre, indigenous story tellers, songs among other communication media (Baker, 2011). Increasing in the number of communication channels provide an avenue to reach the most vulnerable populations. Over the years, technology has become more portable, which can also increase the frequency of such communication interventions across different rural areas.

5.7 Role of Government and other Agencies in Increasing Collective Efficacy

Bandura, borrowing on the work of Saul Alinsky (e.g., 1971) and other community organizers, offers a roadmap for building community-wide efficacy for social change through community enablement. Community enablement, according to Bandura, goes beyond solving people's immediate problems. It also differs from empowerment because no outside forces can empower a community, without the community members striving themselves to achieve it. Community enablement involves developing capabilities of the community members to "operate as a continuing potent force for bettering their lives and upholding their sense of self-worth and dignity" (Bandura, 1997, p. 501). In other words, providing opportunities for community members to master important group processes not only results in faster solution to immediate problems, but can also build their efficacy beliefs to do so in case of similar collective problems in future. For example, training group advocacy skills has been found to increase both personal and collective efficacy and motivated the members to take actions for group goal attainment (Yeich & Levine, 1994). Similarly, Goddard (2002) found that in teachers in schools that enabled them to influence instructionally-relevant decisions were more likely to have stronger collective efficacy beliefs. Further, such community organizations can extend their collective by aggregating into issue-based constituencies, thereby wielding more pressure on governmental institutions through a wider public support base. According to Bandura (2000, p. 77) "social structures are created by human activity, and socio-structural practices, in turn, impose constraints and provide resources and opportunities for personal development and functioning."

Therefore, it is critical to note that access to government institutions, and increased role in governance issues such as planning adaptation interventions, can potentially play a critical role in enhancing efficacy perceptions. Research on water management programs has shown that the more community members are involved as stakeholders—from conceptualization of the nature of the problem, to implementation of solutions—the more likely the programs are to succeed (e.g., Manikutty, 1998; also see Cohen & Uphoff, 1980). For example, Manikutty (1998) found that in projects where participation of local stakeholders began early, there was more community participation in meetings, increased awareness of risks and opportunities among community members, better design and implementation of projects such as site selection, resulting in behavioral changes in water management practices, and thereby reducing internal conflicts between community members. Indeed, the role played by government institutions is so important that the first step in Sabido methodology mentioned above is to find a government entity that is willing to offer the services that communication managers want to offer. The second step is to select the target audiences in consultation with the government entity (see Sabido, 2011).

In sum, entertainment-education channels—by providing modeling behaviors for community members to follow—can enhance the collective efficacy perceptions with positive benefits for the community. In addition, government and other agencies, by providing different avenues for community members to practice their newly acquired skills through increased participation in formulation and implementation of local policies,

in turn, can sustain the high levels of collective efficacy for collective adaptation to climate change impacts.

5.8 Limitations

There are several limitations of this study, as pointed out in above sections. First, the findings from a cross-sectional data rule out any assumptions of causality, therefore all results presented above need to be tested longitudinally to assess the triadic reciprocal relationship between community behaviors, perceptions of collective efficacy, and community contextual factors. Second, the small degree of variance explained by the models, and the moderate correlations between the measures, indicate a large amount of unaccounted variance in the dependent measures. This could be probably because this study may have ignored other important variables that may affect the outcome variables. Applying more robust statistical models such as Hierarchical Linear Models (HLM) may be able to indicate a higher degree of effect between the predictor collective efficacy and the outcome variable that future research could explore. Hierarchical Linear Models (HLM) help to account for grouping effects that were ignored in this study (Raudenbush & Bryk, 2002). Third, although demographic and risk perception variables were statistically controlled in the hierarchical regression models, more experimental evidence will provide the mechanisms of causal direction of influence as modeled in this study. Fourth, instead of using self-reported community adaptation actions, future research could test with government data such as the number of water conservation activities undertaken in a community or such local administrative units to decrease self-reporting bias. Finally, future research could investigate small and large-scale communication

efforts to increase people's collective efficacy beliefs, and subsequent effects of heightened collective on community behaviors related to different domains of climate change adaptation.

5.9 Conclusion

Several social scientists have already found that "barriers to community or individual action do not lie primarily in a lack of information or understanding alone, but in social, cultural, and institutional factors" (Tompkins & Adger, 2004, p. 15). Primary among such barriers are perceived beliefs about self and collective competencies (e.g., Grothmann & Patt, 2005; Lorenzoni et al., 2007). The findings of this study, and research documented in the above sections, indicate that increasing collective efficacy beliefs through mass medium channels can have a positive impact in increasing Indian community's adaptive capacity to drinking water vulnerability.

As Bandura (1997) articulated, "as a society, we enjoy the benefits left by those before us who collectively fought inhumanities and worked for social reforms that permit a better life. Our own collective efficacy, in turn, will shape how future generations live their lives. Considering the pressing worldwide problems that loom ahead, people can ill-afford to trade efficacious endeavors for public apathy or mutually immobilization. The times call for social initiatives that build people's sense of collective efficacy to influence the conditions that shape their lives and those of future generations" (p. 525).

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Curriculum Vitae

JT (Jagadish Thaker) is a final year PhD student in George Mason University's Health and Strategic Communication program. His dissertation research investigates the role of collective efficacy—people's perceptions in their group's collective abilities—in enhancing Indian community's adaptive capacity to climate change impacts.

His research investigates different approaches to communicate climate change that fosters positive public engagement. His primary research interests include human dimensions of adaptive capacity, media content analysis, heath communication, and strategic communication campaigns. He has served as a Graduate Research Assistant on a National Science Foundation grant examining American broadcast meteorologists' best practices to communicate climate science. A paper that he co-authored won the top student award in the Applied Communication Division in National Communication Association (NCA) conference, San Francisco, 2010. He is working with Dr. Anthony Leiserowitz to conduct and analyze the first national sample survey of Indians' beliefs, attitudes, and policy support about climate change, and other sustainability issues.

Prior to joining Mason, he worked as English compere in All India Radio, and as a copy-writer in advertising agencies, before a brief stint at teaching English in Nizam college, his alma mater. He also holds a master's degree in English literature from University of Hyderabad.