Climate Change Risk Perception and Perceptions of Adaptation Measures in Egypt:

A Mixed Methods Study of Predictors and Implications

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Abstract

Egypt is among the most susceptible countries in the world to the potential impacts of climate change. The Intergovernmental Panel on Climate Change (IPCC) identified the Nile Delta as one of the most exposed deltas to sea level rise. Despite these alarming predictions, there is a lack of in-depth studies on public risk perceptions of climate change in Egypt. Understanding the public's risk perception of climate change is vital in informing policy and developing effective risk communication strategies that improve public engagement with climate change and, in turn, encourage actions to address its potentially harmful impacts.

This thesis provides a novel contribution to the literature through a mixed methods approach, using an online survey and semi-structured interviews. The research investigates three main topics: (1) Public perceptions of climate change; (2) Predictors of climate change risk perception; and (3) Perceptions of climate change adaptation. Results of the survey and the interviews showed that while participants were concerned about climate change and believed in the human causation of it, they had limited understanding and misconceptions about its causes (for example, erroneously linking climate change to the ozone layer).

The Climate Change Risk Perception Model (CCRPM) adopted in this study explained 19.2% of the variance in risk perception. In addition, it revealed that experiential factors (affect and personal experience) were the strongest predictors of climate change risk perception in Egypt, while socio-cultural factors (value orientations) were the weakest predictors. Interviews with participants also highlighted that negative feelings featured prominently when speaking about personal experiences with the impacts of climate change. Moreover, regression analysis showed that personal and societal climate change risk perception had different predictors. These results offer important recommendations for policy, relating to matters such as targeted ways of communicating the science, impacts and risks associated with climate change.

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Hayam Elshirbiny

He hono tangata e kore e motu

The ties that bind us can never be broken

Contents

List of Figures

List of Tables

Acronyms

IPCC   Intergovernmental Panel on Climate Change

GHG   Greenhouse Gas

CCRPM   Climate Change Risk Perception Model

IDSC   Information and Decision Support Centre

CAPMAS   Central Agency for Public Mobilisation and Statistics

Chapter 1: Introduction

1.1.   Preamble

According to the Intergovernmental Panel on Climate Change (IPCC), climate change refers to changes in the mean and/or the variability of the climate properties, such as rain and temperature, that persist for an extended period of time, causing substantial disruptions in human and natural systems. Climate change may occur due to natural forcings such as solar cycles and volcanic eruptions, or due to anthropogenic changes. Anthropogenic changes in the climate are caused by human activities which involve the emission of greenhouse gases (GHGs), such as carbon dioxide, methane, and nitrous oxide through the burning of fossil fuels, agricultural activities, and industrial processes (IPCC, 2013a). Although knowledge of the link between the greenhouse effect and GHGs dates back to the 1860s, the global warming phenomenon was first noted in 1896 by a Swedish chemist. He predicted that if atmospheric carbon dioxide doubled in concentration, the average temperature on earth would increase by 4-5 degrees Celsius (Etkin & Ho, 2007; Hulme, 2009). However, global-scale comprehensive observations of the climate system based on direct measurements and remote sensing only began in the 1950s (IPCC, 2013c).

Climate change emerged as an issue of public concern in 1988 after James Hansen, the head of NASA's Goddard Institute for Space Studies at the time, testified before the US Congress that global warming was happening, which made headlines all over the world (Ungar, 1992). Robust scientific evidence has been compounding ever since to support his claim, and scientists have come to an almost full consensus that climate change is happening and that it is caused by human activities (Anderegg, Prall, Harold, & Schneider, 2010; Cook et al., 2016; IPCC, 2013b). Climate change poses serious risks to human and natural systems with impacts affecting livelihoods, health, ecosystems, economies, societies, services, and infrastructure. The impacts of climate change on geophysical systems include floods, droughts, and sea level rise (IPCC, 2014b).

Climate change is more complex and harder to understand than other environmental hazards and is usually perceived as a temporal, social, and geographically distant risk that happens in the future to other people in faraway places (Markowitz & Shariff, 2012; Spence, Poortinga, & Pidgeon, 2012). Climate change is also unique compared to other environmental risks because

of its magnitude, which is unprecedented in terms of its global scale and timeline spanning centuries (van der Linden, 2015). Etkin and Ho (2007) consider climate change to be an example of a 'post-normal science' problem, as it involves great uncertainty, high risks, and requires urgent decisions. Climate change is also different from other environmental problems in that it is slow, cumulative, and largely invisible, so it cannot be experienced directly and therefore does not activate a direct risk response (van der Linden, 2014). Markowitz and Shariff (2012) suggested that climate change poses challenges to the human perceptual, cognitive, and affective information processing systems. Based on evidence, they stated that climate change is not identified by people as a moral imperative nor as a wrong that demands to be righted, and hence does not motivate an urgent need for action. Studies have shown that people usually overestimate how vulnerable they are to hazards and that some minor risk events often cause strong public concern; however, climate change is different (Kasperson et al., 1988). Pidgeon and Henwood (2010) believe that climate change is an example of a significant hazard that is subjected to the social attenuation of risk, which means that its risks are downplayed by the public.

This thesis addresses three main topics related to climate change: (1) Public perceptions of climate change; (2) Climate change risk perception and its predicting factors; and (3) Public perceptions of climate change adaptation. The following sections in this chapter introduce the different concepts related to these topics and give an overview of the related theories and conceptual frameworks. The research takes place in Egypt and details of the location and local context of the research are also discussed in this chapter. The chapter concludes by discussing the research aim and main research questions in addition to giving a general outline of the layout and structure of this thesis.

1.2. The Concept of Risk

The concept of risk varies widely in its meaning across different disciplines, and there is no specific definition for "risk" that is commonly used in the sciences or in public understandings of the term (Rohrmann & Renn, 2000). Some scholars believe that the concept of risk is inherently subjective and therefore it can never have a single definition (Slovic, 1992). According to Rohrmann and Renn (2000), risk can be defined as "the possibility of physical, social, or financial harm/loss due to a hazard within a particular time frame" (p. 14). In this definition, a hazard

refs to a situation, event, or substance that can become harmful to people or to nature. They define risk assessment as the scientific process of outlining the implications of a specific hazard, usually in quantitative technical terms, while risk management refers to "the process of reducing risks (either the hazard itself or its consequences) to a level deemed tolerable or acceptable by society" (p. 14). Rohrmann and Renn (2000) believe that since risk refers to the potential of "real" consequences, it is both a social construction and a representation of reality. The social construction of risk refers to how people invented the concept of risk to help them cope with the dangers and uncertainties of life (Slovic, 1992).

1.3.   Risk Perception

Perception refers to various kinds of attitudes and judgments towards certain issues (Slovic, 1992). In the context of risk, risk perception includes people's beliefs, attitudes, judgments, and feelings, as well as the wider cultural and social dispositions they adopt towards hazards which threaten things they value (Pidgeon, 1998). This view of risk perception is broad and takes into account that it is the characteristics of hazards rather than a single abstract concept (such as risk) that people seem to evaluate. Risk perception is a multidimensional concept, with a particular hazard meaning different things to different people, and different things in different contexts (Pidgeon et al., 1992). Most modern risks, such as climate change, are not directly experienced but are learned through communication. This makes risk perception less a product of direct experience or personal evidence and more a result of social communication (Rohrmann & Renn, 2000).

Studies of risk perception seek to provide an understanding of people's opinions of hazards in order to develop effective methods of communicating risk information to laypeople, technical experts, and decision makers. Risk perception research can help policymakers develop effective policies. For example, if the public underestimates the risk of an earthquake happening, they may be less likely to take earthquake preparedness measures. From a policy perspective, it is then important to know how these risk perceptions may be altered so that people are more likely to take preparedness action. Moreover, risk perception research also contributes to improving risk analysis and risk management strategies, and develop educational programs (Slovic, 1987). Pidgeon (1998) suggests that understanding public opinion and including it in the process of risk decision making is also important on ethical grounds as it uncovers moral issues and concerns raised by the public. In addition, risk perception research attempts to determine the factors

influencing people's perceptions of risk, and to develop a theory of risk perception that can predict the public's response to new hazards. Practical applications of risk perception research include effective disaster insurance programs which help to reduce expenditures, delays, and frustration (Slovic, Fischhoff, & Lichtenstein, 1982).

Despite the many practical applications of risk perception research, it has both proponents and critics. Pidgeon (1998) offers a summary of the main arguments for and against risk perception research in public policy and risk management. For example, proponents of risk perception research argue that consulting people on risk decisions that affect them is an integral part of the democratic process. Another argument in favour of risk perception research claims that risk perception reflects aspects of people's preferences, underlying values, and factual information concerning risk rather than scientific information, which improves experts' risk analyses with additional information leading to an overall better analysis. On the contrary, risk research critics claim that the public does not have the proper knowledge to accurately evaluate what will harm them and therefore their judgements will be biased. Critics also argue that the public is not homogeneous, and different sectors of society will select and represent risks in different ways. Furthermore, they claim that if risk perception is considered an input to risk decisions, then reducing risks might involve manipulating the public to convince them the threat is negligible (Pidgeon, 1998).

Contributions to risk perception research have come from geography, sociology, political science, anthropology, and psychology. Geographical research focused at first on understanding human behaviour in the face of natural hazards, but then expanded to include technological hazards as well. Sociological and anthropological studies have explored the social and cultural roots of the perception and acceptance of risk. Psychological research on risk perception originated in empirical studies of probability assessment and decision making processes (Slovic, 1987). Despite the different areas of studies of risk perception, there seems to be consensus on some main points: (1) Risk perceptions are valid and must be investigated; (2) Individual risk perceptions are shaped by a wide range of social, cultural, and psychological factors; and (3) The public should not be viewed as an undifferentiated entity but there are many groups within society holding different risk perceptions (Pidgeon, 1992).

1.4.   Theories of Risk Perception

Theories on risk perception emerged in the 1960s with the work of Chauncey Starr who proposed an approach to risk perception which mainly links risk to societal benefits. Starr's hypothesis suggests that people's tolerance of a risk is related to their perception of its benefits and whether the risk is voluntary or involuntary (Starr, 1969). Voluntary risks such as smoking or skiing are based on individual decisions, while involuntary risks are based on involuntary exposure to risks, such as drinking polluted water or being exposed to nuclear radiation. Starr proposed that, by trial and error, society has arrived at an optimum balance between the risks and benefits associated with any activity, and therefore risk and benefit data might be used to show patterns of acceptable risk-benefit trade-offs. He examined such data for several industries and activities and came to two main conclusions. First, the public is about 1,000 times more likely to accept voluntary risks compared to involuntary risks that provide the same level of benefits. Second, the acceptable level of risk is inversely related to the number of people exposed to that risk. This means that the higher the number of people exposed to the risk the less acceptable it is (Krimsky, 1992; Slovic, 1992). Starr's study laid the groundwork for subsequent theories on risk perception (Slovic, 1987).

There are different theoretical approaches or perspectives on the concept of risk and risk perception that are grounded in various disciplines. The most common approaches are the technical approach, the economic approach, the psychological or cognitive approach, and the cultural approach, each of which has its shortcomings and its merits. These approaches are briefly discussed in the following subsections.

1.4.1   Technical Perspective: Technical Risk Analysis

The technical definition of risk is the multiplication of the probability of the occurrence of a particular risk activity or event (such as an earthquake or a volcanic eruption) by the magnitude of the risk's specific consequences (such as the number of deaths or injuries) (Kasperson et al., 1988). This definition has a narrow focus on only the probability and magnitude of a risk and implies that there is no difference between a low probability/high consequence risk (such as a nuclear power plant accident) and a high probability/low consequence risk (such as a car accident) where both have the same technical value, but might have different social impacts (Kasperson et al., 1988). Hence, the technical perspective and its quantitative expression of risk does not integrate the technical and social aspects of risk and is therefore inadequate to reflect

the complex pattern of individual risk perception (Rohrmann & Renn, 2000). However, the technical approach to risk usually deals with quantifiable and real risk consequences such as health effects or ecological damage (Renn, 1992).

1.4.2 Economic Perspective: The Economic Theory

The economic approach is based on economic theory where the concept of risk is perceived as part of a risk-benefit analysis in which risks are the expected utility gains and/or losses resulting from an event or activity (Renn, 1992). Utilities are often measured in monetary units. Hence, when risks are treated as utilities they are assigned a monetary value, which some argue is incommensurable with the risk of serious injuries or death, and this is one of the approach's many criticisms (Renn, 1992; Rohrmann & Renn, 2000). Despite its shortcomings, the economic approach enables decision makers to make more informed choices and improves the technical risk analysis by accounting for the nonphysical aspects of risk (Renn, 1992).

1.4.3 Psychological Perspective: The Psychometric Paradigm

In the 1970s, a lot of attention was given to the public risk perception of natural hazards, such as floods and earthquakes, and to new technologies, such as pesticides and nuclear energy. This encouraged Paul Slovic and other colleagues in the decision research group at the University of Oregon to work on a new approach to risk perception called the "Psychometric Paradigm" or the "Psychometric theory of risk" (Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978; Slovic et al., 1982). Their early work was based on laboratory studies on risk-taking behaviour in gambling, but then they shifted their attention to natural hazards, and later to technological hazards (Slovic, 1992). The psychometric approach to risk perception is derived from cognitive psychology and the study of human decision-making behaviour, and it is sometimes referred to as the "Cognitive theory of risk" (Krimsky, 1992; Pidgeon et al., 1992; Slovic et al., 1982).

The psychometric paradigm is a theoretical framework which assumes that risk is inherently subjective and that there is no "real" or "objective" risk. The framework proposes that risk is defined by individuals and is influenced by psychological, social, institutional, and cultural factors. It also assumes that risk perception can be quantitatively measured, and that the response to risk can be predicted (Slovic, 1992). Psychometric studies of risk perception use questionnaires to investigate people's judgments of the current and desired riskiness of a set of hazards, what they say risk means to them, and which risk activities are acceptable or unacceptable to them (Krimsky, 1992; Pidgeon et al., 1992).

Studies using the psychometric paradigm have shown that psychometric techniques are suitable for identifying similarities and differences in risk perception among groups, and that the term "risk" means different things to different people (Slovic, 1987; Vassie, Slovic, Fischhoff, & Lichtenstein, 2005). For example, when experts were asked to judge a range of risks, their responses correlated highly with technical estimates of annual fatalities related to each risk, but when lay people judged the same risks, their judgments were related more to other risk characteristics, such as catastrophic potential and the threat to future generations (Slovic, 1987, 1992). Slovic et al. (1982) concluded that people's tolerance of a risk is related to their perception of its benefits (which is in line with Starr's earlier hypothesis), but they also found that it is related to other factors such as familiarity, control, catastrophic potential, and uncertainty about the level of risk. Moreover, results also showed that despite lacking statistical and technical information about hazards, lay people's conceptualization of risk is much richer in other ways than that of experts and reflects legitimate concerns that are typically ignored in expert risk assessments (Slovic, 1987).

Based on a series of studies, the psychometric paradigm proposed a structure in which risk characteristics (such as voluntariness, controllability, timing of effect, etc.) are divided into two main factors: (1) The degree to which a risk evokes a feeling of dread; and (2) The degree to which a risk is understood (See Figure 1.1) (Slovic, 1987). Hazards or risks are allocated on the structure within those factors as per people's judgments of them, and people's perceptions of risk are related to the position of a hazard in the structure. The higher a hazard scores on the dread factor, the higher the perceived risk, and the more people want its risks reduced (Pidgeon et al., 1992). For example, people tend to judge car accidents as known risks that do not have a high dread factor, whereas nuclear technology is perceived to be a relatively unknown risk characterized by high dread (as highlighted on Figure 1.1). This means that people's risk perception is higher for nuclear technology than for car accidents. As shown in Figure 1.1, the psychometric model predicts that the public is more accepting of activities that are more understood and have lower dread factor (those in the lower left quadrant of the structure), and is more fearful of activities in the upper right quadrant, which have higher dread and are less understood. This is also indicated on the structure by the size of the points that represent each risk (i.e. the bigger the point representing the hazardous activity the higher the public perception of risk).
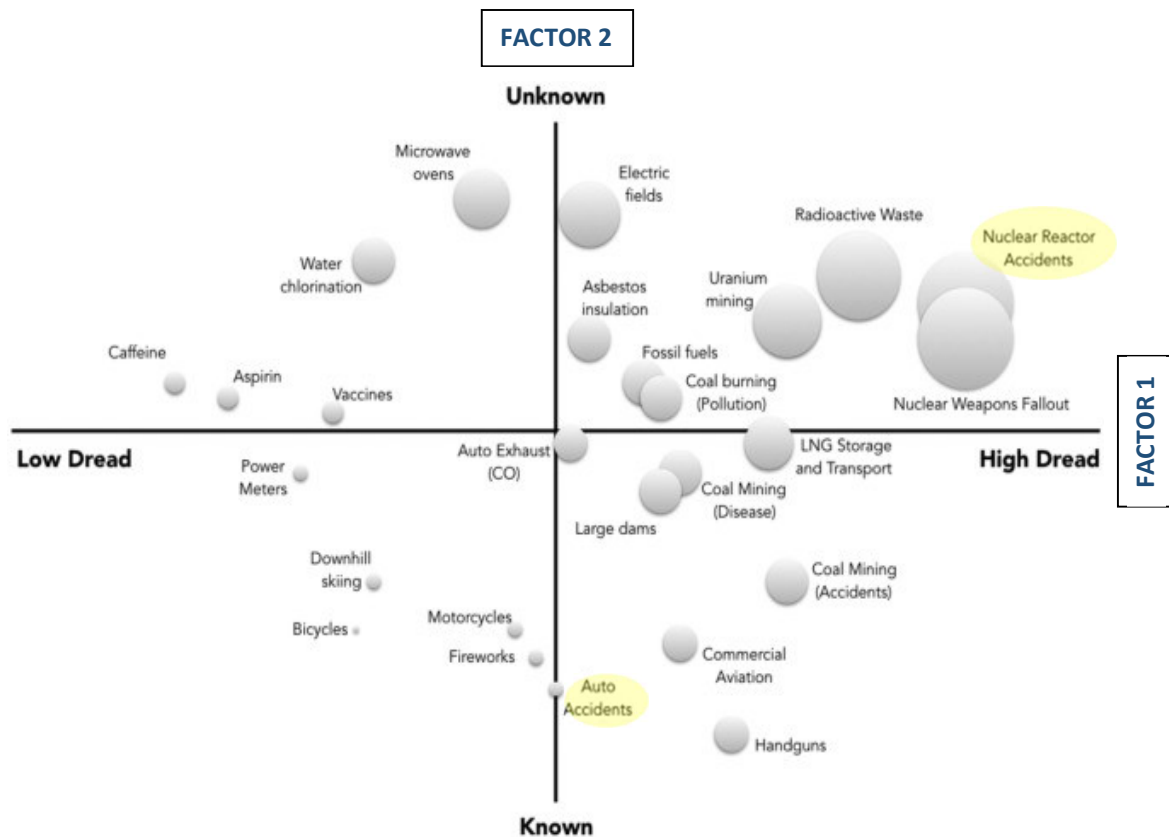
Figure 1.1 - Locations of hazards on the factor structure of the psychometric paradigm according to the public's risk perception

Source: Stewart and Lewis (2017) (P.129)

Later studies using the psychometric paradigm acknowledged that risk perceptions are not only related to the profiles of the hazards, but also to the characteristics of the people who perceive the risks. Studies explored underlying social dimensions such as trust, stigma, blame, and accountability, which emphasized the interactions between social context and individual perceptions (Kasperson, Kasperson, Pidgeon, & Slovic, 2003; Marris, Langford, & O'Riordan, 1998). Early studies using the psychometric paradigm were criticized on a number of aspects. For example, it was argued that the psychometric paradigm provides a description of the perceived risk characteristics of hazards and not the underlying psychological or social processes (Pidgeon et al., 1992). Moreover, Sjöberg (2000a) and Sjöberg, Moen, and Rundmo (2004) criticized the psychometric paradigm factor structure for explaining a modest share of the variance of perceived risk as a result of lacking some factors, such as morality and whether the hazard is natural or not. Both Sjöberg (2000a) and Marris et al. (1998) also criticized the use of averages or aggregates in the analysis rather than raw data for individual data analysis. The

psychometric paradigm's focus on individual subjective estimates of risk was considered by Renn (1992) to be its major weakness since risk perception varies among individuals and groups.

In response to the critics Slovic et al. (1982) have argued that some of the criticism of the psychometric paradigm is based on misconceptions of the results and the analyses used. Slovic (1992) acknowledged that cognitive, societal, economic, and cultural factors interact to determine individual and societal risk perception and response to risk, and thus a multidisciplinary way of study is needed. He confirmed that the psychometric approach is not inherently psychological, but it could include other social, institutional, political, and economic variables as well. Many climate change risk perception studies have used the psychometric paradigm as their main theoretical framework, and integrated its psychological approach with other factors.

1.4.4 Cultural Perspective: The Cultural Theory

The cultural theory is usually traced back to the work of Mary Douglas in the 1960s. Douglas studied rituals in tribal societies, which provided insights into social selection and response to risk (Krimsky, 1992; Rayner, 1992). The theory's application to risk analysis was developed in the early 1980s with the work of Thompson (1980), and later gained widespread attention after Douglas and Wildavsky (1982)'s "Risk and Culture" was published (Pidgeon et al., 1992). According to the cultural theory, risk is a social construction, and social context is what determines the selection and response to risk, not individual cognition (Krimsky, 1992).

Cultural theorists propose that individuals select what to fear and how much to fear it as a product of cultural biases (Kasperson, 1992). Cultural biases are values and beliefs that correspond to a certain culture and affect how risk is interpreted and judged. Social relationships and cultural biases interact and viable combinations of them are referred to in the cultural theory as ways of life or worldviews (Wildavsky & Dake, 1990). Hence, each society or social group will have its own specific set of risks selected for concern based on its dominating worldview (Rayner, 1992; Rohrmann & Renn, 2000). The theory also claims that there is a specific number of cultural biases (such as hierarchical, egalitarian, individualistic) which can be identified in diverse contexts and societies, and that these cultural biases are chosen rather than predetermined (Pidgeon et al., 1992).

The cultural theory of risk is based on a grid/group model as shown in Figure 1.2 below. The 'Group' variable in the model represents the social incorporation of the individual in a social unit, while the 'Grid' variable represents the degree to which someone accepts and respects a formal system of hierarchy and procedural rules (Krimsky, 1992; Renn, 1992; Rohrmann & Renn, 2000). For example, in a weak group, individuals will tend to be competitive, while in a strong group they will depend on each other and have more solidarity. A low grid indicates an egalitarian state in which no one is prevented from participating in any social role, while a high grid indicates a state where access to social roles depends on other discriminating factors such as gender (Rayner, 1992). By linking the two independent variables, grid and group, four categories or cultural biases were identified: Individualists, Egalitarians, Fatalists/stratified, and Hierarchists/Bureaucrats. Each group has a different view on risk and is concerned about a different set of hazards. These four categories were expanded to five by Thompson (1980) who added the autonomous individuals or 'Hermits'.
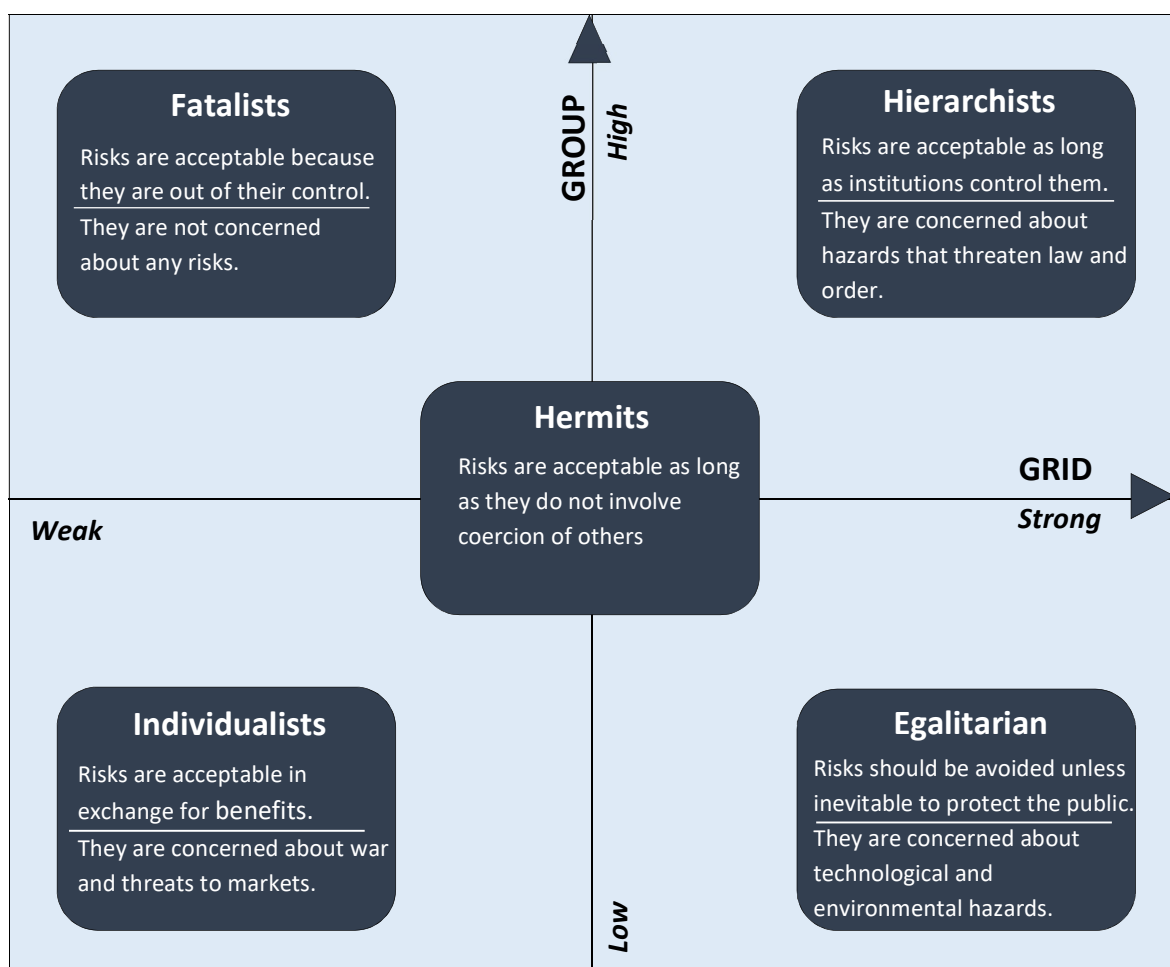
Figure 1.2 - *The cultural theory's categories for cultural biases and views on risk*
Source: *Adapted from Pidgeon, Hood, Jones, Turner, and Gibson (1992), Rayner (1992) and Rohrmann and Renn (2000)*

The cultural theory offers additional evidence of the importance of cultural factors in risk perception, as well as better explanations for social actions and responses to risk (Renn, 1992). However, the theory has been criticized on several grounds (Rayner, 1992). Marris et al. (1998) pointed out that there seem to be two different versions of the theory. One version argues that individuals will conform to the same cultural bias over time regardless of the social context, while the other version suggests that individuals adopt different cultural biases as they move from one type of social context or institution to another. Sjöberg (2000a) and Oltedal, Moen, Klempe, and Rundmo (2004) criticized the theory for having different versions of the categories of cultural biases, and highlighted its limited empirical evidence. Renn (1992) argued that having only five categories of cultural biases is insufficient, and might not capture all social groups in today's modern society. Despite the criticism, the cultural theory provided a qualitative approach to risk, and highlighted the importance of incorporating cultural and social factors in risk perception research, which became the focus of many studies.

1.5.   Climate Change Risk Perception and Risk Communication

Despite the growing scientific evidence and consensus about the causes and seriousness of climate change, public risk perceptions have shown different patterns over the years. Shifts in public risk perceptions of climate change have been attributed to various political, socio-economic and meteorological factors (Brulle, Carmichael, & Jenkins, 2012; Capstick & Pidgeon, 2014; Joireman, Truelove, & Duell, 2010; Li, Johnson, & Zaval, 2011; Ratter, Philipp, & von Storch, 2012; Scruggs & Benegal, 2012; Shum, 2012). For example, in the US, the different political views of climate change have led to extreme opinions about it. Republicans who deny the overwhelming scientific evidence about the human causation of climate change, claim that it is a hoax and a plot against capitalism aiming for more government regulations (Klein, 2014; Leiserowitz, 2005). Furthermore, media play a key role in influencing public perceptions of climate change. Think tanks, websites, and conferences, funded and led by climate change deniers and by the fossil fuel industry, have been undertaking media campaigns to raise public doubts and scepticism about climate change (Hamilton, 2012; Klein, 2014).

Improving public knowledge and education on climate change is therefore vital to shaping public risk perception, which is a strong initiator for public engagement with climate change (Lee, Markowitz, Howe, Ko, & Leiserowitz, 2015). Better climate change awareness will help overcome the campaigns increasing confusion and mistrust among the public (Milfont, 2012).

Understanding public risk perception is important in informing policy and predicting the public's behavioural responses to hazards. In addition, risk perception will also influence the public's willingness to act to address climate change impacts, which will require voluntary actions by individuals and organizations, as well as effective national and international policies (Aitken, Chapman, & McClure, 2011; Lorenzoni, Pidgeon, & O'Connor, 2005; O'Connor, Bord, & Fisher, 1999; Slovic et al., 1982). Communicating the risks of climate change to the public is an essential part of risk management. Nevertheless, there are many challenges to climate change communications, such as the invisibility of climate change's causes, the lack of direct experience with its impacts, and the disbelief in its reality and urgency (Moser, 2010). To overcome some of these challenges and to make risk communication strategies more effective, public risk perceptions of climate change should be taken into consideration (Kempton, 1991; Rohrmann & Renn, 2000).

1.6. Climate Change Adaptation

Climate change impacts can be reduced and managed through climate change mitigation and adaptation. Climate change mitigation refers to measures taken to reduce the causes of climate change, such as GHG emission reductions (Capstick, Pidgeon, & Whitehead, 2013). Climate change adaptation is defined by the IPCC as the process of adjustment to actual or expected climate change impacts to moderate or avoid harm (IPCC, 2014b). Climate change adaptation also refers to actions that help individuals, communities, and governments prepare for and adjust to the impacts of climate change (Capstick et al., 2013). Adaptation measures encompass a wide range of options such as modifying infrastructure to cope with changes in temperature, changing farming practices to reduce impacts of heavy rainfall, and decreasing institutional barriers (Singh, Zwickle, Bruskotter, & Wilson, 2017). One of the main differences between climate change mitigation and adaptation is the scale at which each of them takes place. Climate change mitigation takes place on multiple scales but requires international collective action in order to be effective. On the other hand, climate change adaptation takes place on multiple levels, from global adaptation measures such as developing drought-tolerant crops, to local adaptation measures such as improving storm surge protection (Adger, 2001; van Kasteren, 2014).

There are many classifications of climate change adaptation depending on different dimensions. For example, with respect to timing, climate change adaptation can be classified into proactive

adaptation (i.e. anticipatory or planned) and reactive adaptation (i.e. responsive) (Smith, Burton, Klein, & Wandel, 2000). Proactive adaptation refers to the actions motivated by predictions of an event occurring at an unknown time in the future, such as water storage prior to a drought. Whereas, reactive adaptation refers to actions motivated by the onset of the event itself, such as resettlement after a flood has occurred (Klein, 1998, 2003). Adaptation measures can also be classified as hard or soft adaptation. Hard adaptation approaches include the construction of structures such as breakwaters, dikes, and sea walls to adapt to sea level rise and coastal erosion (i.e. coastal adaptation) by altering the influence of waves. On the other hand, soft adaptation approaches try to avoid any further ecological impacts and in the case of coastal adaptation, for example, they include managed realignment, revegetation, beach nourishment, and beach drainage (Agrawala et al., 2004; Myatt-Bell, Scrimshaw, Lester, & Potts, 2002).

1.7.   Research Location: The Egyptian Context

This research took place in Egypt with a focus on its main cities. Egypt lies in the northeast corner of Africa overlooking the Mediterranean Sea in the north and the Red Sea in the east. With a population of over 90 million people, Egypt is the most populated country in North Africa and the Arab World. Egypt's main cities are greater Cairo (which includes Cairo and Giza governorates) and Alexandria, with populations of approximately 20 and 5 million people respectively (Central Agency for Public Mobilisation and Statistics CAPMAS, 2017). Cairo lies approximately 165 km inland south of the Mediterranean on the east bank of the Nile River, while Alexandria lies right on the Mediterranean coast (refer to Figure 1.3).

Figure 1.3 – Map of Egypt showing locations of main cities
Source: http://d-maps.com

The Nile Delta is one of the largest river deltas in the world. It is the most important agricultural region in Egypt, and the source of almost 40% of the country's agricultural production and 60% of fish catch production (Attaher, Medany, & Abou-Hadid, 2009; El-Nahry & Doluschitz, 2010; Hasan et al., 2015). The Nile Delta was once referred to as the 'bread basket' of the world, but today is suffering from high population growth, urbanization, soil salination, saltwater intrusion and land subsidence (Hasan et al., 2015). The Nile Delta's coastal zone lies along the Mediterranean Sea, it hosts 18 urban areas located in six governorates and extends from Alexandria in the west to Port Said in the east (Abdrabo & Hassaan, 2015; Hassaan & Abdrabo, 2013). The delta's coastal area hosts 70% of Egypt's industrial and commercial activities, including recreational venues, new cities and housing communities, two major trading seaports, three fishing ports, and an international highway (refer to Figure 1.4) (El-Raey, 2010; Hasan et al., 2015; Hassaan & Abdrabo, 2013).
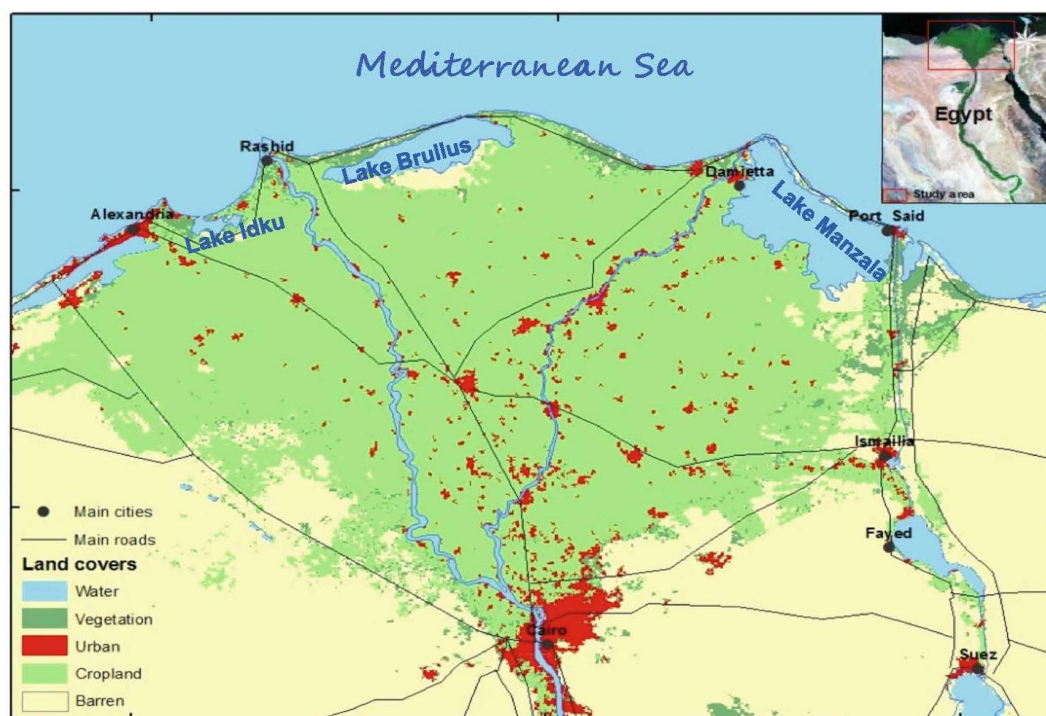
Figure 1.4 – Location map and land uses for the Nile Delta
Source: Hasan, Khan, and Hong (2015) (P. 649)

Egypt is among the most susceptible countries in the world to the potential impacts of climate change. It is also expected to be the most affected country in the Middle East and North Africa, have the highest population exposed to climate change, and the highest amount of agricultural land impacted by changes in the climate (Dasgupta, Laplante, Meisner, Wheeler, & Jianping Yan, 2007). The IPCC identified the Nile Delta among the three most vulnerable deltas to sea level rise

in the world (refer to Figure 1.5) (IPCC, 2007). Under current adaptation measures and with optimistic sea level rise predictions, Alexandria is expected to be the most vulnerable coastal city in the world by 2050, with more than one million people potentially displaced, and more than 100% increase in average annual monetary losses due to flooding (Hallegatte, Green, Nicholls, & Corfee-Morlot, 2013; IPCC, 2014a). Extreme weather events have started occurring in Egypt in recent years. In 2010, an unusually strong storm hit the Nile Delta coast; torrential downpours, extensive flooding and gale force winds caused serious damages to coastal structures and resulted in many fatalities (Malm, 2013; Williams & Ismail, 2015).

Figure 1.5 - *Vulnerability of coastal deltas around the world to sea level rise indicated by predictions of populations to be displaced*
Source: *IPCC (2007) (P.327)*

Sea level rise is the main climate change impact threatening Egypt's coastal areas along with extreme weather events, increases in storm surge, and increases in flash floods (El-Raey, 2010; IPCC, 2013c). There is a scientific consensus that the Nile Delta will also be subjected to severe impacts of sea level rise which will be exacerbated by local factors such as land subsidence (Bohannon, 2010; El-Nahry & Doluschitz, 2010). Most projections also suggest a decline in the Nile flow in the future caused by regional climate change (Sušnik et al., 2015). Given that the vast majority of Egypt's crops are irrigated by water from the Nile, any reductions in the Nile flow will have serious impacts on agricultural productivity (McCarl et al., 2015). Climate change will also have indirect socio-economic impacts on Egypt. Sea level rise and variations in rainfall will affect water security and drinking water quality (El-Nahry & Doluschitz, 2010; Sušnik et al., 2015). Saltwater intrusion is projected to reduce land productivity, and sea level rise will lead to the loss of agricultural land, which will threaten Egypt's food security and reduce farming

opportunities (El-Raey, 2010; Hassaan & Abdrabo, 2013). Increased seawater salinity and ecosystem changes are expected to cause changes in fisheries catches in the northern lakes which are the source of one-third of Egypt's fish production (El-Nahry & Doluschitz, 2010; El-Raey, 2010). Climate change will also have a severe impact on infrastructure and industry, and vulnerable populations along the coast will face threats to their businesses, lands, and homes, and will be forced to move to safer areas (Batisha, 2015).

Despite the wide range of adaptation measures available in principle to deal with sea level rise, only hard options such as the construction of breakwaters, dikes, and sea walls have been used in Egypt (Agrawala et al., 2004; El-Raey, 2010). Adaptation policies in Egypt are limited, they are not integrated into wider coastal management and development plans, and are constrained by weak governance (Hassaan & Abdrabo, 2013). Non-structural long-term adaptation options such as preventative resettlement of populations have not yet been considered, although they could be the only viable option in certain areas like Alexandria where 35% of the population live in areas below sea level (Frihy, Deabes, Shereet, & Abdalla, 2010; Sušnik et al., 2015). Developing necessary adaptation strategies for Egypt will be a complex and challenging process as Egypt is currently battling serious economic problems after years of political instability after the 2011 revolution. The government will have to make significant efforts to improve public awareness of climate change risks and adaptation responses, as well as enhance people's resilience and the country's overall capability to adapt to climate change.

1.8. Research Aim and Questions

This research contributes to the academic literature by taking an in-depth look at public risk perceptions of climate change and perceptions of climate change adaptation in Egypt. It identifies the main predictors of climate change risk perception in Egypt using the Climate Change Risk Perception Model (CCRPM) conceptual framework (the CCRPM will be discussed in detail in the following chapter). There is a clear gap in the study of public risk perceptions of climate change; developing countries in general and Egypt in particular are underrepresented, while the effects of climate change on them are projected to be serious. Moreover, the most recent data used for Egypt in previous studies was from 2010, and there is a need for updated data. In providing an update, this research also offers an insight into the Egyptian public's perceptions of climate change after the 2011 revolution which had a significant impact on the country. Furthermore, the results of this research suggest useful recommendations for policy

and communication strategies for better public engagement with climate change, which may in turn, influence the public's willingness to address climate change.

This research employs a mixed-methods approach which is carried out through two studies. Study (1) involves the analysis of responses from a quantitative online survey, while study (2) uses a qualitative approach through analysing semi-structured interviews. There are three main research questions that this thesis is investigating in addition to sub-questions as shown in the following table:

Main Research Questions	Sub-questions	
1. **How do Egyptians perceive climate change?**	1.1	How do Egyptians perceive climate change in comparison with other environmental problems?
	1.2	What are Egyptians' beliefs about the reality and causation of climate change?
	1.3	How concerned are Egyptians about climate change?
	1.4	Are there demographic differences in perceptions of climate change in Egypt? (i.e. age and gender)
2. **What are the predictors of climate change risk perception in Egypt?**	2.1	How does the CCRPM explain the factors influencing climate change risk perception in Egypt?
	2.2	Are there different predictors of societal and personal risk perception in Egypt?
3. **How do Egyptians perceive climate change adaptation?**	3.1	What are the perceived adaptation priorities for Egyptians?
	3.2	What are Egyptians' perceptions of responsibility for adaptation?
	3.3	How willing are Egyptians to adapt to climate change?

Table 1.1 – Research questions and sub-questions

1.9.   Thesis outline

This thesis is divided into six chapters. The following table provides a brief description of the structure and contents of each chapter.

Chapter	Outline
1. Introduction	The first chapter has provided an overview of key concepts and theories used in this thesis. Next, the location and local context of the research were discussed in detail. Finally, the chapter concluded by discussing the research aim and main research questions, in addition to the thesis outline and structure.
2. Literature Review	The second chapter offers a comprehensive review of the different types of studies that addressed the main topics investigated in this thesis. In addition, the conceptual framework on which this research is based is introduced and a brief overview of other conceptual frameworks is also briefly discussed.
3. Research Methodology and Epistemology	The third chapter provides a detailed overview of the research approach and design adopted in this thesis. It starts by discussing the research's epistemology, then moves on to discuss the methodology and why it was used to answer the research questions. The chapter concludes by discussing some ethical considerations.
4. Study (1) – Quantitative Methods and Results	The fourth chapter discusses the quantitative study of this research which uses an online survey. The chapter starts by providing details on the survey design, the process of data collection, recruitment of participants, sample characteristics, measurement of key variables, and statistical analyses used. The chapter then discusses the results of study (1).

Chapter	Outline
5. **Study (2) – Qualitative Methods and Results**	The fifth chapter discusses the qualitative study of this research which uses semi-structured interviews. The chapter starts by providing details on the interviews' structure, the sampling, and recruitment procedure, and the qualitative analysis used. The chapter then discusses the results of study (2).
6. **Discussion**	The sixth chapter discusses the quantitative and qualitative results and similarities and/or differences are explored and linked to relevant literature. Limitations, recommendations, and areas of further research are discussed at the end of the chapter.

Table 1.2 – Thesis outline

Chapter 2: Literature Review

2.1   Introduction

Public perceptions and concern about climate change have been the focus of numerous studies throughout the past few decades. Different disciplines study climate change risk perception and its determinants, such as human geography, environmental science, environmental psychology, and social anthropology (Nielsen & D'haen, 2014). The studies encompass a wide range of different methodologies ranging from quantitative studies, using opinion polls and surveys, to ethnographic qualitative studies using semi-structured and unstructured interviews, focus groups, and participant observation methods (Pidgeon, 2012). The vast majority of studies have been conducted in North America and Europe; while most other regions of the world are represented in a very limited number of studies. In a recent review of studies related to public perceptions of climate change and climate change adaptation published in Global Environmental Change from 2000 to 2012, Nielsen and D'haen (2014) pointed out that all populated regions of the world were represented, except North Africa.

Early studies on public perceptions of climate change examined the difference between lay people's understanding and knowledge of climate change and that of experts. The studies then progressed to include different measures of attitudes, beliefs, perceived risk, and willingness to act to address climate change. In addition, studies started looking into the relationships between perceptions of climate change and different social, cultural, economic, political, demographic, and psychological factors. Changing public perceptions of climate change over time also became the focus of some studies which tried to investigate the factors influencing those shifts in attitudes. This literature review explores those different types of studies by dividing them into the following groups:

- Qualitative in-depth studies
- Quantitative studies using surveys and opinion polls
- Studies exploring the temporal shifts in public perceptions of climate change
- Studies investigating the factors influencing public risk perceptions of climate change
- Studies focusing on perceptions of climate change adaptation
- Studies including data for Egypt

Sections 2.2 to 2.4 discuss the different types of studies in detail. In section 2.5, the conceptual framework on which this research is based is introduced and a brief overview of other conceptual frameworks is also briefly discussed. The terms "climate change" and "global warming" are both used throughout this literature review, not interchangeably but rather to reflect the exact term used in each study.

2.2 Qualitative In-depth Studies

Pioneering qualitative research about lay people's perceptions of global warming started in the US and Europe in the early 1990s with the work of Kempton (1991), Löfstedt (1991), and Bostrom, Morgan, Fischhoff, and Read (1994). They conducted ethnographic and in-depth studies on small samples of lay people using focus groups and interviews. Studies showed that lay people interpreted the new phenomenon of global warming by adjusting it to fit their known world through four pre-existing concepts: (1) Ozone depletion; (2) Plant photosynthesis; (3) Air pollution; and (4) Experienced temperature variations (Kempton, 1991). This made the lay perspective on global warming very different from the expert perspective. Moreover, Kempton (1991) found that many people believed that the weather had already changed and they attributed the changes to human activities. Similar results were found in Northern Sweden (Löfstedt, 1991) and in New Zealand (Bell, 1994).

Bostrom et al. (1994) conducted three studies in the US and found that ozone depletion and air pollution are integral parts of lay people's mental models of global warming. Mental models of a hazard are the sets of principles from which people generate predictions of the hazard's behaviour (Bostrom, Fischhoff, & Morgan, 1992). If mental models are flawed, this will restrict lay people in their ability to distinguish between effective and ineffective strategies to deal with global warming. Bostrom et al. (1994) also found that human effects of global warming already existed in people's imagination and that the majority of the sample believed the US should do something about global warming.

By the late 1990s, more studies focused on the public's understanding of climate change and its underlying mechanisms. Kempton (1997) explored the cultural models used by US voters in order to understand climate change. He defined cultural models as "conceptual models of the fundamental ways in which the world works that are shared by most people in a certain culture" (p. 14). Consistent with his previous work, Kempton (1997) found that the two main concepts that people associated with climate change in the US were air pollution and ozone depletion

which he argued became linked with climate change in people's minds as a result of media coverage. Kempton (1997) also found that climate and weather meant the same thing to most people and that people who believed the climate was already changing might, in fact, be referring to local weather patterns. Kempton (1997) argued that due to the use of the term global warming as synonymous with climate change, people tended to think that climate change simply meant hotter weather. Kempton (1997) suggested that to overcome people's misconceptions about climate change, pre-existing concepts should be addressed because humans do not just passively receive new information, they actively fit the information into pre-existing cultural models and concepts. Similar findings were reported in an observational study in the US by Henry (2000), but in contradiction with Kempton (1997), he found that people tended to think that natural phenomena such as volcanoes had more far-reaching effects on climate change than humans ever could.

More than a decade after their first mental models study (Read, Bostrom, Morgan, Fischhoff, & Smuts, 1994), Reynolds, Bostrom, Read, and Morgan (2010) repeated the study on a similar sample of well-educated people in the US and found higher awareness and better comprehension of climate change causes. Unlike in 1994, respondents rarely mentioned ozone depletion as a cause of global warming. They were also more likely to mention energy use as a major cause of climate change and to differentiate between good environmental practices and specific actions to address climate change. This showed that people's mental models about climate change had changed over time. However, some incorrect beliefs about climate change still existed and some key facts were still not well understood, such as that global warming is primarily caused by carbon dioxide emissions from the combustion of fossil fuels.

In a review of qualitative studies on public understanding of climate change, Wolf and Moser (2011) provided some valuable insights from 68 in-depth studies that used focus groups, interviews, and participant observation. The review included studies from many countries such as Germany, UK, Australia, and the US, but no studies from Egypt. It showed that individuals' perceptions about climate change were linked to broad issues such as equity, development and perceived economic power, and that each country's socio-political context plays an important role in risk perception (Bulkeley, 2000; Darier & Schüle, 1999; Maibach, Nisbet, Baldwin, Akerlof, & Diao, 2010). For example, Bulkeley (2000) indicated that in Australia, public understanding of global environmental issues drew not only on scientific information, but also on local knowledge, values and moral responsibilities. Wolf and Moser (2011) suggested that rather than focusing on

providing information to encourage public action, attention could also be directed to the social and institutional barriers that act to constrain public involvement in addressing climate change.

In-depth qualitative studies offer valuable insights into the cognitive and emotional processes underlying responses to climate change information allowing researchers to understand why individuals respond in certain ways. It can also offer better understanding of perceptions among particular population segments, such as rural versus urban communities facing different contextual barriers to engagement with climate change (Wolf & Moser, 2011). Another advantage of qualitative studies is that ethnographic interviews use open-ended questions and follow-up probes to understand what the answer really means and to explore unfamiliar concepts, while in surveys the questions and range of possible answers are limited and predetermined (Kempton, 1991). In addition, qualitative studies provide a depth of explanation and insights into people's perceptions of climate change but they usually lack an explanation of how these perceptions changed over time. Qualitative studies also lack generalizability potential and are hard to use for cross-country comparisons as they are highly contextual (Capstick et al., 2015).

It is clear that there is a lack of qualitative studies about public perceptions of climate change in Egypt. As the literature showed, the vast majority of qualitative studies were conducted in Western countries, mainly in the US and Europe. This research addresses this gap through a qualitative component that offers an in-depth look into Egyptians' understanding, knowledge, and perceptions of climate change. Moreover, the semi-structured interviews used in this study capture a wide range of participants' feelings and personal experiences with climate change impacts.

2.3   Quantitative Studies Using Surveys and Opinion Polls

In the early 1980s, questions about global warming began appearing in national surveys and opinion polls in the US and Europe. By the late 1980s, global warming had emerged as a specific topic of interest in surveys, a trend which continues today. Survey questions related to global warming usually focused on awareness, knowledge, the degree of concern, and willingness to address the potential negative impacts (Bord, Fisher, & Robert, 1998). In 1992, the 'Health of the Planet' survey was the first cross-national survey to include questions about global warming and was conducted in 24 countries. It also included developing and developed countries for the first time (Dunlap, Gallup, & Gallup, 1993). By the late 1990s, data from national and cross-national

surveys and opinion polls were used in studies to draw conclusions about public perceptions of environmental issues in general, and of climate change in particular, and to make comparisons between countries. Three important early studies laid the groundwork for this type of quantitative research (Bord et al., 1998; Brechin, 2003; Dunlap, 1998). They used large samples and cross-national comparative data which complemented the perspective from in-depth qualitative studies.

Dunlap (1998) used data from a 1992 Gallup survey conducted in Canada, USA, Mexico, Brazil, Portugal, and Russia, and concluded that the public in all surveyed nations had limited understanding of the causes of global warming which they usually confused with ozone depletion and air pollution. He also concluded that there was a significant level of concern for global warming, but it was less than other environmental issues, such as deforestation and water pollution. In addition, the study showed that compared to other countries the US was the least concerned about global warming. Developing countries such as Brazil and Mexico tended to be more concerned about global warming than the US, Canada, and Russia. Similar conclusions were obtained by Bord et al. (1998) who also indicated that there was a limited willingness of the public in the US and other countries to act to better cope with global warming.

Brechin (2003) used the 1992 Health of the Planet survey, and other Gallup surveys administered in the US from 1989 to 2003, and his conclusions were consistent with previous studies. Concern about global warming was ranked lower than concern about other environmental problems in the US and other countries and there was no significant difference in climate change knowledge between richer and poorer countries. This study did show a slightly better understanding of climate change in 2001 as compared to 1992, but in all countries limited understanding of climate change causes and confusion with ozone depletion were still clear. Similar results were found in the US, the UK and Europe (Lorenzoni & Pidgeon, 2006; Norton & Leaman, 2004). Lorenzoni and Pidgeon (2006) pointed to another recurring finding, which was that climate change was generally associated with a higher risk for society than for individuals, and higher risks for developing countries and future generations.

In summary, quantitative studies in the 1990s and the early 2000s had two main findings. First, the public had limited understanding of global warming and confused it with other environmental problems, such as ozone depletion and air pollution. Second, global warming had a lower ranking in terms of importance and concern than other environmental problems. This is

broadly consistent with the findings of in-depth qualitative studies done in the 1990s (Bostrom et al., 1994; Kempton, 1991, 1997; Löfstedt, 1991). Quantitative studies that included data for Egypt will be discussed separately in section 2.7 of this chapter.

In a review of hundreds of polling questions about global warming from over 70 national surveys administered in the US over a twenty year period, Nisbet and Myers (2007) investigated and summarized general trends in public perceptions of global warming. Their main findings were that there was an increased awareness and understanding of global warming, among the public, but that there were also clear fluctuations in public concern about it. For example, the percentage of respondents reporting having heard or read about global warming rose from 39% in 1986, to 58% by 1988, to 80% or above in the late 1990s, and finally to over 90% in 2006. In 1992, only 11% reported they understood the issue of global warming very well. This percentage ranged between 15 and 18% from 2001 to 2005 and increased to 22% in 2007. With respect to public concern about global warming, about a third of the respondents worried a great deal about global warming between 1989 and 1991 but then dropped to 24% in 1997, increased to 34% in 1999 and to 40% in 2000. This percentage dropped again to 29% in 2002 after the 9/11 terrorist attacks but appeared to rebound in 2007 when it reached 41%.

In another review, Brechin (2010) looked into five major cross-national surveys about climate change from 2007 and 2008 with data from 51 countries and explored different patterns of public opinion. The main conclusion of this review was that it showed a lot of variation between countries in their perceptions of different aspects of climate change. Each country seemed to have its own national trends and dynamics that were usually hard to explain. For example, in the 2008 National Geographic Greendex survey of 14 countries, 36% of Australian respondents reported that climate change was the most important national problem which was a high percentage compared to other countries. Another example appeared in a 2007 BBC survey. When asked if human activity was a significant cause of climate change, at least 91% of respondents from Mexico, Spain, Italy and South Korea reported that human activity was a significant cause of climate change. However, an urban sample in Egypt had the highest percentage of respondents who believed that human activity was not a significant factor (33%). Despite these variations between countries, the results suggested that a considerable increase in knowledge about the causes of climate change, higher levels of concern, and willingness to take action have taken place worldwide since the 1980s (Kull et al., 2007; Leiserowitz, 2007).

The significant differences between countries in perceptions of climate change and in support for policies was pointed out by Pidgeon (2012) as a recurring finding. He argued that these differences were not just attributable to different national levels of education or economic development; rather, they were shaped by localized contextual factors in each country. Lee et al. (2015) mapped public awareness and concern about climate change for 119 countries representing all regions of the world using survey data from 2007 and 2008, and they also reported cross-country variations. For example, more than 65% of Egyptian respondents reported that they had never heard of climate change while less than 10% of respondents in the US reported being unaware of climate change. Among those who were aware of climate change in Egypt, more than 80% thought it was a serious threat (refer to Figure 2.1 below). According to Capstick et al. (2015), there is cross-cultural variability between countries in notions of climate change and its varying meanings and understandings, which should be kept in mind when doing international comparisons.
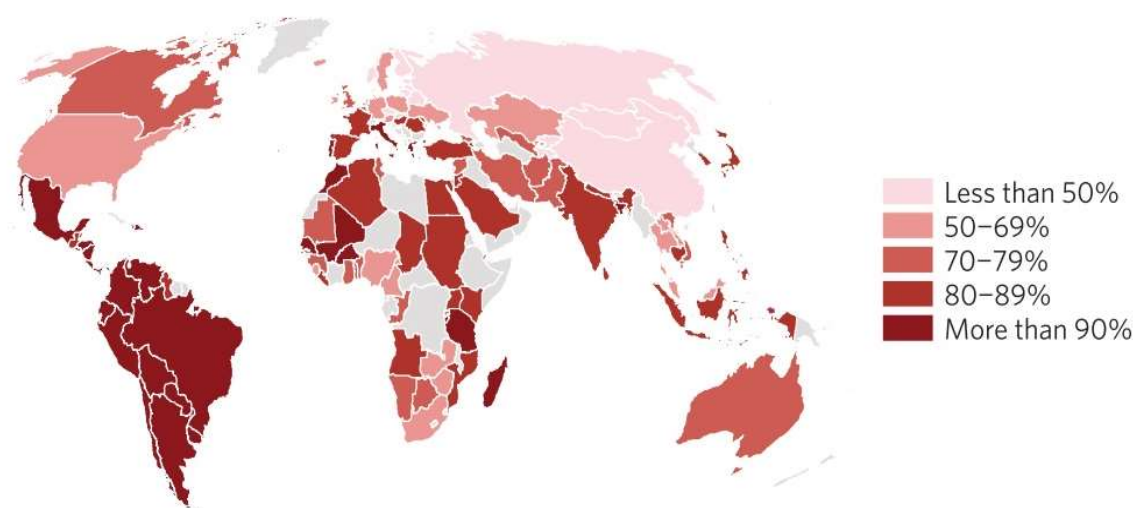
Figure 2.1 - *Among survey respondents from 119 countries in 2007 and 2008 who were aware of climate change, percentages of those who think it is a serious threat*
Source: *Lee et al. (2015) (P. 1015)*

Surveys and opinion polls undertaken between 2010 and 2016 have shown the same trend of fluctuating public concern about climate change, but they have also shown signs of stabilization in some countries. For example, the European Commission (2014)'s Eurobarometer survey undertaken in 28 European Union countries revealed that concern about climate change and its level of importance had remained largely the same from 2010 to 2013. On the other hand, a survey in 2012 conducted in 22 countries showed a decline in concern about climate change from the levels in 2009 in countries such as China and Brazil (Globescan, 2013). A recent Gallup

poll indicated that the percentage of Americans who worry a great deal about climate change rose from 37% in 2016 to 45% in 2017 which is the highest percentage reached in the past three decades in the US (Gallup, 2017).

Surveys and opinion polls are ideal for exploring public opinion and for comparing a wide range of attitudes, levels of understanding and concern among different countries through large samples. They are also able to provide a big picture of the long-term trends of public opinion when they are taken over time (Pidgeon, 2012; Wolf & Moser, 2011). Despite providing many useful insights into global trends of public perceptions, large-scale surveys and opinion polls have some limitations. They do not provide explanations of the drivers of public opinion trends, and do not take into account contextual and cultural differences between countries in their understandings of different notions of climate change (Capstick et al., 2015). Furthermore, studies have shown that changing question wordings and using different terms such as climate change and global warming in surveys yielded different responses from participants (Nisbet & Myers, 2007; Schuldt, Konrath, & Schwarz, 2011; Whitmarsh, 2008b).

This research addresses some of the limitations of survey research, and offers a starting point for in-depth studies about public perceptions of climate change in Egypt. Most surveys have used relatively simple measures of climate change risk perception, and seldom asked questions about personal risks of local climate change impacts. Moreover, survey questions rarely put the perceived risk of climate change within the context of perceived risks from other environmental problems (Bord et al., 1998; Leiserowitz, 2006). The survey in this thesis overcomes this by measuring general, personal, and societal risk perception, and asking questions about specific contextual and local impacts of climate change in Egypt. In addition, it investigates how respondents perceive climate change in comparison with other local environmental problems facing Egypt. Previous quantitative studies often overlooked within-country differences which were lost in aggregation in national samples (Brechin & Bhandari, 2011; Capstick et al., 2015). This research highlights some differences in perceptions between individuals from different cities in Egypt, such as Cairo and Alexandria, and recognizes the different climate change impacts affecting each city.

2.4   Temporal Shifts in Public Risk Perception of Climate Change

Throughout the past four decades public risk perception of climate change has shown varying trends across different parts of the world. In a comprehensive review of almost 40 studies conducted between 1980 and 2014, Capstick et al. (2015) looked into quantitative and qualitative longitudinal studies that explored the continuous temporal shifts in public risk perception of climate change and attempted to explain them. The main finding from this review was that in some countries, such as the UK, Germany, Australia, and most notably the US, there has been a very significant decline in public concern about climate change in the late 2000s (refer to Figure 2.2 below). This decline was accompanied by a growth in public scepticism about climate change despite the growing scientific consensus. However, as also noted by Pidgeon (2012), clear majorities in other parts of the world, such as Latin America still expressed high levels of concern about climate change throughout the same period. This is usually attributed to the growth in civil society climate justice activism at the time as well as the occurrence of extreme weather events (Capstick et al., 2015).
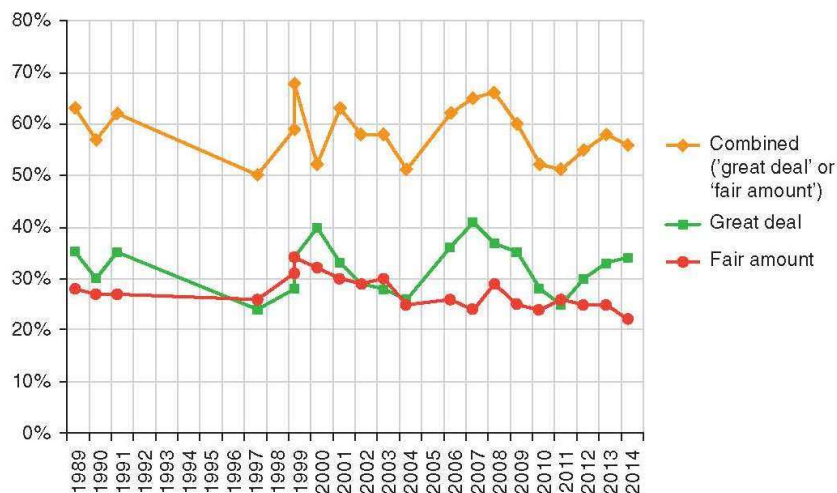
Figure 2.2 - *Changing levels of 'worry' about climate change in the US over a 25-year period*
Source: *Capstick, Whitmarsh, Poortinga, Pidgeon, and Upham (2015) (P. 44)*

Pidgeon (2012) suggested a number of reasons for the decreased concern and increased levels of scepticism about the reality of climate change between 2007 and 2010 in many countries. First, he noted that, due to the extensive discussions about climate change in the media worldwide, the public may have become bored or exposed to 'Climate Fatigue', which means that the public may have lost interest in the topic or that it had become an old story. Second, the 2008 global financial crisis might have driven environmental issues temporarily out of public

concern. Third, the politicization of climate change and the partisan divide in opinion over it, especially in the US, between liberals and conservatives, either led to extreme public opinions or alienated the public from the issue. This was also indicated by McCright and Dunlap (2011) who found evidence of both ideological and partisan polarization on climate change beliefs and concern in the US, and by Whitmarsh (2011) who found that climate change scepticism is strongly determined by individuals' political values rather than by education or knowledge. Finally, Pidgeon referred to the 'Uncertainty Transfer' as another possible reason for increased scepticism about climate change. Uncertainty about one specific aspect of climate change science gradually and subtly spreads, so that uncertainty is generated about a different aspect of climate science, which increases the overall uncertainty level (Spence et al., 2012).

Another possible explanation for climate change scepticism and decline in concern is media coverage. Ratter et al. (2012) suggested that negative media coverage surrounding climate change between 2008 and 2010 impacted the public's beliefs about climate change and led to their distrust of communications about it. The authors referred to three main incidents: (1) The allegations of errors in IPCC assessments in 2009; (2) The failure of the UN climate change conference in Copenhagen in 2009; and (3) The 'Climate Gate' incident in 2010 in which the unauthorized release of e-mails from the Climatic Research Unit at the University of East Anglia led to accusing climate scientists of fraud and data manipulation. Media were also used as a political tool by Republicans in the US to influence public opinion as a means of challenging the Democrats' climate policy after Obama's election in 2008. Republicans together with the fossil fuel industry funded and led think tanks, websites, and conferences, to cast doubts about climate change (Oreskes & Conway, 2010). Furthermore, media campaigns were based on denying the overwhelming scientific evidence about the human causation of climate change and claiming that it is a hoax and a plot against capitalism aiming for more government regulations (Hamilton, 2012; Klein, 2014).

A few studies attempted to empirically examine multiple potential causes of increased scepticism and decline in concern about climate change in the late 2000s. Scruggs and Benegal (2012) used public opinion survey data from the US and Europe, data for global temperature anomalies from NASA, information about media coverage on climate change, and data for unemployment rates as a measure for economic conditions to investigate the influence of these factors on the decline in belief about climate change. They concluded that the decline in concern about climate change in the US and Europe was mostly driven by economic insecurity caused by

the global financial crisis of 2008. Similar results were concluded by Shum (2012) who used data from the European Union, and Brulle et al. (2012) who found that political positions on climate change and economic factors had the largest effect on the US public concern over climate change between 2000 and 2010. Other empirical studies in the US found that the decline in concern about climate change could be explained by local temperature fluctuations (Deryugina, 2013; Donner & McDaniels, 2013; Hamilton & Stampone, 2013). However, Egan and Mullin (2012) found that the effect of local weather on beliefs is more significant after longer periods of unusually hot or cold weather, and that this effect decays rather quickly and therefore is unlikely to induce permanent attitude change.

Studies that used time series analysis to draw conclusions about the drivers of the changing trends of public perceptions of climate change, such as social, economic, political, and meteorological factors, provided valuable insights into the reasons behind changing public perceptions. Nevertheless, their shortcoming is that they used a limited number of variables, and were only carried out in developed countries (Capstick et al., 2015).

2.5   Predictors of Climate Change Risk Perception: Climate Change Risk Perception Model (CCRPM)

Researchers investigating public risk perception of climate change have used different theoretical models and conceptual frameworks linking climate change risk perception to different factors. van der Linden (2015) conducted a comprehensive review of such studies, which he selected based on the empirical explanatory power of their tested models. He focused on ten major studies which were all reviewed in relevant sections of this literature review (Akerlof, Maibach, Fitzgerald, Cedeno, & Neuman, 2013; Kellstedt, Zahran, & Vedlitz, 2008; Leiserowitz, 2006; Malka, Krosnick, & Langer, 2009; Menny, Osberghaus, Pohl, & Werner, 2011; Milfont, 2012; Smith & Leiserowitz, 2012; Spence et al., 2012; Sundblad, Biel, & Gärling, 2007). As a result of his review, van der Linden highlighted the following conclusions:

1. Despite the various models of climate change risk perception used in the reviewed studies, a more systematic and comprehensive model of the key determinants of climate change risk perceptions was still lacking.
2. The majority of the studies were conducted in the US.

3. The amount of variance that the proposed models explained ranged between 22% and 55% which leaves significant room for further developments in the theoretical and empirical explanatory power of the current climate change risk perceptions models.

4. The studies used limited and different sets of factors or predictors of climate change risk perception which might explain the varying explanatory power.

5. Different measures of climate change risk perception and different terms such as 'climate change' and 'global warming' were used which might also explain the variation.

6. Most studies did not differentiate between personal and societal climate change risk perception.

Based on the above conclusions, van der Linden (2015) offered a new conceptual framework for climate change risk perception which integrates different theoretical perspectives branching from the psychometric paradigm and the cultural theory of risk (for details on the psychometric paradigm and the cultural theory of risk please refer to chapter 1 sections 1.4.3 and 1.4.4). He proposed the Climate Change Risk Perception Model (CCRPM) in which climate change risk perception is a function of cognitive factors (i.e. knowledge about climate change), experiential factors (i.e. affect, and personal experience), socio-cultural factors (i.e. worldviews, social norms and values), and demographic factors (i.e. age, gender, income, and education level) (refer to Figure 2.4 below). The CCRPM also proposes that societal and personal risk perceptions are two different dimensions having different influencing factors. The CCRPM was tested empirically on a national representative sample of the British population (N= 808) through an online survey (van der Linden, 2015). The survey measured societal, personal, and holistic risk perceptions in addition to the proposed influencing factors: knowledge about climate change, affect, personal experience with extreme weather events, value orientations, social norms, and socio-demographic characteristics. The measurements used for each of the previous factors were based on previous studies.

The CCRPM was able to explain nearly 70% of the variance in climate change risk perception after controlling for demographic factors, which provides insights into the relationship between cognitive, experiential, and socio-cultural factors and climate change risk perception. The results of the study also showed that experiential and socio-cultural factors explained significantly more variance than cognitive or demographic characteristics. Moreover, the findings also confirmed an empirical distinction between societal and personal risk perceptions and highlighted differences in the factors influencing each of them. For example, personal experience was a

significant predictor for personal risk perception but did not predict societal risk perception, while knowledge about climate change was a significant predictor of societal risk perception but did not predict personal risk perception.
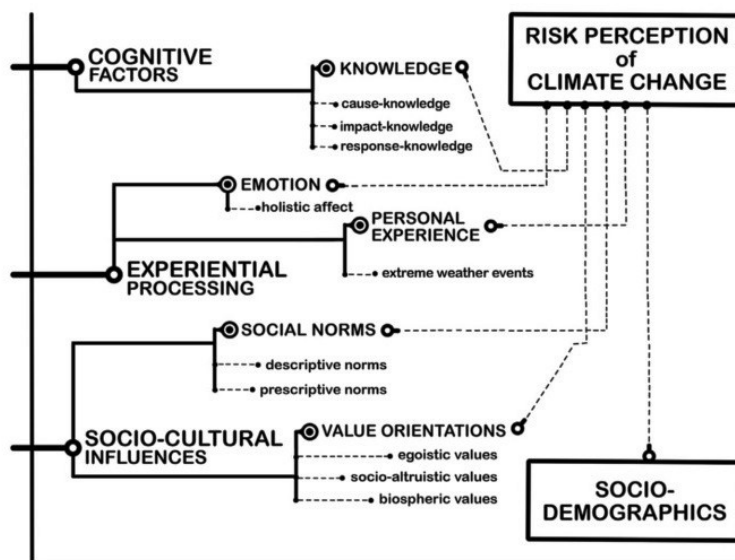
Figure 2.3 – *Climate Change Risk Perception Model (CCRPM)*
Source: *van der Linden (2015) (p. 117)*

Given that the CCPRM was able to explain more variance than any of the other available climate change risk perception models and that it is based on a very recent review of key studies in the literature, this research adopts the CCPRM as a conceptual framework and uses most of the measurements and survey questions it implemented. This is presented in more depth in the quantitative methods chapter. The studies addressing the different factors influencing perceptions of climate change that are part of the CCRPM will be reviewed and discussed in more detail in the following sections.

2.5.1 Socio-demographic Factors

Socio-demographic factors that might be related to climate change risk perception include gender, race, education level, age, parental status, and income. The two factors that will be addressed in this research are gender and age. Regarding gender, studies consistently showed that women express more concern than do men when it comes to environmental issues, including climate change (Blocker & Eckberg, 1997; Bord & O'Connor, 1997; Davidson & Freudenburg, 1996; Mohai, 1997). With respect to climate change risk perception, the 1992 health of the planet survey showed that women rated possible human health effects of climate change as significantly more harmful than men did in all six nations surveyed (Dunlap, 1998). In

Sweden, a survey conducted by Sundblad et al. (2007) showed that gender was the only demographic factor that had a relationship with risk perception, with women worrying significantly more than men about climate change. Similar results were found in Germany (Menny et al., 2011), Norway (Lujala, Lein, & Rød, 2015) and the US (McCright, 2010). Loewenstein, Weber, Hsee, and Welch (2001) indicated that a possible explanation for this is women's ability to have more vivid mental images of the consequences of climate change. Other researchers argued that because women are less often employed in primary industries, they are less inclined to consider economic trade-offs when evaluating environmental risks, which may account for their higher levels of environmental concern (Kellstedt et al., 2008).

Gender also seems to be associated with willingness to act to address climate change. In a 2015 Pew Global Attitudes survey of developed countries including the US, Germany, South Korea, and Australia, in 7 out of 11 countries women were more likely than men to consider climate change a serious problem, be concerned it would harm them personally and say that major lifestyle changes were needed to solve the problem (Pew Research Center, 2015b). Zahran, Brody, Grover, and Vedlitz (2006) also found that women express significantly greater support for climate change policy interventions than men. However, another study showed that while women were more likely to take personal voluntary actions to prevent negative consequences of climate change, older men were more likely to support governmental policies to address climate change (O'Connor et al., 1999). In Australia, Agho, Stevens, Taylor, Barr, and Raphael (2010) found that women were more likely than men to report they had made changes to the way they lived their lives due to the risk of climate change. Overall, it seems that the relationship between gender and climate change concern is more consistently reported in studies than the relationship between gender and responses to address climate change.

The relationship between age and concern about climate change is inconsistent. Agho et al. (2010) found that individuals in the 35-44 age group were significantly more likely to report high concern for self or family from climate change, while Kvaløy, Finseraas, and Listhaug (2012) found that the 30-60 age groups perceived climate change as more serious than the young and the very old. However, in the US a recent survey showed that Americans aged 18 to 29 were significantly more likely than those aged 50 and older to see global warming as a very serious problem (Pew Research Center, 2015a). Sundblad et al. (2007) found that there was no relationship between age and concern about climate change and that gender was the only factor affecting risk perceptions of climate change. Using the CCRPM, van der Linden (2015) also found

that gender was a significant predictor of climate change risk perception while age was not. In addition, socio-demographics accounted for a relatively small amount of the variance in climate change risk perception.

2.5.2   Cognitive Factors

Knowledge is the main cognitive factor related to perceptions of climate change that will be explored in this research. The relationship between different types of climate change knowledge and concern about it has been investigated in many studies. A survey in Sweden showed that knowledge of the causes and impacts of climate change predicted risk perception, while knowledge of the current state of the climate was not linked to risk perception (Sundblad et al., 2007). In Switzerland, Tobler, Visschers, and Siegrist (2012) found that knowledge about the causes and impacts of climate change was positively correlated with climate change concern, while knowledge about the state of the climate was negatively correlated with concern. This was consistent with van der Linden (2015) who found that knowledge about the causes, impacts, and responses to climate change were all significant predictors of climate change risk perception. Similar findings were reported by Stevenson, Peterson, Bondell, Moore, and Carrier (2014) who used a sample of adolescent middle school students in the US. Their results showed that climate change knowledge was positively related to acceptance of human-caused climate change which, in turn, predicted climate change risk perception.

In contrast to the previous findings, Kellstedt et al. (2008) found that respondents to a survey in the US, who self-reported being better informed about global warming, showed less concern about it than respondents who self-reported being less informed. In the US, Malka et al. (2009) explored the relationship between self-reported knowledge and concern about global warming and the moderating factors affecting this relationship. The results showed that a positive relationship between knowledge and concern was only evident for people who trusted scientists and who identified themselves as Democrats or Independents. On the other hand, knowledge and concern were uncorrelated for those who were sceptical of scientists and were Republicans. This study showed that the relationship between self-reported knowledge and concern about climate change is complex and is moderated by other factors such as party identification. Similar results were reported by Milfont (2012) for a sample of New Zealanders.

The difference between self-reported knowledge and actual knowledge about climate change and their relationship with concern about climate change was investigated in a study conducted

in Germany by Menny et al. (2011). They found that respondents with more accurate knowledge about climate change consequences perceived climate change impacts as less hazardous than those with less knowledge. On the other hand, respondents who had high scores on self-reported knowledge about climate change showed a higher degree of risk perception of climate change than those who reported having a lower level of information. This means that actual knowledge of climate change consequences may not lead to increased risk perception, which implies that the effectiveness of large-scale public awareness campaigns in changing behaviours might be doubtful.

With respect to the relationship between knowledge about climate change and willingness to act to address climate change, studies showed mixed results. In the US, Bord, O'Connor, and Fisher (2000) found that the main determinant of behavioural intentions to address global warming -both voluntary action and policy support- was correct knowledge of the causes of global warming. Similar results were reported by Fortner et al. (2000) and Tobler et al. (2012) who also found that knowledge about climate change causes was the strongest predictor of attitudes towards climate change. In contrast, other studies indicated that knowledge about climate change might not necessarily increase support for a relevant policy or motivate effective behavioural responses (Krosnick, Holbrook, Lowe, & Visser, 2006; Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007). In addition, Shi, Visschers, and Siegrist (2015) found that action-related knowledge had a significant positive impact on willingness to change behaviours, while consequences-related knowledge had a small but negative impact on willingness to change behaviour.

2.5.3 Experiential Factors

The two main experiential factors which this research focuses on are affect and personal experience of extreme weather events. According to Leiserowitz (2006), affect refers to "a person's good or bad, positive or negative feelings about specific objects, ideas, or images." (p. 48). People develop judgements about risks through referring to their feelings; thus a potential hazard that evokes negative feelings, such as nuclear energy, will be judged as high in risk (Sundblad et al., 2007). Reliance on feelings as a guide to risk perception, judgments, and decisions is usually referred to as "the affect heuristic" (Slovic, Finucane, Peters, & MacGregor, 2007; Slovic & Peters, 2006). The role of affect in risk perception was also explained by the 'Risk as feelings' hypothesis which suggests that feelings play a prominent role in decision making in

risky situations and that emotional reactions often diverge from cognitive assessments of risk and drive behaviour (Loewenstein et al., 2001).

Leiserowitz (2006) explored the role of affect and values on climate change risk perceptions and policy preferences on a nationally representative sample of the American public. He found that negative affect was the strongest predictor of global warming risk perception while values were the strongest predictor of policy preferences and that both were stronger predictors than all other socio-demographic variables. Moreover, negative affect was also a predictor of support for national policies to address global warming: as negative affect increased, risk perception and support for policies increased. In Sweden, Sundblad et al. (2007) have also shown that negative affect is an important predictor of climate change risk perception. In a later study, Smith and Leiserowitz (2012) conducted a time-series study of nationally representative surveys in the US, using data collected between 2002 and 2010, to track the changes in affect and other variables over time. Consistent with the previous studies, they found that affect was a stronger predictor of global warming risk perception than cultural worldviews or sociodemographic variables, including political party and ideology. Similarly, negative affect about climate change was significantly related to increased risk perception.

In the UK, van der Linden (2014) explored the relationship between personal experience with extreme weather events, negative affect and risk perceptions of climate change. The findings suggested that personal experience with extreme weather events was a predictor of risk perception, while affect and risk perception influenced each other. This means that the causal direction of the relationship between affect and risk perception was found to go both ways. Affect could be seen as a post-cognitive process in which risk perception is processed first and then leads to negative affect, as well as an information processing mechanism in which negative affect drives risk perception. Furthermore, using the CCRPM, van der Linden (2015) found that affect was the strongest predictor of climate change risk perception while personal experience had less explanatory power.

On the other hand, despite the empirical evidence affirming the relationship between affect and risk perception in general and climate change risk perception in particular, some scholars doubt that this relationship exists (Sjöberg, 1998, 2006). Sjöberg claims that the relationship between risk perception and affect is unclear and that it is based on weak empirical evidence. He claims that affect and emotion are used interchangeably in risk perception studies, in spite of their

different meanings and influences on risk perception. According to Sjöberg this has led to incorrect conclusions about the relationship between affect and risk perception.

The experience of extreme weather events is another important experiential factor influencing perceptions of climate change. Extreme weather events include floods, storms, and unusually hot or cold weather. Krosnick et al. (2006) conducted a large-scale survey on a nationally representative sample of the US public and found that people who believed they had witnessed rising temperatures in recent years were more concerned about global warming and were more likely to believe in the reality of it. Similar findings were reported by Li et al. (2011) who conducted a study in the US and Australia, and asked participants to report their opinions about global warming and whether the temperature on the day of the study was warmer or cooler than usual. Results showed that respondents who thought the day was warmer than usual believed more in, and had greater concern about, global warming than respondents who thought the day was cooler than usual. Furthermore, Akerlof et al. (2013) found that perceived personal experience of global warming, in the form of changes in seasons, weather, lake levels and snowfall, predicted local risk perceptions of global warming even when controlling for demographics, political affiliation, and cultural beliefs.

With respect to flood experience, Whitmarsh (2008a) found that flood victims in the UK differ very little from other respondents in their knowledge, concern, and behavioural responses to climate change. The author suggested that the reason why the link between flooding and climate change is weak is that the public - including flood victims - view flooding and climate change as two separate issues with no causal relationship between them. In contrast, Spence, Poortinga, Butler, and Pidgeon (2011) using another national survey in the UK, found that those who report experiencing floods express more concern over climate change, see it as less uncertain, and feel more confident that their actions will have an effect on climate change. These contradictory findings in the UK might be explained by the increased frequency of floods in various parts of the UK in the years following Whitmarsh's (2008a) study. In Wales, Capstick et al. (2013) found that individuals who had experienced flooding were more likely to report higher levels of concern about the effects of climate change on themselves and on Wales. Similar results for the UK were also reported by Demski, Capstick, Pidgeon, Sposato, and Spence (2017) who found that direct experience of flooding was associated with the increased salience of climate change, greater perceived personal vulnerability, and greater risk perception.

Another aspect of personal experience with extreme weather events that was explored in studies is the experience of damages. In a study in Germany, Menny et al. (2011) found that personal experience of damages due to extreme weather events led to higher climate change risk perception which, in turn, had a positive effect on the willingness to have insurance coverage. In Norway, Lujala et al. (2015) showed that direct personal experience of damages caused by climate-related events, such as flooding or landslides, is an important factor in explaining climate change attitudes and perceptions. Norwegians with direct damage experience were more likely to be concerned about the personal consequences of climate change, and believed there will be more natural-hazard events globally, nationally and locally. The results also showed that living in a more exposed area but not having a personal experience of damages did not affect concern about climate change.

2.5.4   Socio-cultural Factors

Socio-cultural factors influencing perceptions of climate change include social norms, value orientations, and cultural worldviews. Social norms and value orientations were the two socio-cultural factors used in the CCRPM, but this research will only explore value orientations as a potential predictor of climate change risk perception. In the CCPRM, the social norm questions focused on climate change mitigation, and because this study focused on risk perception and climate change adaptation, these questions were not deemed relevant in this context. In the environmental domain, one of the most commonly used classifications of values divides them into three broad clusters: (1) Egoistic values which are self-focused and emphasize maximizing individual outcomes, (2) Biospheric values which are environmentally-focused and emphasize the importance people attach to the environment and the biosphere, and (3) Altruistic values which are focused on others and reflect a concern for the welfare of others (De Groot & Steg, 2007; Schwartz, 1992; Stern, Dietz, Abel, Guagnano, & Kalof, 1999; Stern, Dietz, & Kalof, 1993).

Various studies have looked into the relationship between value orientations and support for climate change action and policy measures. In Sweden, Nilsson, von Borgstede, and Biel (2004) found that environmental values were positively related to support for climate change policy measures. Similar results were reported by Dietz, Dan, and Shwom (2007) in the US. They found that altruistic values were predictors of climate change policy support, but that these values indirectly affected policy support via environmental beliefs and worldviews. Studies in the UK have also shown that pro-environmental values were predictors of personal importance of

climate change, belief in the reality of it, and taking action to address it, even more than personal experience with climate change (Poortinga, Spence, Whitmarsh, Capstick, & Pidgeon, 2011; Whitmarsh, 2008a). Furthermore, in a recent review of the literature on values and public engagement with climate change, Corner, Markowitz, and Pidgeon (2014) came to the conclusion that self-transcendent and altruistic values were predictive of positive engagement with climate change while self-enhancement values were not.

With respect to the relationship between value orientations and concern about climate change, Corner et al. (2011) found that individuals with high biospheric and altruistic values were more likely to report concern about climate change in the UK. van der Linden (2015) also found that biospheric values were a strong predictor of climate change risk perception, but egoistic and altruistic values were not significant predictors. This meant that individuals with stronger biospheric values tended to view climate change as a greater risk. It is clear that the vast majority of the studies exploring value orientations and their relationships with perceptions of climate change were done in Western countries that share cultural backgrounds (i.e. the US and Europe). Given that value orientations are highly contextual and culture specific, different findings might be expected in other parts of the world such as Egypt.

2.6   Perceptions of Climate Change Adaptation

Research on perceptions of climate change has mainly focused on climate change mitigation and has paid little attention to climate change adaptation and its psychological dimensions (Grothmann & Patt, 2005; Myatt-Bell et al., 2002). In the climate change adaptation literature, there seems to be a special interest in studies exploring agricultural adaptation and farmers' perceptions of climate change adaptation in particular. These studies were done in many countries such as Senegal (Mertz, Mbow, Reenberg, & Diouf, 2009), the US (Carlton et al., 2016; Mase, Gramig, & Prokopy, 2017), Denmark (Jørgensen & Termansen, 2016), Hungary (Li, Juhász-Horváth, Harrison, Pintér, & Rounsevell, 2017), and many African countries including Egypt (Maddison, 2007). With respect to the general public's perceptions of climate change adaptation, there are fewer studies and they were mainly carried out in the US, the UK, and Australia, which highlights a gap in the literature. Moreover, there is also a lack of studies exploring public support for adaptation policies (Singh et al., 2017).

In the UK, Myatt-Bell et al. (2002) conducted a survey on a small sample of 42 visitors to a public exhibition in Brancaster, North Norfolk. The study aimed to explore people's perceptions of

flooding in Brancaster and assess their awareness about a managed realignment scheme. Managed realignment is a new coastal defence strategy used to address coastal erosion and defend coastlines against sea level rise. Results of the survey showed that a majority of respondents thought flooding was likely or very likely in Brancaster, while actual data showed that only a few properties were vulnerable to flooding. This reflected a misperceived vulnerability to floods by the public which could be explained by the severity of the storm surges and floods that had previously occurred in the area. In addition, respondents with direct experience with the realignment scheme perceived themselves as very well informed, which showed that direct experience with adaptation measures enhances awareness. The authors also indicated that many factors influence public perceptions of climate change adaptation measures, including personal experience, lack of information and media influence.

A different approach to public perceptions of climate change adaptation was used by van Kasteren (2014) who used reports compiled from 96 public group deliberations on climate change adaptation. The reports were issued as part of a climate change engagement program aimed at understanding households' perspectives of climate change adaptation in Australia. The study revealed that households were not able to distinguish between adaptation and mitigation measures, which is probably because of the focus of communication and policy on mitigation strategies. They were also uncertain about specific actions households could undertake to adapt to climate change. However, participants did not view themselves as passive players in adaptation, rather they were willing to be part of the solutions to manage climate change risk which showed a strong sense of community efficacy that would, in turn, enhance the adaptive capacity of their local communities. This study has also shown that householders need information about issues such as food security, equity, and rising costs which are part of the broader picture of climate adaptation planning that needs to be communicated.

In another study in the UK, Capstick et al. (2013) examined people's perceptions of, and attitudes towards, climate change adaptation in Wales using a national representative survey. The results showed that a majority of respondents perceived there is an urgent need to take action to adapt to climate change. Moreover, a majority considered the increased risk of flooding in the future to be a priority area for adaptation measures in Wales. With respect to perceptions of specific adaptation approaches, the highest support was given to building new reservoirs to store water during periods of drought, followed by assisting communities at risk of flooding to move elsewhere. The results also showed that from the public's perspective, responsibility for

adaptation lies primarily at the national and local government level. Unlike the previous studies, this study explored multiple aspects of perceptions of climate change adaptation using a survey that took into consideration the local Welsh context.

In the US, Singh et al. (2017) used an online survey conducted on a representative sample of the general public to explore the relationships between an individual's level of concern about climate change impacts, and their support for adaptation policies. Results of the study revealed a significant and positive relationship between concern and support for adaptation policies, and also between the perceived likelihood of climate change occurring and support for adaptation approaches. Furthermore, it also revealed that the more distant climate change impacts are perceived to be, the less concerned individuals are and the less supportive they are of adaptation policies. This suggests that greater support for climate change adaptation policies may be achieved by framing climate change impacts as happening here, now, and affecting people similar to the target audience.

2.7   Public Perceptions of Climate Change in Egypt

Data about public perceptions of climate change in developing countries started to be used in studies in the early 2000s and were collected using large-scale cross-national surveys and opinion polls. It is clear that there is a gap in the literature regarding in-depth and country-specific climate change risk perception studies for developing countries such as Egypt (Lorenzoni et al., 2005; Rohrmann & Renn, 2000). In the available quantitative studies, the main purpose of using data from developing countries was to have a global representative sample without giving much attention to variations between countries (Kvaløy et al., 2012). In some studies, findings from a few developing countries were generalized to represent a larger number of countries, some of which were not even in the same geographical region (Leiserowitz, 2007). As this literature review showed previously, there are major differences in public perceptions of climate change even between geographically close countries, which suggest that the generalizing of results is problematic (Tien Ming, Markowitz, Howe, Ko, & Leiserowitz, 2015).

Multi-country surveys in the late 1990s and 2000 have shown a limited public awareness and understanding of climate change in Egypt despite a relatively strong belief in the human causation of it. The earliest available data for Egypt related to public perceptions of climate change is from a 1999 Globescan survey of 25 countries, which showed that 43% of Egyptian respondents did not know the main cause of the greenhouse effect, the highest percentage

among all the surveyed countries (Leiserowitz, 2007). In a 2006 PEW Global Attitudes survey of 15 countries – in which Egypt appeared for the first time - 53% of respondents from Egypt reported that they had never heard of global warming (Pew Research Center, 2006). This percentage was lower in a BBC 2007 survey in which 16% said they had not heard or read anything at all about global warming or climate change and 25% said not very much (BBC, 2007). Furthermore, Gallup World Poll data from 2007 and 2008 showed that 65% of respondents from Egypt had never heard of climate change (Lee et al., 2015). With respect to belief in the human causation of climate change, the 1999 Globescan survey showed that 75% of Egyptians were totally convinced that human activities were a significant cause of climate change (Leiserowitz, 2007). Almost a decade later, the percentage of Egyptians who thought that human activity was a significant cause of climate change dropped to 66% (BBC, 2007).

Concern about climate change in Egypt has increased over the years, but is still low compared to other countries. In a PEW 2006 survey, Egypt was among the countries that were least worried about global warming, with only 24% worrying a great deal about it (Pew Research Center, 2006). This question changed in later versions of the PEW survey and asked instead about the seriousness of the problem of global warming. In the PEW 2007 survey, 32% of Egyptians thought global warming was a very serious problem which was the lowest percentage among 47 surveyed countries (Pew Research Center, 2007). This percentage rose to 38% in the PEW 2008 survey and to 54% in 2009 (Pew Research Center, 2008, 2009). However, in the PEW 2010 survey, the percentage dropped back to 44% but the wording of the question changed and asked about climate change instead of global warming (Pew Research Center, 2010). Another multi-country poll in 2009 carried out as part of the World Bank's World Development Report showed that 60% of Egyptians thought climate change was a very serious problem (The World Bank, 2010).

When climate change was compared to other threats, Egyptians seemed to give higher priority to other issues. The growing gap between the rich and the poor was identified as the greatest threat to Egypt in the PEW 2007 survey while pollution and environmental problems came second (Pew Research Center, 2007). In later versions of the survey, Egyptians' top concerns were international financial instability, Iran's nuclear program, and Islamic extremist groups; only 16% thought global climate change was a major threat to Egypt (Pew Research Center, 2013). In 2014, 34% of Egyptians reported that religious and ethnic hatred was the greatest threat to the world, inequality came second with 27%, while only 11% thought it was pollution and the environment which was last among five global threats (Pew Research Center, 2014).

Egyptians' willingness to address climate change seemed to vary in different surveys with different questions being asked. A BBC survey in 2007 showed that 29% of Egyptians found it unnecessary to make lifestyle or behaviour changes to address climate change -which was one of the highest percentages among 21 countries- and 52% were opposed to higher fuel prices (BBC, 2007). In the World Bank survey conducted in 2009, 82% of Egyptian respondents agreed or somewhat agreed that dealing with climate change should be given priority, even if it slows economic growth and causes job losses. Moreover, 69% were willing to pay more for energy and other products as part of taking steps against climate change (The World Bank, 2010). On the other hand, in the 2010 PEW survey, 68% of Egyptian respondents reported unwillingness to pay higher prices to address climate change, the highest percentage of unwillingness to pay among 22 surveyed countries (Pew Research Center, 2010).

With respect to the public's belief in the reality of climate change and the need to take action, the 2010 World Bank survey showed that 35% of Egyptians thought that climate change is substantially harming people now, and 23% thought it will harm people in 10 years. Different results were apparent in the 2007 BBC survey in which 43% of respondents favoured taking major steps very soon to address climate change, while equally 43% favoured taking modest steps (BBC, 2007). Responsibility to act to address climate change was investigated in the World Bank 2010 survey and the findings revealed that 88% of Egyptian respondents think that Egypt has a responsibility to take steps to deal with climate change. In addition, 62% thought the Egyptian government wasn't doing enough, and 27% thought it was doing too much which might imply signs of polarization (The World Bank, 2010).

Although there are no studies specifically exploring the factors influencing climate change awareness and risk perception in Egypt, some data can still be obtained from multi-country studies. Lee et al. (2015) investigated the predictors of climate change awareness and risk perception in 119 countries using Gallup World Poll data from 2007 and 2008 and found that education was the strongest predictor of climate change awareness worldwide, and understanding the human causation of climate change was the strongest predictor for risk perception. However, when we look at the data at a country level, the top three factors affecting climate change awareness in Egypt in order were access to communication, gender, and income, while the top three factors affecting risk perception in order were age, understanding the cause of climate change, and marital status.

Despite the lack of in-depth studies investigating public perceptions of climate change in Egypt, and the fact that the available data was only collected through surveys and opinion polls, the available studies offered some useful insights into the general trends of the past two decades. However, most of the surveys done in Egypt used an urban sample and were not nationally representative. Moreover, the changes in questions' wording and the use of different terms, such as climate change and global warming even within the same survey across various years led to different and inconsistent findings and made it hard to compare data across different studies over time.

This literature review has shown that the available data about public perceptions of climate change in Egypt is insufficient. It also needs to be updated as the latest data was collected in 2010. There is also a need for further research exploring the multiple factors influencing public perceptions of climate change in Egypt. Furthermore, when it comes to public perceptions of climate change adaptation, there is a total absence of studies about Egypt. This thesis addresses these shortcomings in the literature and offers a novel contribution through a mixed methods approach. The research provides an in-depth look into various aspects of public perceptions of climate change, including public perceptions of adaptation measures, while taking into account the local Egyptian context. In addition, it explores the predictors of general, personal, and societal climate change risk perception in Egypt through testing the CCRPM.

Chapter 3: Research Methodology and Epistemology

3.1 Introduction

This chapter provides an overview of the research approach and design adopted in this thesis. It starts by discussing the research's epistemology, then moves on to discuss the methodology and why it was used to answer the research questions. The research employs mixed methods, including quantitative and qualitative components which are explained in detail in the following chapters. This research was granted ethics approval number 24565 from the Victoria University Human Ethics Committee on the 18th of May 2017. The ethics approval is attached under Appendix A. Some ethics considerations are also discussed at the end of this chapter. The chapter concludes with some reflections on the researcher's positionality and reflexivity.

3.2 Research Approach and Epistemology

This research uses a quantitative approach as the overarching method while drawing on some supplementary qualitative work to gain in-depth insights into some areas of interest guided by the quantitative analysis. Hence, the research adopts a postpositivist approach as a means of knowledge generation relying mainly on an environmental psychology framework. The positivist approach relies on empirical observation and assumes that the social world is external, objective, and independent of the researcher, and can be observed and measured through collecting and analysing data using quantitative methods (Neuman, 2011; Panelli, 2004). Positivists argue that by carefully and objectively collecting data regarding social phenomena we can predict and explain human behaviour (Kitchin & Tate, 2013).

Postpositivism represents another level of positivism, where notions of absolute truth or certainty of knowledge are challenged. It assumes that we cannot be confident about our claims of true or certain knowledge when studying the behaviour and actions of humans, and that all observation is fallible and has error (Creswell, 2014). Postpositivism holds a deterministic view in which causes probably determine effects or outcomes, and thus there is a need to identify these causes. Postpositivism's approach for knowledge generation is based on three main steps. First, narrowing and focusing on selected variables which is referred to as reductionism. Second, capturing detailed observations and measuring variables. Finally, testing theories that are continually refined and revised (Creswell & Plano Clark, 2011).

3.3   Research Design: Mixed Methodology

As the research primarily seeks to explore a breadth of perceptions of a large number of people, it uses a quantitative method as the main research component. However, due to the fact that this is a new area of research that also requires an in-depth look, a qualitative method is used as a supplementary tool in order to reflect individual perceptions, feelings, and personal experiences (Creswell, 2014). Johnson, Onwuegbuzie, and Turner (2007) refer to this approach as "Quantitative dominant mixed methods research", and they define it as "the type of mixed research in which one relies on a quantitative, postpositivist view of the research process, while concurrently recognizing that the addition of qualitative data and approaches are likely to benefit most research projects" (p.124). The adopted mixed methods approach uses an online survey as the main quantitative method which is supplemented by semi-structured interviews as the qualitative component.

Mixed methodology is a relatively new research approach in the social and human sciences. It allows for exploring both breadth and depth of the research topic through quantitative and qualitative data collection and analysis, so that a better understanding of the research is achieved (Creswell, 2014). Each type of data has limitations and strengths and by combining the two in a mixed method approach, a stronger understanding of the research questions is achieved, and limitations in each method are minimized (Creswell, 2014). The quantitative approach simplifies and singles out the most important themes instead of generating more complex details and new aspects, while the qualitative approach has more focus on specific themes and seeks more detail (Sjöberg, 2000b). The main challenge of using mixed methods is the extensive data collection, the time consuming nature of analysing both types of data, and the requirement that the researcher is familiar with both types of methods (Creswell & Plano Clark, 2011; Johnson & Onwuegbuzie, 2004).

Many studies have shown that mixed methods research is important in the area of climate change risk perception (Capstick et al., 2015; Pidgeon, 2012). Small scale qualitative approaches are used to explain determinants of risk perception and its variability, and quantitative approaches are used to explain the aggregate opinion or collective level macro analysis. Both approaches are important as they uncover broader sociocultural and political factors and offer better understanding of changes in public opinion over time (Capstick et al., 2015; Pidgeon, 2012).

The mixed methodology approach adopted in this research follows what Creswell (2014) refers to as a 'Sequential explanatory design'. It is sequential in the sense that the quantitative data was collected first through an online survey, and then the initial responses from the online survey were used in guiding the interview questions for the qualitative data collection. The analysis of the data was also sequential as the quantitative data was analysed first and then the results informed the qualitative analysis and the choice of specific themes to explore in more depth. This design is considered explanatory because the initial quantitative data results are explained further by the qualitative data (Creswell, 2014; Creswell & Plano Clark, 2011).

3.4   Ethical Considerations

The researcher strived to align this research project with ethical practice through her conduct and responsibilities towards all research participants, and towards everyone involved in the research. The main ethical consideration in this research was ensuring confidentiality and anonymity of the online survey and that the data obtained was only accessible to the researcher and the supervisor of this thesis. This was made clear to the survey respondents in the participants' information sheet which they were invited to read before accessing the survey (refer to Appendix B). For the semi-structured interviews, participants were also presented with an information sheet explaining their rights as research participants and describing the aim of the project and how the information obtained from them will be used (refer to Appendix C). Interview participants were then asked to sign a consent form if they agreed to take part in the research (refer to Appendix D). In both the survey and the interviews, participants were given the option to request a summary of the research findings to be available after the conclusion of the research.

3.5   Reflections on Positionality and Reflexivity

Researchers must be aware of how they are perceived by the people they interview, as this can both limit and expand the opportunities for data collection and insights (Nielsen & D'haen, 2014). Moreover, researchers have to acknowledge their social position and critically examine the way in which their positionality and social interactions can influence the information they collect as well as the interpretations they make; this is referred to as critical reflexivity (Hay, 2010). While conducting the interviews, the researcher was aware of her positionality and how it might affect the data collected and therefore worked actively to minimize any potential biases as a result.

The main issue observed by the researcher was that the interview participants seemed to be treating her as an expert on the topic of climate change. This made them think more about what they were going to say to avoid saying something that might be perceived as 'incorrect', or they hesitated to say what they really thought fearing that it might be 'wrong'. To address this issue, the researcher talked to the research participants before the interviews and made it clear that there were no right or wrong answers and that their honest opinions, feelings, and experiences was what the interview was aiming to capture.

Chapter 4: Study (1) – Quantitative Methods and Results

4.1   Introduction

This chapter concentrates on the quantitative study of this research which used an online survey. It provides details on the quantitative method used, including the survey design, the process of data collection, recruitment of participants, sample characteristics, measurement of key variables, and the statistical analyses used. The chapter then discusses the results of study (1) which are divided into three sections according to the three main research questions. The first section presents the results that explain public perceptions of climate change in Egypt in general. Then in the second section, the predictors of climate change risk perception in Egypt are presented and explained through testing the CCRPM. Lastly, the third section illustrates the findings on public perceptions of climate change adaptation in Egypt.

4.2   Quantitative Methods

As discussed in detail in chapter two (refer to section 2.3) surveys are ideal for exploring general trends in public opinion and comparing a wide range of attitudes, levels of understanding and concern in large samples (Fowler, 2009). When information obtained from surveys is combined with in-depth interviews through a mixed methods approach, more comprehensive and quantifiable results can be achieved (Bird, 2009). An online survey was used for this research and was generated using 'Qualtrics', an easy to use web-based survey tool that was available through Victoria University. Qualtrics offered the use of two languages (English and Arabic) thus ensuring the sample would not be biased against people who only spoke one of them. Participants had the option of choosing their preferred language at any time whilst completing the survey through a language tab at the top right corner of each page (refer to figure 4.1). This allowed participants to go back and forth between the two languages if they needed further clarification and better understanding. The survey was prepared in English first and then translated into Arabic by the researcher who is a native Arabic speaker. Copies of both the English and Arabic versions of the survey are enclosed under Appendix B.

According to the Egyptian Ministry of Communication and Information Technology (2017), there are 35.35 million internet users in Egypt as of June 2017; 54% of them are in Cairo, Giza, and Alexandria. This suggests that an online survey can be an efficient way of collecting data.

Moreover, given the rise in the use of social media platforms in Egypt such as Facebook which has around 33 million Egyptian users according to Internet World Stats (2017), administering the survey online seemed to be an effective way to share the survey quickly and across a large number of people. However, the recruitment method was still biased towards including only people with access to the internet (i.e. people with higher income and education level).
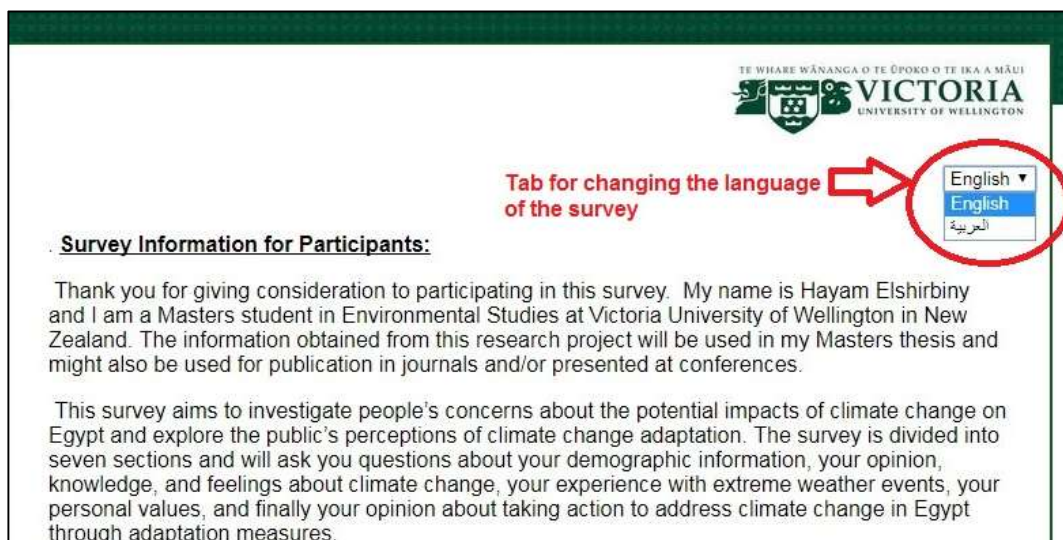
Figure 4.1 – Screenshot of the online survey showing the language change tab

4.2.1 Survey Design

The online survey started with an information sheet that provided information about the researcher and the research, and gave participants the option to receive a summary of the results. Most of the survey questions were adapted from two main previous studies in this area. The survey questions about the different predictors of climate change risk perception were adapted from van der Linden (2015), and questions regarding the perceptions of climate change adaptation were adapted from Capstick et al. (2013). Some minor modifications were made to the questions to align them with the local Egyptian context. While the online survey consisted mostly of closed ended questions, there was one open ended question at the end of the survey inviting the respondents to give any further comments they had on the topic. The results of this question are not reported in this study.

The survey was divided into seven sections with a total of 30 closed ended questions. First, participants were asked demographic questions about their gender, age, city of residence in Egypt and their level of education. Then in the following sections participants were asked

questions about their values, their feelings about climate change, their experience with extreme weather events, their knowledge about climate change, their risk perception, and finally their opinion about climate action and climate change adaptation in Egypt. Figure (4.2) below shows the survey structure. The survey took on average 15 minutes to complete.

| Section A | Demographic Information: |
| Questions 1 to 4 | Gender, Age, City of Residence, and Level of education |

| Section B | Values: |
| Question 5 | Measuring Biospheric values, Egoistic values, and Socio-Alturistic values |

| Section C | General Questions: |
| Question 6 | Opinion about environmental problems facing Egypt |

| Section D | Feelings about climate change: |
| Questions 7 to 9 | Measuring Affect |

| Section E | Experience with extreme weather events: |
| Questions 10 & 11 | Personal experience with Floods, heatwaves, droughts and storms |

| Section F | Knowledge about climate change: |
| Questions 12 to 16 | Measuring self-reported knowledge, knowledge about the causes and consequences of climate change |

| Section F | Climate change risk perception: |
| Questions 17 to 24 | Measuring Societal and Personal Risk Perception |

| Section G | Opinions about climate action: |
| Questions 25 to 30 | Opinions about adaptation measures, responsibility to act and willingness to adapt |

Figure 4.2 – Online survey structure

4.2.2 Pilot Survey

A pilot phase of the survey was launched on the 10th of June till the 21st of June 2017 in order to test the flow and logic of the survey, the clarity of questions, and the time taken to answer them. Twelve people took part in the pilot survey, some of whom had previous experience in doing online surveys and most had English as their second language which mirrored the intended target audience of the final survey. Two Arabic speakers were also asked to take the Arabic version of the survey to test that the translation was accurate and comprehensible. All

participants reported that it took from 9 to 15 minutes to complete the survey. Participants were grouped so that some took the survey on their mobile phones and others took it on their laptops in order to check the different screen displays and ease of access in both cases. Based on generous and constructive feedback from the pilot survey participants, the survey was revised, with some questions reworded, more detailed descriptions added in some sections, and some words exchanged for others in the Arabic version for better clarity.

4.2.3   Data Collection

The survey was active online for two months. It was launched on July 2nd and closed on the 1st of September 2017. The total number of participants who accessed the survey was 1,044. Approximately 65% completed all of the survey questions, and approximately 6% completed 50% or more of the survey questions. Participants who answered less than 50% of the survey questions were excluded to avoid having a lot of missing data. This left a final sample size of 732 participants, approximately 70% of the number who accessed the survey. Six more participants were excluded as they were not residents in Egypt, making the final sample size N=726. Of the 726 respondents, 113 took the survey in Arabic and 613 took it in English.

4.2.4   Sampling and Recruitment

Participants were recruited through a snowball sampling strategy in which target participants were identified and then asked to refer the survey to others (Ritter & Sue, 2012). The researcher reached out to her personal contacts in Cairo, Giza and Alexandria through personalized emails and phone calls inviting them to take the survey and to spread it among their networks. Different social media platforms were also used to reach participants. Personal messages were sent to all the researcher's contacts on Facebook, and three posts were shared on Facebook during the two months the survey was active asking people to participate. Facebook groups and WhatsApp groups were also used to spread the survey. In addition, many people shared the survey on different social media platforms which led to responses from people in cities in Egypt other than Cairo, Giza and Alexandria. The main limitation of this sampling strategy is the self-selection bias as participants had the choice of whether or not to participate in the survey, which is always the challenge of using online surveys (Ritter & Sue, 2012). This also meant that the respondents to the survey were more likely to be those who had more interest in the topic of climate change.

4.2.5 Research Sample Characteristics

The data set for the survey is based on a sample (N= 726), composed of 69.3% females and 30.6% males. The 25-34 age group had the highest percentage in the sample (47.4%) followed by the 35-44 age group (30.9%) (details are shown in Table 4.1). The sample's education level was high, with 61.4% having a bachelor's degree, and 32.4% having a postgraduate degree. The sample population was urban, with 54.1% of respondents residing in Cairo, 33.3% in Giza, 9% in Alexandria, and 2.9% were from other governorates and cities in Egypt.

Characteristics	Categories	Number	Percentage
Age	(18-24)	74	10.2%
	(25-34)	344	47.5%
	(35-44)	224	30.9%
	(45-54)	53	7.3%
	(55-64)	25	3.4%
	(65-74)	4	0.6%
Gender	Male	222	69.3%
	Female	502	30.6%
Educational Level	High school degree	27	3.7%
	Diploma	15	2.1%
	Bachelor's degree	446	61.6%
	Postgraduate degree	235	32.5%
City of Residence	Cairo	393	54.5%
	Giza	242	33.6%
	Alexandria	65	9%
	Others	21	2.9%

Table 4.1 – Survey sample characteristics

4.2.6   Measures

As this thesis tests the CCRPM to determine the factors predicting climate change risk perception in Egypt, it is applying the same measures used in the original model by van der Linden (2015) after modifying the questions to fit the local Egyptian context. Nevertheless, since this thesis focuses on climate change adaptation and not mitigation, the measures that dealt with climate change mitigation were excluded from this study (i.e. knowledge about the responses to climate change and social norms). The measures used are discussed in detail below.

Public perceptions of climate change:

Respondents were asked to rate the importance of eight environmental problems that Egypt is facing today on a five-point scale ranging from Not important at all (=1) to Extremely important (=5). The eight environmental problems were: air pollution, water pollution, excessive use of pesticides, climate change, inappropriate waste disposal, building on agricultural land, loss of natural resources, and coastal erosion.

To explore the public's beliefs about the reality and urgency of climate change, respondents were asked to state when they thought the negative effects of climate change would begin to happen in Egypt. Respondents were given five options ranging from They have already begun (=1) to They will never happen (=5). Respondents' beliefs around the causation of climate change were investigated through a series of questions that asked them to choose whether they thought certain activities are a cause or not a cause of climate change. The activities included three human causes of climate change (burning fossil fuels, deforestation, and cattle breeding activities), one natural cause of climate change (solar cycles and volcanic eruptions), and two activities that are not a cause of climate change (the hole in the ozone layer and nuclear power plants).

The survey also explored different aspects of concern about climate change through a series of eight questions. Respondents were asked to rate how concerned they were about climate change on a 7-point scale ranging from Not concerned at all (=1) to Very concerned (=7). Three different dimensions of concern were considered in the online survey: personal concern, societal concern and global concern. Respondents were asked to rate the seriousness of climate change as a threat to them personally, to Egypt, and to the world, using a 7-point scale ranging from Not serious at all (=1) to Very serious (=7). Moreover, respondents were asked to rate the likelihood

of climate change having serious impacts on their personal overall wellbeing and the likelihood of climate change having harmful impacts on society. Both questions used a 7-point scale ranging from Very unlikely (=1) to Very likely (=7).

Values:

Broad value orientations were measured using a scale adapted by De Groot and Steg (2007) and based on previous work by Schwartz (1992) and Stern et al. (1999). The scale measures biospheric values which emphasize the importance people attach to the environment and the biosphere, egoistic values which focus on maximizing individual outcomes, and socio-altruistic values which reflect concern for the welfare of others (De Groot & Steg, 2007). Those three value orientations might affect environmental beliefs and behaviour according to Stern et al. (1993). Respondents were asked to rate the importance of 12 randomly ordered statements corresponding to the three values on a 9-point scale ranging from Opposed to my values (=-1) to Of supreme importance to me (=7). Reliable scales were obtained for biospheric values with Cronbach's alpha (α=0.866), and socio-altruistic values (α=0.825), while egoistic values had a lower Cronbach's alpha value (α=0.623). This lower value will still be considered a reliable measure as lower reliability scores were found in other studies and were deemed acceptable. For example, De Groot and Steg (2007) explored values orientations in five countries and found that Cronbach's alpha ranged from 0.69 to 0.79 for egoistic values, 0.59 to 0.77 for altruistic values, and between 0.78 and 0.93 for biospheric values, all of which were considered acceptable. In addition, Schwartz et al. (2001) had relatively low reliability scores and they considered them adequate. They suggested that values can be expected to have relatively low internal reliability scores because only a few items corresponding to each value orientation are included, and because values have conceptually broad definitions that encompass multiple components.

Affect:

According to Leiserowitz (2006), affect refers to "a person's good or bad, positive or negative feelings about specific objects, ideas, or images." (p. 48). Respondents' positive or negative feelings about climate change or what is referred to as affect was measured using three questions. Each question asked the participants to rate how they felt about climate change on a 7-point bi-polar scale with the two poles being very unpleasant-pleasant, unfavorable-favorable, and negative-positive. The scales were developed by van der Linden (2015) and were based on

previous research by Peters and Slovic (2007). An acceptable reliability scale was obtained for affect with a Cronbach's alpha (α=0.826).

Experience with extreme weather events:

Four questions were used to examine respondents' experience with extreme weather events. The questions were adapted from van der Linden (2015) but were slightly modified to fit the local Egyptian context. The four questions listed specific extreme weather events that are relevant to Egypt rather than just asking one question about experience with one extreme weather event which is what van der Linden (2015) did. Respondents were asked to recall how often they had experienced flash floods, heat waves, droughts, and storms in the last five years, and the choices given were: never, once, twice, and three or more. The reliability measure was α=0.44 which was low. This might be because the four questions measured varying experiences with extreme weather events of which respondents might have experienced one but not the others. Based on this, the researcher decided to use the experience with flash floods as a measure of the experience with extreme weather events which is in line with what was used in the original model. Respondents were also asked an additional yes or no question as to whether they, or anyone they knew, had experienced damages caused by extreme weather events in the past five years.

Knowledge about climate change:

Three different types of knowledge about climate change were measured in the survey. First, respondents' self-reported general knowledge and level of understanding of climate change was measured by two questions. Respondents were asked to report if they had heard or read about climate change or global warming and the choices were: Yes, a great deal (=1), Yes, some (=2), Not very much (=3), and No, nothing at all (=4). The next question asked respondents to rate how well they thought they understand climate change and the choices were: Very well (=1), Fairly well (=2), Not very well (=3), and Not well at all (=4).

Second, respondents' knowledge about the causes of climate change was measured by asking them to choose whether each of six items (burning fossil fuels, the hole in the ozone layer, nuclear power plants, cattle breeding activities, deforestation, and natural processes) was a cause or not a cause of climate change. Respondents were also given the option to choose "I don't know". Third, respondents' knowledge about the impacts or consequences of climate

change was measured by asking them to indicate whether each of eight possible climate change impacts (e.g. melting of glaciers and polar ice caps) was likely to increase, decrease or not change at all as a result of climate change. Again, respondents were also given the option to choose "I don't know".

Measures for knowledge about the causes and impacts of climate change were adopted from van der Linden (2015) but some modifications were made to the questions in this survey, such as including an option of choosing "I don't know", and decreasing the number of items used in each question. For knowledge about the causes of climate change 6 items were used and the answers were classified as either right or wrong. The number of correct answers ranging from 0 to 6 was used as the measure of knowledge, where more correct answers indicated a higher knowledge score. The procedure was the same for knowledge about the impacts of climate change, except the knowledge score ranged from 0 to 8 as 8 items were used.

Risk perception:

Risk perception was measured using eight questions based on a 7-point Likert scale adapted from van der Linden (2015) who based his measurements on previous work by Bord et al. (2000) and Leiserowitz (2006). In the first question respondents were asked to rate how likely they thought it was that they would personally experience serious threats to their wellbeing. The second question asked how likely it was that climate change would have harmful long-term impacts on society. The two questions used a 7-point scale ranging from Very unlikely (=1) to Very likely (=7). The following four questions asked the respondents to rate how serious a threat climate change was to the natural environment, how serious the current impacts of climate change around the world were, and how serious the threat of climate change was to them personally and to Egypt. A 7-point scale was used ranging from Not serious at all (=1) to Very serious (=7). The last two questions asked respondents how often they worried about the negative consequences of climate change and how concerned they were about it. Both questions used a 7-point scale, the first ranged from Very rarely (=1) to Very frequently (=7), and the second ranged from Not concerned at all (=1) to Very concerned (=7). A reliability measure was obtained for risk perception ($\alpha=0.83$), personal risk perception ($\alpha=0.80$), and societal risk perception ($\alpha=0.72$).

Perceptions of climate change adaptation:

In the final section of the survey, six questions were used to measure different aspects of people's perceptions of climate change adaptation in Egypt. The questions were adapted from Capstick et al. (2013) but were modified so that they fit the local Egyptian context. In the first question, respondents were asked to choose the adaptation approach they would support for their own city in Egypt. The approaches ranged from Taking no action at this stage (=1) to Taking urgent action now to adapt to the existing and future impacts of climate change (=4). A number of potential adaptation priorities for Egypt were identified based on national and international reports and local news, in addition to the researcher's personal experience (Hallegatte et al., 2013; Information and Decision Support Center IDSC, 2011; IPCC, 2014a). Six potential adaptation options were identified and respondents were asked to indicate the extent to which they viewed each of the six risks as a priority area for Egypt in the next 50 years on a five-point scale ranging from Very high priority (=1) to Very low priority (=5). The six risks were: (1) Increased number of homes exposed to flash floods; (2) Increased numbers of homes at risk of sea level rise; (3) Increased risk of people becoming unwell due to heatwaves; (4) Increased risk of infrastructure damage due to flash floods and extreme weather events; (5) Increased risk of infrastructure damage due to sea level rise; and (6) Increased risk of water shortages and droughts.

To explore the public's perceptions of responsibility for adaptation in Egypt respondents were asked to rank in order from 1 to 5 who they thought should be held responsible from the following options: individuals and their families, local communities, local authorities and municipalities, the government, or the international community. In a subsequent question, respondents were asked to evaluate the performance of the government and what it is doing right now regarding adaptation measures to climate change. They were given the following choices: Doing nothing (=1), Not doing enough (=2), Doing the right amount (=3), and Doing too much (=4).

The survey also explored Egyptians' willingness to support and invest in adaptation options to be undertaken by the Egyptian government. Five potential adaptation measures that could be undertaken by the government were identified based on Egypt's national strategy for adaptation to climate change (Information and Decision Support Center IDSC, 2011). Respondents were asked to indicate how willing they were to support each of these adaptation measures using a

5-point scale ranging from Not willing at all (=1) to Very willing (=5). The last question in the final section of the survey investigated how respondents perceived their own capability of adapting to climate change. On a 5-point scale ranging from Not capable at all (=1) to Very capable (=5), respondents were asked to indicate how capable they thought they would be to adapt to climate change.

4.2.7 Quantitative Analysis

IBM's Statistical Package for the Social Sciences (SPSS23) was used as the main analysis tool for the quantitative data. Raw data was exported from Qualtrics in an SPSS compatible file with variables and value labels already created. The raw data was then cleaned and invalid responses were removed to reach the final sample size (N=726) as reported earlier in this chapter. New variables were then created and/or recoded, and reliability scores were computed. Finally, correlation and regression analyses were carried out on the data using SPSS's various options. Results of these statistical analyses are reported in the following section.

4.3 Quantitative results

This section discusses the responses to the research questions through the analysis of the online survey. First, the results explaining public perceptions of climate change in Egypt are presented. Next, the predictors of climate change risk perception are explained through testing the CCRPM. Lastly, the results related to public perceptions of climate change adaptation in Egypt are illustrated. The main research questions and sub questions investigated are:

- How do Egyptians perceive climate change? (Are there demographic differences?)
- What are the predictors of climate change risk perception in Egypt? (Are there different predictors for personal and societal risk perceptions?)
- How do Egyptians perceive climate change adaptation?

4.3.1 Public Perceptions of Climate Change in Egypt

Climate change in context with other environmental problems:

The majority of survey respondents rated all eight environmental problems (refer to Figure 4.3) either as very important or extremely important (all means were above 4.0, maximum=5). Water pollution was rated the most important environmental problem facing Egypt (Mean=4.75,

SD=0.57) with 94.8% of respondents rating it as very important or extremely important. The second most important environmental problem was air pollution (Mean=4.58, SD=0.65) with 93.6% of respondents rating it as very important or extremely important. The two least important environmental problems facing Egypt were climate change (Mean= 4.09, SD=0.9) and coastal erosion (Mean= 4.08, SD=0.89) with 73.9% and 72.4% of respondents rating them as very important or extremely important respectively. A t-test done on the responses to the rating of climate change as an environmental problem showed that there are significant differences between males and females (t(713) = -2.994, p<0.01) with mean scores 3.94 and 4.15 respectively. This suggests that females rate these environmental problems as more serious than men. No significant differences with respect to age were found.
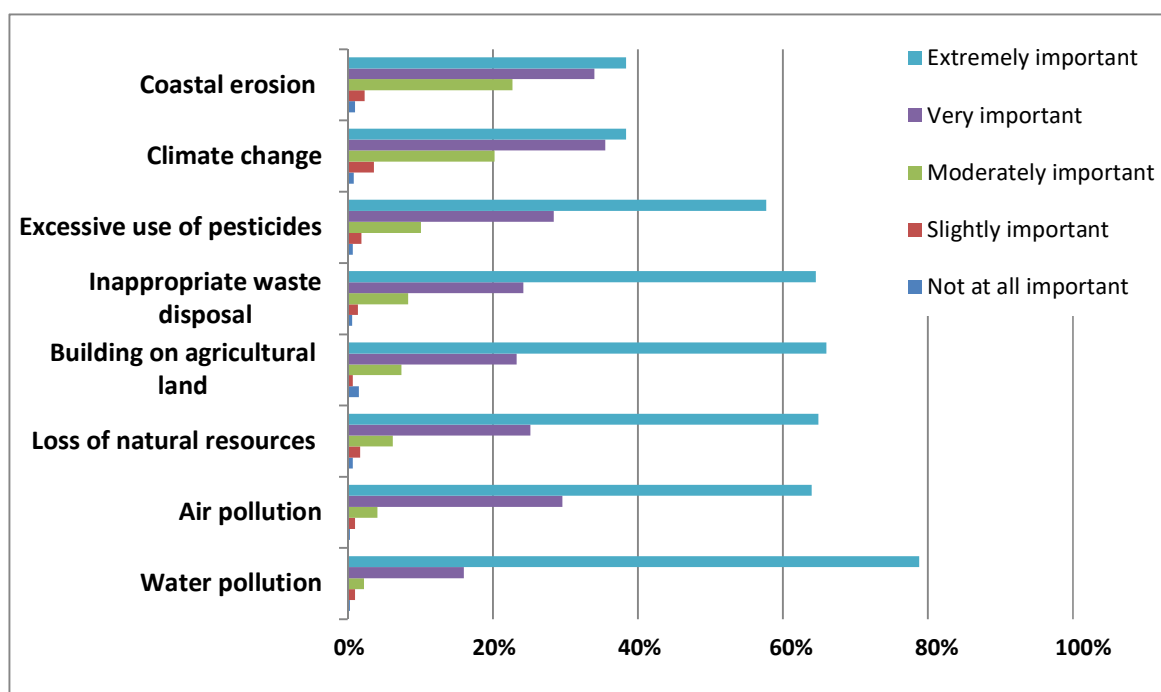

Figure 4.3 – Percentages of answers to the question: "In your opinion, how important are each of the following environmental problems facing Egypt?"

Egyptians' beliefs about the reality and causation of climate change:

The majority of survey respondents (82.6%) thought that the negative effects of climate change in Egypt had already begun and 6.7% thought it would start in a few years. Only 0.7% of respondents thought that the negative effects of climate change would never happen. A t-test showed significant differences between males and females (t(718)=2.799, p<0.01) with mean scores 1.46 and 1.27 respectively. Females were more likely than males to report that the negative impacts of climate change had already begun. There were also differences between age

groups (chi square (20)= 41.435, p<0.01) with 64% and 50% of older age groups (55-64 and 65-74) respectively reporting that negative effects of climate change had already begun, while the percentage was above 80% in other age groups. This means that older people were less likely to report that the negative impacts of climate change had already begun.

Results also showed that the majority of respondents correctly thought that burning fossil fuels and deforestation (90.4% and 84.8% respectively) were causes of climate change while only 17.1% thought raising cows for meat consumption was a cause of climate change. Results were mixed around the natural processes (solar cycles and volcanic eruptions) with 31.1% thinking it was a cause, 32.9% thinking it was not a cause, and 35.5% reporting that they did not know. A majority of respondents (85.1%) thought that the hole in the ozone layer was a cause of climate change, while respondents seemed to be less certain about nuclear power stations with 47.4% thinking it was a cause, 11.8% thinking it was not a cause, and 40.8% not knowing (refer to Figure 4.4). Overall, it seems that respondents were inclined to believe that human activities were causing climate change but they were not fully aware of the correct activities.
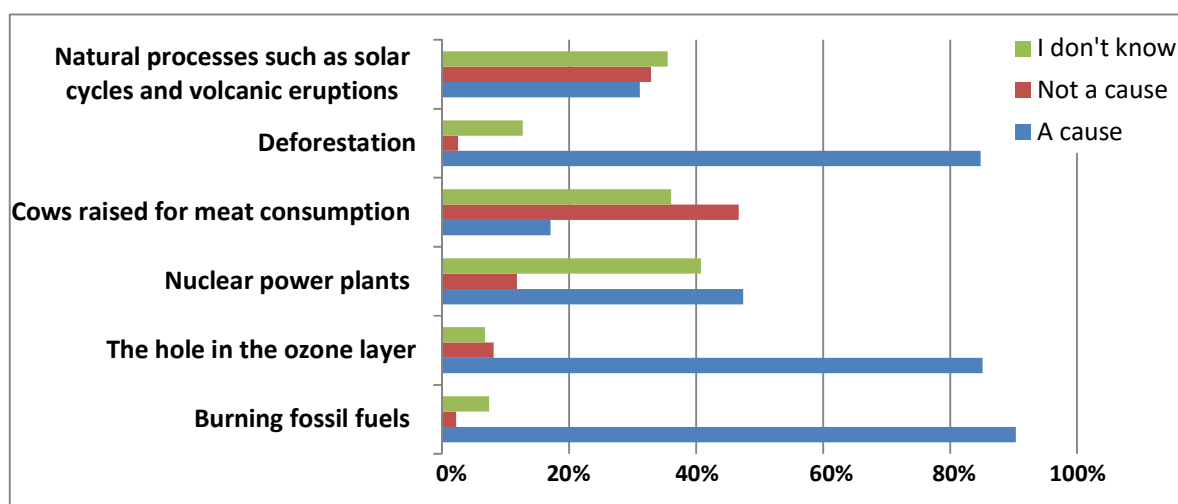

Figure 4.4 – Percentages of answers to the question: "Please choose whether each of the following is a cause or not a cause of climate change."

Levels of concern about climate change:

In general, respondents showed high levels of concern (Mean= 5.13, SD= 1.44) with 67.1% of respondents having some level of concern about climate change and 21.9% being very concerned. Only 9.4% were not concerned and 21.1% reported being neutral. When comparing the level of concern between males and females, a t-test showed no significant differences between the two groups. When comparing age groups there seemed to be significant differences

(chi square(30)=55.999, p<0.01). The 45-54 age group seemed to be the most concerned about climate change with 78.8% reporting having some level of concern, while the 18-24 age group seemed to have the lowest concern among all age groups with 52.2% reporting having some level of concern.

Results also showed that respondents saw climate change as more serious to Egypt and the world than to them personally. Only 18.6% of respondents indicated that climate change was very serious to them personally (Mean= 5.16) compared to 35.7% and 36% who indicated that it was very serious for Egypt (Mean= 5.77) and the world (Mean= 5.83) respectively. Similarly, only 15.3% of respondents thought that climate change was very likely to have serious impacts on their personal wellbeing (Mean= 4.48) while 46.6% thought it was very likely that climate change would have harmful impacts on society (Mean= 6.25).

<u>Self-reported awareness and understanding of climate change:</u>

The majority of respondents reported either having heard or read a great deal about climate change (22%) or that they had heard or read to some extent about it (56.3%). Only 3.4% of respondents reported having heard or read nothing at all about climate change, and 18% indicated that what they had heard or read about it was not very much (refer to Figure 4.5). With respect to the level of understanding of climate change, results showed a similar pattern. 7.4% reported that they understood it very well, 57% said they understood it fairly well, 31.7% not very well, and only 3.7% indicated that they did not understand climate change well at all (refer to Figure 4.6). A t-test showed that there were significant differences between males and females in their self-reported understanding of climate change (t(721)=-2.475, p<0.05) with mean scores 2.23 and 2.36 respectively. Males were more likely than females to report that they understood climate change very well or fairly well. No significant differences were found for age.
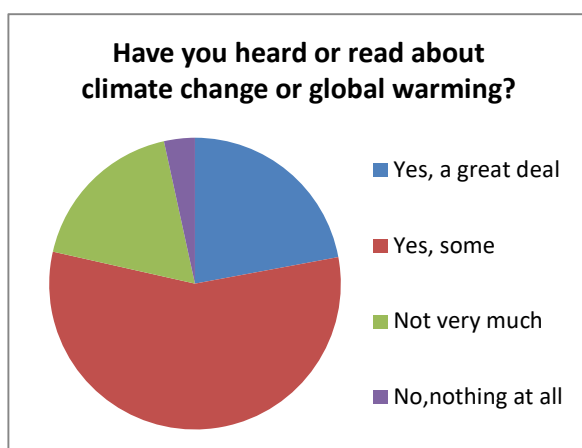

Have you heard or read about climate change or global warming?

- Yes, a great deal
- Yes, some
- Not very much
- No, nothing at all

Figure 4.5 – Pie charts showing answers to the question: "Have you heard or read about climate change or global warming?"

How well do you think you understand climate change?

- ■ Very well
- ■ Fairly well
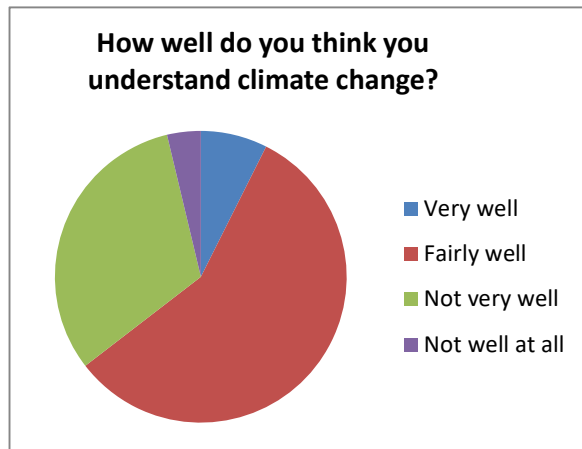- ■ Not very well
- ■ Not well at all

Figure 4.6 – Pie charts showing answers to the question: "How well do you think you understand climate change?"

The relationships between respondents' self-reported awareness and understanding of climate change and their concern about it were examined through a correlation analysis as detailed in Table (4.2). Knowledge of the causes and impacts of climate change were also added to the analysis to test whether respondents' self-reported knowledge matched their actual knowledge of the causes and impacts of climate change or not.

Variables	Scale	M	SD	N	1	2	3	4
1. Self-reported awareness about climate change	1-4	2.03	0.73	725				
2. Self-reported understanding of climate change	1-4	2.32	0.66	725	0.520**			
3. Impact knowledge	1-8	4.98	1.82	726	-0.304**	-0.241**		
4. Cause knowledge	1-6	2.43	1.00	726	-0.231**	-0.238**	0.292**	
5. Concern about climate change	1-7	5.47	0.93	969	-0.235**	-0.257**	0.171**	0.121**

*p<0.05, **p<0.01

Table 4.2 - Correlation analysis showing relationships between self-reported awareness and understanding of climate change, actual knowledge of the causes and impacts of climate change, and concern about climate change

The results of the correlation analysis showed that respondents' self-reported understanding of climate change was significantly negatively correlated with their actual knowledge about its impacts (r = -0.241) and causes (r = -0.238). In other words, the more respondents reported that they understood climate change, the less they actually knew about its causes and impacts. This suggests that respondents tended to overestimate what they knew about the topic. The same

results were found for respondents' self-reported awareness of how much they had heard or read about climate change which was also significantly negatively correlated with actual knowledge about climate change causes ($r = -0.231$) and impacts ($r = -0.304$). The more respondents reported they had read or heard about climate change the less their actual knowledge about the impacts and the causes was. The results also showed that self-reported understanding ($r = -0.257$) and awareness about climate change ($r = -0.235$) were significantly negatively correlated with concern about climate change. This means that the more respondents reported they understood climate change and had read or heard about it, the less concerned they were.

4.3.2   Predictors of Climate Change Risk Perception in Egypt

Climate change risk perception model:

As discussed in Chapter 2, the Climate Change Risk Perception Model (CCRPM) proposes that climate change risk perception is a function of cognitive factors (i.e. knowledge about climate change), experiential factors (i.e. affect, and personal experience), socio-cultural factors (i.e. social norms and value orientations), and demographic factors (i.e. age, gender, income, and education level). This research uses the CCPRM as a conceptual framework to explore the relationships between cognitive, experiential, socio-cultural, and demographic factors and climate change risk perception, in addition to investigating the main predicting factors of general, societal, and personal climate change risk perception in Egypt. Correlations and regression statistical analysis were used to answer this research question.

Correlation Analysis:

Correlation analysis was conducted to explore the relationship between the different predicting factors proposed by the CCRPM conceptual framework and climate change risk perception as detailed in Table 4.3. All predicting variables were significantly correlated with risk perception with r ranging from $r = 0.08$ to $r = -0.33$, except for egoistic values and experience with flash floods. Affect was the variable most strongly correlated with risk perception. This means that the more respondents saw climate change as negative, unpleasant, and unfavorable, the higher their risk perception was. Age and knowledge of the causes of climate change were the least strongly correlated variables with risk perception.

Variables	Scale	M	SD	N	1	2	3	4	5	6	7	8	9
1. Gender	1-2	1.69	0.46	724									
2. Age	1-7	2.48	0.93	724	-0.053								
3. Biospheric Values	1-9	7.29	1.43	691	0.021	0.097*							
4. Altruistic values	1-9	7.82	1.34	691	0.037	0.071	0.702**						
5. Egoistic Values	1-9	5.88	1.27	692	-0.087*	0.113**	0.335**	0.402**					
6. Cause knowledge	1-6	2.43	1	726	-0.067	-0.003	0.119**	0.066	-0.052				
7. Impact Knowledge	1-8	4.98	1.82	726	-0.021	-0.014	0.219**	0.199**	0.036	0.292			
8. Affect	1-7	2.32	1.27	722	0.02	0.016	-0.236**	-0.192**	0.022	-0.162**	-0.319**		
9. Experience with flash floods	1-4	2.31	0.56	682	0.074*	-0.084*	-0.03	-0.04	0.003	-0.034	-0.05	0.094*	
10. Risk perception	1-7	5.46	0.93	696	0.132**	0.080*	0.243**	0.199**	0.5	0.110**	0.219**	-0.330**	0.069

Note: For all variables a higher score is a higher level of agreement. For affect, a higher score means more positive affect

*Correlation is significant at the 0.05 level (2-tailed)   **Correlation is significant at the 0.01 level (2-tailed)

Table 4.3 – Correlation analysis for all variables tested through the CCRPM

Regression Analysis:

Hierarchical multiple regression analysis was used to evaluate to what extent cognitive, experiential, socio-cultural, and demographic factors can predict public risk perception of climate change. Following the analysis by van der Linden (2015), four models were introduced in the regression analysis and each model accounted for a different level of the variance in risk perception as detailed in Table 4.4. Model 1 included demographic factors and results showed that age and gender together explained a total of 2.5% of the variance in risk perception ($F_{(2,625)} = 8.012$, $p<0.001$, $R^2=0.025$). This means that being female and older in age is associated with higher risk perceptions of climate change. Nevertheless, looking at the regression weights, gender was a more significant predictor of climate change risk perception ($\beta= 0.144$, $p<0.001$) than age ($\beta= 0.079$, $p<0.05$).

In model 2, cognitive factors (knowledge of the impacts and causes of climate change) were introduced to the regression analysis and they explained an extra 6.2% of the variance in risk perception while controlling for demographic factors ($F_{(2,623)} = 21.104$, $p<0.001$, $R^2 \Delta = 0.062$). The regression weights in this model showed that knowledge about the impacts of climate change was a significant predictor of risk perception ($\beta= 0.218$, $p<0.001$), while knowledge about the causes was not significant in predicting risk perception. This suggests that higher knowledge of the impacts of climate change is associated with higher risk perception.

Model 3 tested whether experiential factors (affect and personal experience with flash floods) explained any additional variance in risk perception while controlling for demographic and cognitive factors. Results revealed that experiential factors explained a further 8.4% of the variance ($F_{(2,621)} = 31.594$, $p<0.001$, $R^2 \Delta = 0.084$). Regression weights showed that affect ($\beta= -0.3$, $p<0.001$) and personal experience with flash floods ($\beta= 0.105$, $p<0.01$) were both significant predictors of climate change risk perception in the model. This indicates that negative affect or negative feelings towards climate change and personal experience with flash floods are associated with increased risk perception, while holding demographic and cognitive factors constant.

In the final model, the explanatory power of value orientations was explored while controlling for all other factors and it further explained 2.1% of the variance in risk perception ($F_{(3,618)} =5.337$, $p<0.01$, $R^2 \Delta = 0.021$). The regression weights showed that none of the value orientations was a significant predictor of climate change risk perception.

In general, the whole model including demographic, cognitive, experiential and socio-cultural factors, managed to explain 19.2% of the variance in risk perception. Furthermore, the predictors of risk perception in order of significance were affect (β= -0.271, p<0.001), gender (β= 0.151, p<0.001), experience with flash floods (β=0.108, p<0.01), impact knowledge (β=0.099, p<0.05), and age (β= 0.081, p<0.05). Knowledge about the causes of climate change and value orientations were not significant predictors of public risk perception of climate change in Egypt as this model showed.

Model	Independent Variable	R^2	$R^2 \Delta$	B	t
1	Age	0.025	0.025	0.079	1.999*
	Gender			0.144	3.630***
2	Age	0.087	0.062	0.078	2.024*
	Gender			0.160	4.158***
	Cause Knowledge			0.074	1.856
	Impact Knowledge			0.218	5.464***
3	Age	0.171	0.084	0.091	2.486*
	Gender			0.159	4.308***
	Cause Knowledge			0.056	1.452
	Impact Knowledge			0.124	3.074**
	Affect			-0.300	-7.653***
	Experience with flash floods			0.105	2.843**
4	Age	0.192	0.021	0.081	2.194*
	Gender			0.151	4.104***
	Cause knowledge			0.048	1.262
	Impact knowledge			0.099	2.447*
	Affect			-0.271	-6.841***
	Experience with flash floods			0.108	2.954**
	Biospheric values			0.102	1.949
	Altruistic values			0.069	1.306
	Egoistic values			-0.016	-0.399

Note: Dependent variable is risk perception, entries are standardized beta coefficients, *p<0.05, **p<0.01, ***p<0.001

Table 4.4 – Regression analysis with risk perception as the dependent variable

Societal vs personal risk perception:

The CCRPM also proposes that societal and personal risk perceptions are two different dimensions having different predicting factors. Results showed a difference between the means for societal risk perception (Mean= 6.02) and personal risk perception (Mean= 4.88) suggesting that people think climate change poses a higher risk to society than to them personally. In order to examine to what extent demographic, cognitive, experiential and socio-cultural factors can predict both personal and societal risk perceptions, two separate regression analyses were conducted, with personal risk perception as the dependent variable in one and societal risk perception as the dependent variable in the other. Details for the two regression analyses are shown in Table 4.5 below.

Model	Independent Variable	Societal Risk Perception				Personal Risk Perception			
		R^2	$R^2 \Delta$	β	t	R^2	$R^2 \Delta$	B	t
1	Gender	0.032	0.032	0.177	4.489***	0.023	0.023	0.091	2.310*
	Age			-0.010	-0.249			0.131	3.310**
2	Gender	0.096	0.065	0.192	5.019***	0.064	0.040	0.105	2.708**
	Age			-0.012	-0.327			0.130	3.355**
	Cause Knowledge			0.066	1.673			0.065	1.601
	Impact Knowledge			0.229	5.791***			0.173	4.287***
3	Gender	0.166	0.070	0.192	5.186***	0.131	0.067	0.103	2.730**
	Age			-0.001	-0.027			0.143	3.824***
	Cause Knowledge			0.048	1.257			0.049	1.268
	Impact Knowledge			0.143	3.560***			0.089	2.164*
	Affect			-0.276	-7.025***			-0.265	-6.621***
	Experience with flash floods			0.083	2.239*			0.102	2.714**

Model	Independent Variable	Societal Risk Perception				Personal Risk Perception			
		R^2	$R^2 \Delta$	β	t	R^2	$R^2 \Delta$	β	t
4	Gender	0.180	0.014	0.182	4.904***	0.154	0.023	0.098	2.608**
	Age			-0.006	-0.151			0.129	3.447**
	Cause knowledge			0.045	1.172			0.041	1.058
	Impact knowledge			0.124	3.066**			0.064	1.550
	Affect			-0.255	-6.399***			-0.236	-5.840***
	Experience with flash floods			0.087	2.354*			0.104	2.789**
	Biospheric values			0.010	0.196			0.152	2.863**
	Altruistic values			0.126	2.364*			0.011	0.209
	Egoistic values			-0.031	-0.759			0.001	0.018

Note: Dependent variable is societal risk perception in the first regression and personal risk perception in the second regression analysis, entries are standardized beta coefficients, *p<0.05, **p<0.01, ***p<0.001

Table 4.5 – Regression analyses with societal and personal risk perceptions as dependent variables

Results showed that personal risk perception and societal risk perception have different predicting factors. When controlling for all other variables in the regression model, age and biospheric values were significant predictors of personal risk perception but not societal risk perception. This means that older individuals and those with stronger biospheric values tended to view climate change as a greater risk to them personally. On the other hand, knowledge of the impacts of climate change and altruistic values were significant predictors for societal risk perception and not for personal risk perception. In other words, individuals with higher knowledge of the impacts of climate change and individuals with stronger altruistic values were more likely to view climate change as a greater risk to society. Moreover, gender, affect, and personal experience with flash floods were predictors of both societal and personal risk perceptions with varying significance levels (refer to Table 4.5). Comparatively, while demographic, cognitive, experiential and socio-cultural factors explained 18% of the overall variance in societal risk perception they explained 15.4% of the overall variance in personal risk perception.

4.3.3   Public perceptions of climate change adaptation in Egypt

Perceptions of adaptation and its urgency:

The majority of respondents were in favor of taking some kind of action to adapt to climate change. Almost 40% of respondents supported taking an urgent action now and 37.3% supported the approach of beginning to prepare for the future impacts of climate change. Only 3.4% supported taking no action at this stage and 8.3% supported monitoring how climate change may be affecting their city but taking no further action at this stage (refer to Figure 4.7).

Which of the following general approaches would you support, in terms of how people should adapt to climate change in your city in Egypt?

- Take no action at this stage
- Monitor how climate change may be affecting my city but take no further action at this stage
- Begin preparing for the future impacts of climate change
- Take urgent action now to adapt to the existing and future impacts of climate change

Figure 4.7 – Pie chart showing answers to the question: "Which of the following general approaches would you support, in terms of how people adapt to climate change in your city in Egypt?"

Perceived adaptation priorities for Egyptians:

Results showed that the majority of respondents found all adaptation options provided (refer to Figure 4.8) to be of very high or fairly high priority. The two highest priorities were adapting to increased risk of people becoming unwell due to heat waves and adapting to increased risk of water shortages and droughts, with 78.2% and 83.6% of respondents respectively giving them very high or fairly high priority. The lowest priority was given to adapting to increased numbers of homes exposed to flash floods with 56.6% of respondents giving it very high or fairly high priority.

When we look into how residents from different cities in Egypt rated the different adaptation priorities there are clear differences. Respondents from Alexandria seemed to give more priority to adaptation options that dealt with sea level rise. For example, 75.8% of respondents from

Alexandria gave very high priority or fairly high priority to adapting to increased numbers of homes at risk of sea level rise, compared to 58.7% of respondents from Cairo and 51.4% of respondents from Giza. Similar results were also found for the option of adapting to increased risk of infrastructure damage due to sea level rise. On the other hand, respondents from both Cairo and Giza gave higher priority to adapting to increased risk of water shortages and droughts, with 85.1% and 83.4% of respondents from Cairo and Giza respectively giving it very high or fairly high priority, compared to 71% of respondents from Alexandria.
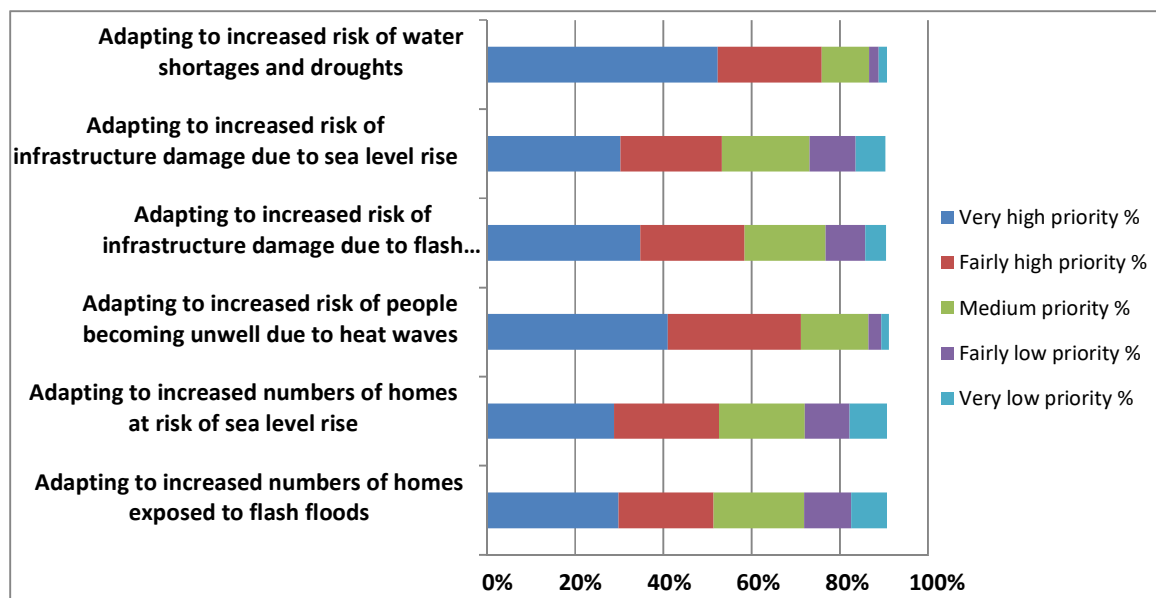
Figure 4.8 – *Bar chart showing percentages of answers to the question: "During the next 50 years in your city in Egypt, how much of a priority should be placed upon adapting to the following climate change risks?"*

Perceptions of responsibility for adaptation:

The results showed that the responsibility for climate change adaptation lies mainly at the government level (Mean= 1.90, SD=1.14), with 43.7% of respondents ranking it first. Local authorities and municipalities came in second in the ranking of responsibility (Mean= 2.76), followed by the international community (Mean= 3.18, SD=1.66) which was ranked as the most responsible by 24.2% of respondents. However, there seemed to be signs of polarisation over this as 31.5% of respondents ranked it as the least responsible. Local communities (Mean= 3.36, SD=1.01) and individuals and their families (Mean= 3.8, SD=1.3) were considered the least responsible. Regarding individuals and their families, the results showed that 36.5% of respondents thought they were the least responsible. With respect to the government's performance in dealing with climate change, the vast majority of respondents thought the

government was either doing nothing (55.2%) or not doing enough (32.4%). Only 1.9% thought it was doing the right amount and 0.8% thought it was doing too much.

Willingness to adapt to climate change:

In general, the majority of respondents indicated a high level of willingness to support all adaptation measures (refer to Figure 4.9). This was clear from the mean values which ranged from 3.56 to 4.05 on a 5-point scale. Investing in building reservoirs to store water during periods of droughts and investing in adaptation strategies in the agriculture sector were the two options with the highest level of support, with 65.9% and 62.4% of respondents respectively indicating that they would be very willing or willing to support these options. The lowest level of support was for investing in flash flood protection measures which 48.9% of respondents were willing or very willing to support. There were no significant differences in willingness to adapt between respondents from different cities in Egypt.
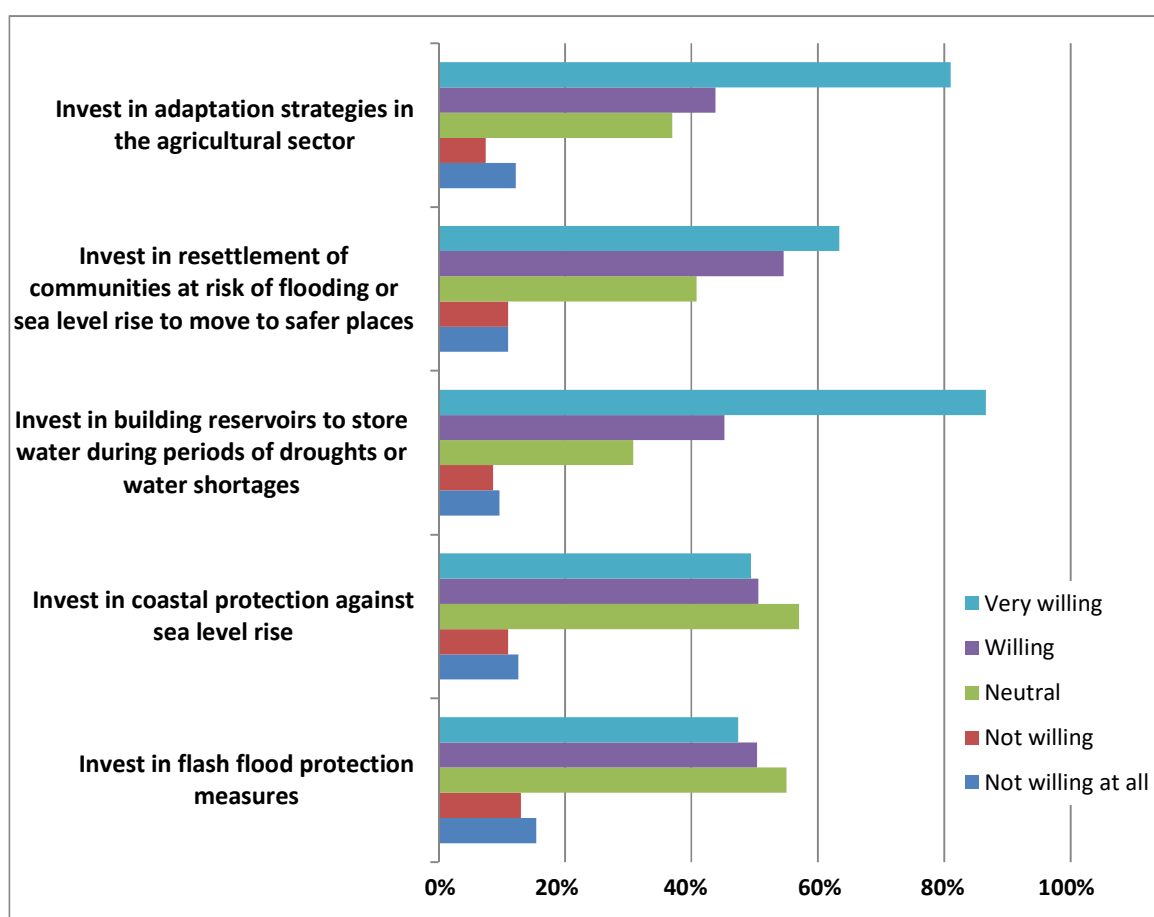
Figure 4.9 – Bar chart showing percentages of answers to the question: "How willing would you be to support the following adaptation options to be undertaken by the Egyptian government to better adapt to the impacts of climate change?"

Egyptians' self-reported capability to adapt to climate change:

Only 24.7% of respondents believed they were capable or very capable of adapting to climate change, while an almost similar percentage (24.8%) believed they were not capable or not capable at all. The remainder of the respondents (41.3%) indicated that they felt neutral about their capability of adapting to climate change. There were no significant differences between respondents in terms of gender, age or city of residence with respect to their perceived capability to adapt to climate change.

Chapter 5: Study (2) – Qualitative Methods and Results

5.1 Introduction

This chapter discusses the qualitative study of this research which uses semi-structured interviews. It starts by providing details on the qualitative method used, including the interview structure, the process of data collection, recruitment of participants, sample characteristics, the qualitative analyses used, and the themes chosen for analysis. The chapter then discusses the results of study (2) which are divided into three sections according to the three main qualitative themes selected for analysis. The first section presents the results that discuss the interview participants' feelings about climate change (i.e. affect). In the following section, the theme of personal experience with extreme weather events is presented. The last section illustrates the analysis of the third theme, which is the knowledge about the causes of climate change and misconceptions about it.

5.2 Qualitative Methods

This research used semi-structured interviews as a supplementary qualitative method to help explain in greater depth specific themes that came out of the online survey results. Semi-structured interviews allow for a more thorough examination of experiences, feelings and opinions that closed-ended survey questions do not capture (Kitchin & Tate, 2013). Moreover, interviews can also gauge the interviewee's reaction to the research topic through their body language and facial expressions (Kitchin & Tate, 2013). According to Hay (2010), semi-structured interviews have many strengths: (1) They fill a gap in knowledge that other methods are unable to bridge effectively, (2) They investigate complex behaviours and motivations, (3) They collect a diversity of meaning, opinion and experiences, and provide insights into differing opinions or debates and areas of consensus, and (4) They allow access to information about events, opinions and experiences that vary enormously among individuals. Semi-structured interviews also allow for the asking of validating questions through restating questions in different ways to make sure everything is captured (Berg & Lune, 2004). In addition, semi-structured interviews allow interviewers to ask specific, pre-determined questions permitting comparisons between interviews, and at the same time pursue areas spontaneously initiated by the interviewee (Berg & Lune, 2004).

5.2.1   Interview Structure

The researcher used an interview schedule featuring the six main topics of discussion explored in the online survey. Under each of the six topics there were carefully worded questions and prompts (refer to the interview schedule in Appendix E). According to Hay (2010), the use of interview schedules has the advantage of providing the researcher with more confidence in the clarity of the questions, and also allows for better comparisons between participants' answers. In addition, having a number of clear topics can assist the researcher to redirect the discussion back to the main issues that need to be covered. The six main topics discussed in the interviews were the following:

1. Feelings about climate change
2. Environmental problems in Egypt
3. Personal experiences with extreme weather events
4. Knowledge about climate change
5. Risk/Concern about climate change impacts
6. Climate change adaptation

All interviews started with general and easy to answer questions in order to establish rapport and trust with the participants. Questions were then ordered so that general ideas and opinions were discussed first, followed by personal experiences, then questions that required deeper reflection were asked towards the end. The aim of this was to give the interview participants time to get comfortable and more accustomed to the interview and the interviewer as recommended by Hay (2010). All interviews followed the interview schedule and main topics, but sometimes time allowed for more probing and validating questions to be asked. At the end of the interview, participants were given the opportunity and time to add any further comments and elaborate on any of their answers.

5.2.2   Data Collection

The interviews were conducted through face to face meetings and used open-ended questions that gave participants the flexibility to communicate their own understanding and meaning of the topics in more depth and detail. Eight interviews were conducted in Arabic and the interview duration ranged from 24 to 50 minutes. The interviews were recorded which allowed the interviewer to be a critical listener, fully focused and concentrating on the discussion, rather than trying to balance between guiding the conversation and taking notes. This also provided the

interviewer with more time to focus on the next probe or on asking validating questions. Note taking was used only to document important movements, expressions and gestures that were not captured by the voice recorder, as recommended by Hay (2010).

5.2.3 Sampling and Recruitment

Participants were recruited using a purposive sampling technique (Palys, 2008). They were strategically selected to be as demographically diverse across age and gender as possible, and to be residing in one of the three main cities in Egypt (i.e. Cairo, Giza, and Alexandria). Through the researcher's networks, participants with certain characteristics were contacted and asked if they would participate in the research as interviewees. Interested participants were asked to sign a consent form and were given an information sheet with all necessary details about the researcher, the research, and their rights as research participants (refer to Appendix D). All participants agreed to take part in an audio recorded interview and signed the consent forms. Convenient times for the interviews were then arranged with the participant. For details on the characteristics of the sample please refer to Table 5.1 below.

Participant	Interview Date	Age	Gender	City of residence	Education level	Place of Interview
1	19th July 2017	30	Female	Cairo	Bachelor in Architecture	Cafe
2	24th July 2017	63	Female	Cairo	Bachelor in Arts	Participant's own home
3	27th July 2017	24	Male	Cairo	MBA	Cafe
4	4th August 2017	57	Male	Cairo	Bachelor in Commerce	Researcher's home
5	5th July 2017	34	Male	Alexandria	Bachelor in Commerce	Cafe
6	9th July 2017	32	Female	Alexandria	MBA	Participant's work office

Participant	Interview Date	Age	Gender	City of residence	Education level	Place of Interview
7	21st August 2017	40	Male	Cairo	Bachelor in Engineering	Cafe
8	23rd August 2017	22	Female	Cairo	Bachelor in Business Information Systems	Cafe

Table 5.1 – Characteristics of the interviews sample

5.2.4   Analysis of Qualitative Data

In order to facilitate the analysis of the qualitative data, the recorded interviews were transcribed by the researcher as soon as possible after they finished as recommended by Hay (2010). As the original language of the interviews was Arabic, interviews were translated into English during the transcribing by the researcher who is a native Arabic speaker. The fact that the interviewer was also the transcriber and translator ensured there was no misinterpretation of the spoken words as the interviewer had the ability to understand the exact meaning of what was said. Moreover, annotations were made during transcribing to add information about the context of the interview and the intentions and meanings associated with the interviewees' actions, words, and references. Furthermore, the notes taken by the researcher during the interviews were added as annotations during transcription for further clarification.

As discussed earlier in chapter 3, this research follows a quantitative-dominant mixed methods approach with a sequential explanatory design. This means that the quantitative analysis forms the main component in answering the research questions, and the qualitative analysis is a supplementary component offering an in-depth look into specific themes that came out of the quantitative results. Therefore, instead of analysing the qualitative data to identify themes, three specific themes were selected based on the quantitative results. The qualitative data was then reviewed in light of these three themes, and only relevant statements that fell under one of these themes were coded to be used in the qualitative analysis and results. The three selected themes were: (a) Feelings about climate change (i.e. affect); (b) Personal experiences with

extreme weather events; and (c) Knowledge about climate change causes and misconceptions about it. The three themes are explained further in the following section.

a. **Feelings about climate change (i.e. affect):**

The quantitative results showed that affect was the strongest predictor of climate change risk perception. For that reason, it was chosen as a main theme to explore in more depth using the qualitative data. In all interviews, participants were asked in the beginning of the interview about the first thing or image that comes to their mind when they think about climate change. In five of the eight interviews, it was the first question that was asked. This allowed the respondents to share their raw unprompted thoughts and feelings about climate change and the images they associated with it before forming certain images as the interview went along. This question was adapted from Capstick et al. (2013) who based it on previous work by Leiserowitz (2006) and Lorenzoni, Leiserowitz, Doria, Poortinga, and Pidgeon (2006) where image associations were found to relate to risk perceptions and to be associated with affect.

b. **Personal experiences with extreme weather events:**

Experience with flash floods was also a predicting factor of climate change risk perception as per the quantitative analysis, and therefore personal experience with extreme weather events was chosen as another theme for further exploration. An in-depth look into people's experiences with extreme weather events in general, and flash floods in particular, was investigated through the interviews. While the online survey showed whether respondents had an experience with extreme weather events or not, interviews offered a more detailed personal and individual look into these experiences and how interviewees felt about them. Participants were asked specific questions about their experiences with extreme weather events and how they felt about them, in addition to whether they, or anyone they knew, had experienced any damages due to extreme weather events.

c. **Knowledge about climate change causes and misconceptions around it:**

The quantitative results showed that a majority of participants thought that the hole in the ozone layer and nuclear power stations were causes of climate change, which is a common misconception. Moreover, respondents' scores for knowledge about the causes of climate change were relatively low (Mean = 2.43, Maximum=6). Results also showed that respondents' self-reported awareness and understanding of climate change were significantly negatively

correlated with their knowledge about the causes of climate change. This means that people overestimated what they knew and understood about climate change. Lack of knowledge and misconceptions about the causes of climate change, in addition to the discrepancy between respondents' self-reported knowledge and actual knowledge, were key quantitative results that required further investigation. Therefore, knowledge about the causes of climate change was chosen as a theme to be explored further through the qualitative analysis.

5.3   Qualitative Results

5.3.1   Peoples' Feelings about Climate Change

Interview participants were asked at the beginning of all interviews about the first thing or image that came to their mind when they thought about climate change. The purpose was to explore their unprompted thoughts and feelings about climate change. In general, all responses to this question reflected negative images and feelings about climate change. There were three main associations or images that participants connected to climate change: (1) Negative consequences of climate change; (2) Catastrophic images about the end of the world; and (3) The ozone layer. The majority of responses were related to negative consequences of climate change that are currently happening. Three participants mentioned sea level rise and the melting of icebergs, and two participants mentioned the heat or really hot weather as the first image that came to mind when they thought about climate change. Some participants seemed to be affected by common images used in the media to communicate climate change, such as images of polar bears struggling with melting ice.

> *"I imagine an iceberg breaking away from another iceberg with a poor polar bear on it who can't cross to the other part and that ice is melting…so mainly ice melting and sea level rise."* – Participant 3

Other participants described the image they associated with climate change as a 'scene' as if it was a scene from a movie or an imaginary situation. This might imply a detachment from the reality of climate change and a tendency to think of it as distant in time and place.

> *"A scene where there is heat or really hot weather."* – Participant 6

Negative consequences of climate change, such as the melting of icebergs, was referred to by most participants as an impact that would affect the whole world. On the other hand, rising temperatures and sea level rise in the form of coastal erosion were often referred to as related

to Egypt with people having personal experiences with them. It seemed that with coastal erosion participants were describing an image that they had already seen rather than a hypothetical image.

> *"Coastal erosion. Because from experience, the coasts are totally different in the old days than they are now even in Alexandria. This is something that I have seen a lot in many beaches."* – Participant 4

Two participants referred to catastrophic consequences that will happen to the whole world as the first image they had in mind when thinking about climate change. These catastrophic images might be in people's minds because of how climate change has been presented lately in the media, especially in movies.

> *"The world is going to drown."* – Participant 1

> *"I feel that the world will end in a while. The end of the world is soon."* – Participant 8

In addition to the responses to the question "*What is the first image that comes to your mind when you think about climate change?*" interview participants also referred to their feelings about climate change in their answers to other questions. All responses reflected negative feelings about climate change, such as fear, panic, and being scared of the future consequences of climate change on Egypt and the whole world. Furthermore, participants' negative feelings about climate change seemed to be connected to general concern and worry about climate change.

> *"I have concerns and fears of the consequences of all of this…It is clear that something is wrong with how we are living…I suddenly get these concerns that we are moving towards something that is totally unpleasant and that is close. Not close that it will be in our time but for the generations in the near future. The world may collapse and the sea level will rise and these things, the world will drown and the ice melting."* – Participant 1

Some participants linked their negative feelings about the consequences of climate change to an inability to do something about it to prevent loss of life, which was why it was scary to them. This might imply a lack of confidence in how the Egyptian government would respond to a natural disaster.

> *"I am very very very scared of a natural disaster that never happened in Egypt before…I really fear this…I feel that this might cause serious problems and paralyze the whole country and we won't be able to control the toll of victims."* –Participant 3

For other participants, the consequences of climate change were so scary and negative to the extent that they consciously chose to avoid reading or knowing more about the topic.

> *"Maybe it is scary for me so that's why I do not like reading much about it…whenever I read I feel like the world is coming to an end soon. So, I do not like going much into it. The more I know the scarier it is and the more terrified I am."* – Participant 6

Overall, the analysis of the interviews showed that participants had negative feelings about climate change and associated it with negative images of harmful consequences. However, it seemed that for most participants the images associated with climate change were of events they expected to happen in the future and that were not already happening.

5.3.2 Personal Experiences with Extreme Weather Events

Flash floods:

All interview participants without exception talked about experiences with flash floods. What was interesting is that, while none of the participants had a direct personal experience with flash floods, all of them knew at least one person who had a direct negative experience. It seemed that participants related to other people's experiences as if they were their own, and they used others' stories to reflect how they saw the negative impacts of flash floods.

> *"I never felt it (flash floods) personally but there are definitely stories that I will never forget about other people experiencing it. One of our neighbours in our old house had a relative whose whole family died in floods in Sinai and only a little girl survived and they got her and raised her. This is a story that I keep remembering. But I know others too. I know someone who works with me who lost his car because of the floods, he was in the Red Sea area."* – Participant 4

Participants' experiences with flash floods were not only based on stories they heard directly from other people. Some participants referred to social media platforms, such as Facebook, as a source of stories about flash floods happening to people they did not know personally. It seemed that seeing videos and photos of the damage caused by flash floods on social media had an influence on the interview participants and how they viewed experiences with flash floods.

> *"We all saw a lot on social media. People getting electrocuted by the floods and other disasters happening (Talking about Alexandria)."* – Participant 4

> *"I do not remember I have seen this while I was living in Alexandria before. I have only seen it recently in photos and on Facebook."* - Participant 6

Flash floods occurring in Alexandria and having negative consequences seemed to be something that all participants were aware of. However, there were also references to experiences with flash floods in other cities such as Cairo, Sinai, Red Sea, Port Said, and Suez.

> *"My father is a football coach and he was coming back with his team from another city Ismailia or Port Said I think to Cairo, and they had to stop on the road for four hours because it was closed as a result of massive flooding."* – Participant 3

Participants also talked about a lot of different types of damages and casualties that were caused by flash floods, such as home and infrastructure damages, loss of personal cars, and loss of human lives.

> *"Some of my friends had their cars drown in their garages in Alexandria because of the floods."* – Participant 5

> *"My previous boss. His house in Ain Sukhna by the Red Sea is a huge villa, a beautiful residential development, it was destroyed and now demolished. The flood drains in the compound were blocked so when the flash floods came the whole compound was under water till there was a collapse in the foundations under the villa, a differential settlement happened under the villa and it collapsed."* – Participant 7

Most of the interview participants mentioned that flash floods did not used to happen with the same frequency before, and made remarks about how it was increasing in recent years.

> *"I feel that the rate of occurrence of floods is increasing."* – Participant 5

> *"Uhhh the flash floods, when we were young we never heard of it, the strong floods that damage homes these days, this was not happening before."* – Participant 2

Some of them also made a connection between flash floods and the increase in lightning and thunderstorms. However, participants did not talk about any direct links that they assumed between flash floods and climate change.

> *"Maybe the thunder and lightning have increased than before, I do not know if this is related or not, but it is very noticeable and happens many times throughout the year."* – Participant 1

> *"The thunder and lightning were only happening in winter when we go to Alexandria, now we have it here (in Cairo), it wasn't there before."* – Participant 2

In conclusion, it seems that all participants were aware of personal experiences with flash floods, even if they were not their own direct experiences. They all viewed flash floods as a negative weather event that causes a lot of damage and has been increasing significantly in recent years

in different parts of Egypt. Participants did not make a clear connection between flash floods and climate change, and they did not refer to any measures that have been taken to deal with them.

Coastal erosion:

When asked about their personal experiences with extreme weather events in general, or with sea level rise in particular, participants frequently mentioned coastal erosion. Some participants linked coastal erosion with sea level rise and others used it as synonymous with sea level rise, but 'coastal erosion' was the term that was mainly used in all interviews. Most of the participants made a direct connection between coastal erosion and climate change.

> *"But the change in temperature in Egypt for me is due to the change in people's nature only and what they can bear…But climate change in terms of temperature is mainly felt because the nature of people changed. But for me, I feel it in the beaches, in the erosion of the beaches."* – Participant 4

All participants who talked about coastal erosion seemed to be very confident of the fact that it was happening and that they had seen it with their own eyes. It also seemed that it is a phenomenon that they had observed over a long period of time, unlike flash floods which have only been noticed over the past few years.

> *"I felt the erosion of the beaches but that was over a time longer than five years."* – Participant 4

> *"I have no doubt about that one. Since my childhood till today I have been seeing it with my own eyes. There are sandy beaches in Egypt that disappeared. They were long and wide and we used to go play in them and now they no longer exist. Eroded totally. So for this I do not need anyone to tell me about it because I see it with my own eyes. It's true you can see it."* – Participant 7

People's direct personal experiences with coastal erosion happened in different cities across Egypt such as Arish (In northern Sinai), Alexandria, and in different places on the north coast along the Mediterranean. However, participants told a similar story of what the beaches used to be like years ago as compared to now.

> *"You mean coastal erosion? This is something that I've seen in Arish. The first time we went to Arish the shore had an elevation and then the last time we went the shore had a different elevation and the coast got narrower and things like that."* – Participant 2

Some participants also mentioned witnessing certain measures being taken to deal with coastal erosion, such as constructing barriers, and others talked about the measures that could be adopted by the government to deal with it.

"Definitely, I've seen the coastal erosion and I always used to see the construction of barriers being made to hold the sea back. It was like they are attacking the sea before it attacks us. I've also seen certain expansions and works to maintain the level of the water in a certain way or the boundaries of the sea." – Participant 6

"Yes of course. This is something that I have seen in the past 6 or 7 years. In the resort we stay in on the North coast every year they repair the shore, every year the water moves closer and once we had a problem that the water rose to reach the swimming pools so it was a problem and they started putting huge blocks to keep the water away but still it gets closer every time. So a long time ago the beach was long, you would walk a long distance to reach it but now you only walk a few steps and then you're in the sea." – Participant 8

In summary, most interview participants had direct personal experiences with coastal erosion that they had observed over a long period of time. Most participants linked coastal erosion with sea level rise and accordingly with climate change, and were very confident of the fact that it is happening now. Furthermore, it seemed that there was a tendency among participants to see certain adaptation measures as a possible solution to sea level rise or coastal erosion.

Heat waves and high temperatures:

Most participants referred to heat waves and high temperatures occurring in summer as something that has increased significantly in recent years in Egypt. They also pointed out that these increases in temperatures were extreme and they used strong words to describe how intense and unbearable the heat waves were becoming.

"The heat has become- the sun has become incendiary." - Participant 1

"I feel that the heat has become extreme and that I've never experienced it this way before. This insane heat of 40 degrees and above is unusual…This year and the year before –a few years- not too long ago, we've had this unbearable extreme heat, maybe in the last six or seven years with an emphasis on the last two to three years." - Participant 6

Heatwaves occurring in recent years were not the only change that participants noticed. Some pointed out changes that they had experienced in the weather and how it was getting warmer over a longer time span. Older participants talked about how the weather was different twenty years ago, and younger participants talked about how the weather was different in their childhood. There also seemed to be a significant contrast between how older participants viewed the weather decades ago versus how they viewed it currently.

"We have lived in a weather that has absolutely nothing to do with today's weather. We used to have the four seasons, summer, winter, autumn and spring and they were

organized, but now we live between hot weather and a few cold days and a fine weather in the winter. I'm talking about my generation of older people, things are different for your generation, you did not feel that but my age and older the weather we were used to was completely different from the weather now. The hot weather in your time is different from our time, the temperature itself is different." – Participant 2 (Age 63)

"I feel that our parents are pointing out climate change, they say that the heat we feel now is not like in the old days." – Participant 3 (Age 24)

"I remember that when I was younger the summer used to come later than now, the weather has become very strange. The summer has become so hot unlike before." – Participant 5 (Age 34)

Participants also talked about the direct impact of the extreme heat on them personally and on their well-being. Their responses reflected frustration and discomfort with the heat which was also affecting their way of living. Participants used very strong words to describe the impact that the heat was having on them and implying that it was killing them.

"The heat bothers me and makes me feel like I can't breathe and that I can't function, can't live." – Participant 1

"I do not remember ever that I was suffering this much in the heat before…Heat waves sometimes differ, so last year, for example, I would say was more unbearable than this year, this year it is also unbearable but last year I remember that there were days I just couldn't take it, I couldn't live, couldn't get out in the street, was just not possible." - Participant 6

Of all the extreme weather events experienced by interview participants, heat waves seemed to have the most direct personal impact on participants' well-being and way of living. Participants referred to heatwaves as something that has been happening more frequently and with higher intensity in recent years, but they also acknowledged an overall change in the weather which is becoming warmer compared to decades ago. It seemed that participants use the word 'weather' to describe both the weather and the climate, though they rarely mentioned the word 'climate' unless they were talking about it within the statement 'climate change'. In the Egyptian context, the word 'climate' is rarely used in Egyptian Arabic dialect, so using the word 'weather' to mean both is not necessarily an indication that Egyptians are confusing the weather with climate. However, it is still possible that participants may not know the difference between the weather and the climate.

Colder winters:

Very hot summers were not the only change in temperatures that the participants talked about. Some also mentioned colder winters as a sign of the weather changing, and pointed out how it was not only extreme summers they were experiencing, but also extreme winters as if both go together.

> *"I experience heat waves and extreme cold, I'm feeling the extreme cold now way more than before. Uh I feel that the winter is stronger and the summer is stronger."* – Participant 5

> *"Also, the extreme cold in the winter is something else. Every year I feel the cold differently now, I would say that now the winter is colder than before. Every winter I have a different experience than the year before…. So, it's extreme hot and extreme cold."* – Participant 6

In addition, participants talked about seeing snowfall in Cairo for the first time in their lives as a sign of the extreme cold and the unusual changes in the weather.

> *"Two or three years ago there was the issue of snow, the snow that came down in big sizes and I saw it in the street…that was the first time I have ever seen this."* – Participant 4

> *"The winter has become so cold. Egypt did not use to have snow or ice falling at all, in the last couple of years it happened that there was a lot of snow falling. So, this is something I noticed and it is something that I think about, the changing weather and the fact that there is something not right with earth."* – Participant 5

All participants who talked about their experience with colder winters, mentioned that they had noticed it only within the past few years. There was also a tendency among most participants to view the extremely cold winters as a sign of a change in the weather in Egypt.

> *"Yes, this last winter was very cold. And the one before it too was extremely cold. Unlike the nature of the weather in Egypt…This was never in Egypt. Three or four years ago this did not use to happen, we had a normal winter... It was never like this before. So, I see that this happened lately in the past three years. This is unusual for Egypt. Since I was born till now I see this as something unusual."* – Participant 8

As with the heatwaves, participants also expressed the inconvenience of the extreme cold, although to a lesser degree. Some participants described it as something they had never experienced before and talked about how it was impacting their lives and way of living.

"I would say that now the winter is colder than before. Not that we do not feel the cold every year but there are certain winters that are just so cold to the extent that my bones hurt, and I'm not a person who gets cold easily. Pain in my bones and feeling like I'm going to die now because of the cold." – Participant 6

"I had some winter clothes that I did not use to wear at all that I only started wearing this past two winters. The clothes I was wearing in Russia when I was there I never wore here but this past winter and the one before I started wearing all these normally." – Participant 8

It seems that for all participants who talked about extreme cold, there was a connection between colder winters and extremely hot summers. There was a tendency to see both together as a sign of the weather changing in Egypt and not as conflicting weather events. However, it seems that participants' experiences with hot summers were more intense, and their feelings towards it were more negative. Moreover, participants viewed rising temperatures in the summer as something that has been happening over a long period of time, while the increase of heatwaves was something they had noticed in the past few years. In the case of cold winters, participants viewed it as something that only happened recently.

5.3.3   Knowledge about the Causes of Climate Change and Misconceptions about it

Interview participants' responses related to the causes of climate change showed a lack of sufficient knowledge and reflected some common misconceptions. When asked about what they thought were the causes of climate change, the ozone or the hole in the ozone layer was one of the recurring causes that many connected to climate change. One participant correctly mentioned emissions as a cause of climate change but still linked this to the ozone layer.

"Something related to the ozone…what I can imagine is that the ozone affects the weather." – Participant 1

"I said the ozone earlier because this is what we learned in school. That we need to make better actions to stop the hole in the ozone layer from increasing…I haven't really thought of the causes, maybe we take it at face value and that we just learned that emissions are what is causing the hole in the ozone layer which causes climate change." – Participant 6

Despite repeatedly mentioning the ozone layer, most participants were either unsure of what caused the hole in the ozone layer or had incorrect information about it. Another recurring common misconception was that air pollution was regarded as a cause of climate change. Again, participants' responses were full of incorrect information and they made improper connections

between pollution, the ozone layer, and climate change. For example, they stated that pollution is what caused the removal of the ozone layer which then led to climate change. It seemed that whenever participants tried to explain the hole in the ozone layer and what caused climate change, their explanations were seldom based on accurate scientific information. It also appeared that participants were sure there was a link between the ozone layer, pollution (i.e. emissions), and climate change, but they did not know how this connection worked. Consequently, participants either tried to guess or they just acknowledged that this connection existed, but they did not know how it worked.

> *"Uh the causes I know I think are pollution first, pollution affects the atmosphere and causes a problem in the ozone layer, the ozone layer is what reflects back the sun, so when this layer is removed the heat is trapped on earth and this increases the temperatures…The causes to me are pollution that leads to removing the ozone layer that leads to trapping the heat that leads to disrupting the ecosystem of earth."* - Participant 3

> *"As individuals, we need to protect the things that affect climate change through their damage. I do not know all of it, I do not know what exactly caused the hole in the ozone layer. So, we need to decrease our use of certain things or find an alternative. Things that cause pollution."* – Participant 5

Another misconception about the causes of climate change that the participants talked about was the excessive use of air conditioning units. Air conditioning units were mentioned by four participants as a human-induced cause of the weather becoming hotter. Furthermore, the participants who talked about air conditioning gave the same explanation as to how it affected the weather. They believed that the hot air coming from an excessive number of air conditioning units in the city made the weather hotter. It seemed that the source of this information was people making incorrect assumptions and then repeatedly saying it to others.

> *"But for example, years ago since the hot weather started happening people in their ordinary conversation used to say that the excessive number of air condition units that people are using the hot air coming out of it all over the city and the fact that buildings are so close to each other, all this makes us feel the heat more."* – Participant 2

Nuclear energy was mentioned by only one participant as a possible cause of climate change, which is another a misconception. The participant was unsure of her information and could not explain how nuclear energy contributed to climate change.

> *"I think I'm just saying nonsense now, maybe nuclear things are having an effect. Countries that work on nuclear weapons or whatever kind of anything that produces*

nuclear things and its waste sure has an effect. There is for sure energy coming out in an unnatural way." – Participant 1

Despite the many misconceptions of the participants regarding causes of climate change, almost all participants acknowledged the human causation of climate change; only one participant thought it was caused by natural processes and had nothing to do with human actions.

"I am not into science so I can't say. I do not know uh uh uh they are cosmic things that are changing in the universe, what's the reason behind it I can't say I do not understand this area. But as a phenomenon, it is a cosmic one that has nothing to do with us or our actions." – Participant 2

Participants used phrases such as human development, human interference, human influence, and human intervention to express their belief in the human causation of climate change. However, there seemed to be a lack of knowledge of the exact human activities that caused the change, such as the burning of fossil fuels and deforestation, which were not mentioned by most of the participants. Only one participant mentioned carbon emissions and energy use as a cause of climate change.

"I feel that we, people's actions are causing a disturbance in the weather…I feel that there are certain interferences that we do to try and solve our problem now but it affects something bigger but we do not imagine that…All that I imagine is that there is a kind of corruption that humans have done and are doing all the time and it is affecting the environment so the environment is responding back, then humans deal with this response with a certain interference that makes it increase." – Participant 1

"I think it has a lot to do with human development. The air conditioning units and the factories. The human interference with nature." – Participant 4

In general, participants' responses reflected a clear lack of awareness and understanding of climate change and its causes. Responses also showed that participants had a lot of uncertainty about their knowledge of climate change. They seemed unsure of whether what they were saying was accurate or not, and sometimes acknowledged that they did not know the required information. They also recognised the need for awareness campaigns that would help Egyptians of all social and educational levels to understand climate change and how to act to address it. Lastly, the ozone layer and pollution seemed to be concepts or mental models strongly embedded in participants' minds. Many participants appeared to be sure that the ozone layer was connected to climate change. This might be due to years of media coverage about the hole in the ozone layer as a major environmental problem which made people think of it as the cause

of climate change. Another possible explanation for this is the fact that the hole in the ozone layer was something participants learned about in school so it stuck with them, but they did not learn about climate change in school.

Chapter 6: Discussion

6.1   Introduction

This thesis explored public risk perceptions of climate change and public perceptions of climate change adaptation in Egypt, an area of research that has rarely been addressed before in this part of the world. The aim of this research project was to address this gap in the literature and to set a basis for further research. This was achieved through a mixed methods approach using a quantitative and a qualitative component. This chapter summarizes the findings of the two studies and presents them in the context of the relevant literature while drawing comparisons where possible. The chapter is structured according to the three main research questions. For each research question, both quantitative and qualitative results are discussed and similarities and/or differences are explored and linked to relevant literature. Limitations, recommendations, implications of the study and areas of further research are discussed at the end of the chapter.

6.2   Public Perceptions of Climate Change in Egypt

Climate change is one of several environmental problems facing Egypt. The results of this research show that even though the majority of participants saw climate change as an important environmental problem for Egypt, it was not seen as the most important compared to other environmental problems. Water pollution, air pollution, and loss of natural resources were all ranked higher than climate change in terms of importance according to survey participants, and this was apparent in the interviews as well. The low ranking of climate change compared to other environmental problems has been a consistent finding in both quantitative and qualitative studies conducted in developed and developing countries since the early nineties (Bord et al., 1998; Brechin, 2003; Brechin & Bhandari, 2011; Dunlap, 1998; Kempton, 1991; Leiserowitz, 2007; Norton & Leaman, 2004).

Previous studies from Egypt have also shown that environmental problems in general, and climate change in particular, were consistently given a lower priority than other national threats, such as poverty, inequality, and religious extremism (Pew Research Center, 2007, 2013, 2014). This was reflected in the interviews, where participants acknowledged the threat of climate change but still thought there were other more important national problems facing Egypt. This is not surprising given that in the seven years since the 2011 revolution, Egypt has faced political

instability and serious national security challenges. Moreover, economic problems such as the devaluation of the local currency in November 2016 was another critical challenge for Egyptians who were faced with rising inflation and falling living standards (Reuters, 2016). Many studies have shown that economic factors, such as the global financial crisis of 2008, can negatively affect concern about climate change (Brulle et al., 2012; Scruggs & Benegal, 2012; Shum, 2012). According to Weber (2010), the 'finite pool of worry' hypothesis could be another possible explanation for the low ranking of climate change compared to other national problems. It proposes that people have a limited capacity for worrying about issues and when worry increases about a certain risk, concern for other risks decreases. Therefore, economic issues such as the devaluation of the local currency in Egypt might have decreased the public's concern about environmental problems such as climate change.

With respect to participants' beliefs about the reality of climate change, this survey showed that the majority of participants thought that the negative effects of climate change in Egypt have already begun. Previous studies have shown different results. In The World Bank (2010) multi-country poll, only one-third of Egyptian respondents thought that climate change was substantially harming people now. However, the same survey showed that a majority in 9 other countries out of 15 believed that climate change was already hurting them. Generally, there seems to be an increase in the public's belief about the reality of climate change in recent years worldwide. For example, in the US, a recent survey showed that two-thirds of Americans now believe that the impacts of climate change have already begun, which is the highest percentage in three decades (Gallup, 2017). Similarly, in New Zealand, the levels of the public's belief in the reality of climate change and the human causation of it have steadily increased over the 2009-2015 period as reported by Milfont, Wilson, and Sibley (2017).

The results of the quantitative and the qualitative study in this research have shown that the majority of survey and interview participants believed in the human causation of climate change, which is consistent with previous studies (BBC, 2007; Leiserowitz, 2007). However, research participants had some misconceptions and lack of knowledge about the exact human activities that are direct causes of climate change. For example, while a large majority correctly thought that burning fossil fuels and deforestation were causes of climate change, the majority of survey participants also thought that the hole in the ozone layer was a cause of climate change, which is a common misconception. Other common misconceptions about the causes of climate change that appeared in the interviews were air pollution and nuclear energy. Confusing climate change

with ozone depletion and thinking that air pollution is a cause of climate change are common misconceptions that have been appearing in many qualitative and quantitative studies in various parts of the world including Egypt (Bell, 1994; Bostrom et al., 1994; Brechin, 2003; Dunlap, 1998; Henry, 2000; Kempton, 1991, 1997; Leiserowitz, 2007; Löfstedt, 1991; Read et al., 1994). Nevertheless, it seems that while fewer people are confusing climate change with ozone depletion recently, as reported by Reynolds et al. (2010) for example, this misconception is still persistent in Egypt. This could possibly be a result of years of media coverage and focus on ozone depletion that it became the main source of environmental change in people's minds as suggested by Kempton (1997). With regard to Egypt specifically, ozone depletion was also something that people studied in school, as reported by some interview participants, while climate change was not, which might explain why it is a persisting mental model in Egypt. It seems that the education system in Egypt has failed to adjust to the fact that the hole in the ozone layer has waned as an issue while climate change has become much more threatening; this reflects a decline in the quality of environmental education in Egypt.

The results showed that the more participants reported they understood climate change or had heard about it, the less they seemed to know about its real causes and impacts. In addition, results also showed a negative correlation between self-reported knowledge of climate change and concern about it. This means that the more participants reported they understood climate change the less concern they had about it. Previous studies have shown mixed results, some reported the same finding (Kellstedt et al., 2008), and others found a positive correlation between self-reported knowledge and concern about climate change (Malka et al., 2009; Menny et al., 2011; Milfont, 2012). Even though survey participants were inclined to overestimate their knowledge and understanding of climate change, the interviews showed a different pattern. Participants' responses reflected a lot of uncertainty about their knowledge about climate change and they seemed to be unsure of whether what they were saying was accurate or not. Moreover, the majority of interview participants acknowledged a need for climate change awareness campaigns, and they believed that people do not know much about climate change in Egypt. This discrepancy might suggest a desirability bias in the survey responses, but it also highlights the deeper insights that a qualitative component can add to the research and hence the importance of using mixed methodology.

Although the majority of survey participants rated climate change as an important or an extremely important environmental problem facing Egypt, a lower percentage of respondents

reported having some level of concern about it. A higher level of concern about climate change was reported for Egyptian respondents in a previous study; however, it was one of the lowest percentages among 15 surveyed countries (Pew Research Center, 2006). When different dimensions of concern about climate change were explored, results showed that respondents were more concerned about the impacts of climate change on society and on Egypt in general than on them personally and their own well-being. This is consistent with previous studies that also showed that people tend to be more concerned about the threat of climate change to society than to them personally (Bord et al., 2000; Leiserowitz, 2005). This was also apparent in the interviews. It seemed that participants were constantly thinking about the societal or country level impacts of climate change even when asked about its possible personal impact on them. This might suggest that people are not aware of the direct impacts climate change might have on them personally, but it might also have a cultural explanation in the case of Egypt. Being in a collectivist culture that emphasizes social harmony and obligation to the group, Egyptians might be more likely to think collectively rather than individually and to not think of themselves as separate from society or local community.

6.3   Predictors of Climate Change Risk Perception in Egypt

The current research tested the climate change risk perception model (CCRPM) proposed by van der Linden (2015) and used it to explore predictors of climate change risk perception in Egypt with some exceptions and modifications to the variables used (refer to the quantitative methods chapter). The CCRPM combines cognitive, experiential, and socio-cultural factors to explain and predict the determinants of climate change risk perception. Correlation analysis showed that all predicting variables in the model were significantly correlated with risk perception, except egoistic values and experience with flash floods. Affect and biospheric values were the most strongly correlated with risk perception, which is consistent with van der Linden (2015)'s findings.

The regression analysis showed that experiential factors (affect and personal experience) were the strongest predictors of risk perception in the CCRPM, a result which was similar to van der Linden (2015). This means that the more negative feelings people had about climate change and the more personal experiences they had with its impacts, the higher their risk perception score. In contrast with van der Linden (2015), socio-cultural factors (only value orientations as social norms were not used in this study) were the weakest predictors of risk perception. However,

when looking at all the predicting variables separately, affect was the most important predictor of climate change risk perception, followed by gender, while personal experience with flash floods held less explanatory power. Lee et al. (2015) reported different results as they found that the top three factors influencing climate change risk perception in Egypt in order were age, knowledge about climate change causes, and marital status.

Affect's role in explaining risk perception has been a consistent finding in many previous studies such as Leiserowitz (2006), Smith and Leiserowitz (2012), Sundblad et al. (2007), and van der Linden (2014). On the other hand, previous studies showed mixed results for the relationship between personal experience with floods and climate change risk perception. Whitmarsh (2008a) found no significant differences between flood victims and other respondents in their concern about climate change, while Spence et al. (2011) and Capstick et al. (2013) found that flood experience was associated with higher levels of concern about climate change. These mixed results might be explained by the timing of conducting the study, given that there was an increase in floods in the UK in recent years compared to the early 2000s.

Being the strongest predictors of climate change risk perception, experiential factors were explored in more depth through the qualitative analysis of the semi-structured interviews. Results showed that participants associated climate change with negative images that were mainly about its negative consequences happening in Egypt and worldwide, such as heat waves and melting of icebergs. Moreover, negative feelings of fear, panic and being scared of the catastrophic consequences of climate change were also reflected in the interviews. Despite having experiences with many extreme weather events such as heat waves, cold winters and coastal erosion, all interview participants, without exception, talked about experiences with flash floods. They also mentioned different types of damages caused by these floods in different cities in Egypt, such as Cairo, Alexandria, and South Sinai and they seemed to believe that flash floods were increasing in recent years. Participants also experienced coastal erosion and were very confident of the fact that it was happening and that they saw it with their own eyes in cities such as Arish, Alexandria, and the North Coast. For most participants coastal erosion was synonymous with sea level rise. Moreover, experiences with heat waves and unusually cold winters, that have been increasing in recent years, were also mentioned and they seemed to be experiences that had the most personal effect on participants' well-being and way of living. Overall, the results showed high concern about the negative consequences of climate change.

The difference between personal and societal climate change risk perception was also explored through the CCRPM in this study to find if they have different predictors. Regression analysis results showed that age and biospheric values were significant predictors of personal risk perception, but not societal risk perception. On the other hand, knowledge of the impacts of climate change and altruistic values were significant predictors of societal risk perception and not personal risk perception. This means that individuals with higher biospheric values (i.e. care about the environment and the biosphere) tended to view climate change as a higher risk to them personally, while individuals with higher altruistic values (i.e. care about the welfare of others) tended to view climate change as a higher risk to society than to them personally. Gender, affect and personal experience with flash floods predicted both personal and societal risk perceptions. In the original CCRPM, van der Linden (2015) reported different findings. He found that personal experience and egoistic values were significant predictors of personal risk perception but not societal risk perception, while knowledge of the causes and impacts of climate change predicted societal risk perception only. Nevertheless, this study supported van der Linden (2015)'s proposal that climate change risk perception can be viewed empirically as a two-dimensional construct of personal and societal risk perceptions, and highlighted that different variables were important in the Egyptian context.

The difference between personal and societal risk perception was also reported by Pidgeon et al. (1992). In addition, Sjöberg (2000a) highlighted that people's rating of risks is different depending on whether the risk is to themselves, their families or society. He emphasized the importance of clearly defining who is subjected to the risk in risk perception studies. Moreover, Bord et al. (1998) argued that many studies lacked a distinction between personal and societal climate change risk perception. This meant that only concern about the societal impacts of climate change was elicited, and indirectly led people to not perceive it as personally threatening.

Regression analysis showed that the CCRPM was able to explain 19.2% of the variance in risk perception compared to 68% explained variance in the original model. This research's percentage of explained variance lies at the lower end when compared to the range of explained variance in other studies, which ranged from 22% to 55% as pointed out by van der Linden (2015). Nevertheless, there are other factors that influence climate change risk perception, such as trust in experts and/or social and political institutions (Fortner et al., 2000; Kellstedt et al., 2008; Lorenzoni & Pidgeon, 2006; Malka et al., 2009; Wachinger, 2013) and media coverage and

exposure (Sampei & Aoyagi-Usui, 2009; Wachinger, 2013; Wahlberg & Sjoberg, 2000) that were not included in the model. In addition, given that social, cultural and experiential factors are the main explored determinants of climate change risk perception in the CCRPM, and that they are highly contextual factors, the CCRPM should not be expected to generate the same results in different countries. Furthermore, the CCRPM has a western focus as it is based on integrating different models and theoretical perspectives that were all developed and tested in Western countries. The public in countries such as the US and the UK are more exposed to information about climate change in their local media, and perhaps are more used to taking surveys than the Egyptian public. In addition, the Egyptian public is also less familiar with scientific terms related to climate change which are rarely used. It is also possible that other factors that might have a stronger influence on climate change risk perception in the Egyptian context were not taken into consideration. For example, given that the political scene in Egypt has become very active in recent years after the 2011 revolution, factors such as political ideology and trust in political institutions might have an influence on climate change risk perception in Egypt today. This is an area future research can look more into.

Another important point to be considered when discussing the results of the CCRPM in this research is the measurements of the different variables used in the model. For example, broad value orientations were used in the model which might be appropriate in the case of general natural hazards, but might not fit a complex and multidimensional phenomenon such as climate change. Broad values might also be understood differently and mean different things to people from different cultures, which might have also played a role in their influence in the model. Furthermore, the scales used to measure value orientations were originally western scales that were then translated into Arabic for this study, which might also affect the way they were understood. All that being said, the CCRPM is considered a suitable model to explain factors influencing public risk perception in the Egyptian context while also highlighting possible expansions to be undertaken in future research.

6.4 Public Perceptions of Climate Change Adaptation in Egypt

The majority of survey respondents were in favour of taking some form of action to adapt to climate change. When asked about specific adaptation priorities for Egypt the majority of respondents found all adaptation options to be of high priority, but the highest priority was given to the increased risk of people becoming unwell due to heat waves and the increased risk of

water shortages and droughts. Adaptation priorities dealing with sea level rise seemed to be more important for respondents from Alexandria which is a coastal city, while in Cairo and Giza the priority was given to adapting to water shortages and droughts. These results are comparable with Capstick et al. (2013)'s study in the UK which used a survey of the Welsh public. Capstick et al. (2013) found that two thirds of respondents were in favour of urgent action to adapt to climate change, which reflected a greater support for urgent action than in Egypt. Moreover, adaptation priorities for the Welsh respondents were different from those of Egyptian respondents. The highest adaptation priority for the majority of the Welsh public was the increased number of homes at risk of flooding, which reflects the main climate change consequence that has impacted them in recent years. These findings show that public perceptions of climate change adaptation are very contextual and can vary even between cities in the same country.

Regarding responsibility to act to adapt to climate change, the majority of survey participants thought that it lay mainly at the government level, followed by local authorities and municipalities, which is similar to the findings obtained by Capstick et al. (2013) for Wales. This is also consistent with The World Bank (2010) survey which found that a majority of Egyptian respondents thought that Egypt had a responsibility to take steps to deal with climate change. Moreover, the survey results also showed that the majority of respondents thought the Egyptian government was either doing nothing or not doing enough regarding adaptation measures to climate change. These percentages are different from The World Bank (2010) survey in which a higher percentage thought the government was either doing the right amount or too much. This suggests that there may be a change in the way Egyptians see the government's performance in dealing with climate change and their increasing expectations for government actions, which might be a result of the 2011 revolution.

Respondents did not just expect the government to take action to deal with climate change, but the majority of them showed high levels of willingness to support specific adaptation measures to be undertaken by the government. They expressed the highest support for the two options that dealt with the most basic needs of having sustainable sources of water and food, namely investing in building reservoirs to store water in periods of droughts and investing in adaptation strategies in the agriculture sector. Adaptation priorities for dealing with flash floods were given the lowest priority and support; this is a surprising finding given the high levels of personal experience with flash floods reported in both the survey and interviews. This might indicate that

respondents may not associate flash floods with climate change; this was also pointed out by Whitmarsh (2008a) for a UK sample.

6.5   Limitations

The quantitative study in this research used a sample that was not representative of the Egyptian population. It was an urban sample with a high representation of females and was biased towards people with higher education levels and access to the internet. This means that some caution is warranted in generalizing the results of this survey to the wider Egyptian population. However, this is not uncommon in studies that use online surveys, and previous studies that included data for Egypt had similar samples, which allowed for useful comparisons. A second limitation had to do with difficulties in recruiting participants from different regions in Egypt. Initially the researcher aimed to draw comparisons between different cities in Egypt that are facing different climate change challenges. Nevertheless, the number of participants from cities and governorates other than Cairo and Giza was low, which made comparisons between different regions difficult. Despite the absence of a rural representation in the survey, one might argue that when it comes to public opinion and its impact on policy, urban populations might be more aware of the topic of climate change and more politically and socially active, which gives them more power to affect public policies. Another limitation of the sampling strategy was self-selection bias, which meant that respondents to the survey were more likely to already have an interest in the topic of climate change as participation in the survey was voluntary.

6.6   Recommendations and Implications

The results of this research have many implications for policy and for climate change risk communication. It is clear that there is a general lack of knowledge of the causes of climate change in Egypt coupled with various misconceptions about it –the most common of which is ascribing it to ozone depletion. In order to achieve better public understanding and engagement with climate change, risk communication should address pre-existing mental models that the public have (e.g. ozone depletion) which have been linked with climate change over the years due to similar media coverage. For example, risk communication should highlight basic facts about the main cause of climate change which is the increase of the concentration of carbon dioxide in the atmosphere, the main source of which is the use of fossil fuels, a fact participants seemed to not be fully aware of (Read et al., 1994). Moreover, climate change risk

communication should use clear messages and simple imagery and metaphors given that climate change is difficult to understand for most people (Moser, 2010). This was also pointed out by research participants who acknowledged the need for awareness campaigns and highlighted that it must be undertaken by good communicators in a way that is easy to understand in order to reach all levels of society.

Since the results of this research showed that experiential factors (affect and personal experience) are the most powerful predictors of climate change risk perception, climate change risk communication messages might be more effective if they highlight the association between personal experiences with extreme weather events and climate change (van der Linden, Maibach, & Leiserowitz, 2015). For example, people should be stimulated to link their own personal experiences with extreme weather events (e.g. flash floods) and their negative feelings about these experiences with the impacts of climate change. Hence, they may start to realize that climate change is affecting them personally and it is likely that they will then be more willing to engage in activities and measures to address it, at least within their local community. What would also be important is to provide people with clear information about effective measures to be taken on an individual level to both mitigate and adapt to climate change. People seemed to be unaware of what they as individuals could do to address climate change.

The interviews also showed that it was easier for participants to think of global climate change impacts, such as sea level rise and the melting of icebergs, than to think of local impacts that affect their own cities. This suggests that climate change risk communication needs to focus more on climate change impacts that are more relevant to Egypt, and to emphasize local rather than global risks. Research has shown that risk communication strategies focusing on the local impacts of climate change and those that are more personally relevant are often more effective in eliciting public engagement with climate change than those that use distant global frames (Scannell & Gifford, 2013).

Another important point to be taken into consideration in risk communication messages is the distinction between personal and societal risk perception and the difference in their determinants. For example, in the Egyptian context, increased knowledge about climate change impacts will probably lead to more concern for society, but might not affect personal concern about climate change. On the other hand, highlighting biospheric values will probably lead people to have more concern for their personal well-being as it relates to the impacts of climate

change. This difference between societal and personal risk perception might also have an impact on how risk communicators choose to present or frame climate change to the public. For example, framing climate change as a shared moral challenge that needs collective action might be an effective strategy to elicit societal concern (Markowitz & Shariff, 2012; Nisbet, 2009). Another possible framing that might be effective in Egypt is framing climate change as an opportunity to grow the economy through innovative and sustainable energy technologies. Given that economic issues are currently the most pressing challenge for Egypt, this framing might be effective in getting people to see the possible benefits of taking action to address climate change (Nisbet, 2009).

6.7 Conclusions

This research has shown a clear gap in the literature for studies about public risk perceptions of climate change in developing countries in general, and in Egypt in particular. There is a need for studies that explore in more depth public perceptions of climate change within the local Egyptian context taking into consideration localized social, cultural, and political factors. This research has provided a starting point for that and has opened up paths for future research by exploring three main areas: (1) General public perceptions of climate change; (2) Predictors of climate change risk perception; and (3) Public perceptions of climate change adaptation. This research has also highlighted the importance of using mixed methods in studies that address a complex and multidimensional issue, such as climate change, as they provide a better understanding on both a general and individual level. Moreover, almost all theories and conceptual frameworks about climate change risk perception have been based on studies in Western countries, mainly the US and the UK. This research has illustrated the differences in results when a conceptual framework was tested on an Egyptian sample. It also showed that there is a need for cross-cultural studies that explore the predictors of climate change risk perception, including factors that can be generalized universally across different countries versus the highly contextual and country-specific factors. This will enhance our understanding of how to effectively communicate the risks of climate change to the public and foster more support for adaptation actions.

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Appendices

Appendix A – Ethics Approval

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI

VICTORIA
UNIVERSITY OF WELLINGTON

Phone   0-4-463 5205
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MEMORANDUM

TO	Hayam Essameldi Elshirbiny
COPY TO	Wokje Abrahamse
FROM	Dr Averil Coxhead, Acting Convener, Human Ethics Committee

DATE	18 May 2017
PAGES	1

SUBJECT	**Ethics Approval: 24565** Public Risk Perceptions of Climate Change and Adaptation Measures in Egypt: Predictors and Implications

Thank you for your application for ethical approval, which has now been considered by the Standing Committee of the Human Ethics Committee.

Your application has been approved from the above date and this approval continues until 1 March 2018. If your data collection is not completed by this date you should apply to the Human Ethics Committee for an extension to this approval.

Best wishes with the research.

Averil Coxhead,
Acting Convener, Victoria University Human Ethics Committee

English (US) ▼

Information

. <u>**Survey Information for Participants:**</u>

Thank you for giving consideration to participating in this survey. My name is Hayam Elshirbiny and I am a Masters student in Environmental Studies at Victoria University of Wellington in New Zealand. The information obtained from this research project will be used in my Masters thesis and might also be used for publication in journals and/or presented at conferences.

This survey aims to investigate people's concerns about the potential impacts of climate change on Egypt and explore the public's perceptions of climate change adaptation. The survey is divided into seven sections and will ask you questions about your demographic information, your opinion, knowledge, and feelings about climate change, your experience with extreme weather events, your personal values, and finally your opinion about taking action to address climate change in Egypt through adaptation measures.

This research has been approved by the Victoria University of Wellington Human Ethics Committee [Approval number: 24565]. If you have any concerns about the ethical conduct of the research you may contact the Victoria University HEC Convener: Associate Professor Susan Corbett. Email: susan.corbett@vuw.ac.nz or telephone +64-4-463 5480.

This survey will take 10-15 minutes. There are no right or wrong answers; we are interested in your opinion. The answers you provide will be treated in confidence and your responses will remain anonymous. Only my supervisor and I will read the information you provide which will be kept securely and then destroyed two years after the research ends. Your submission of this survey constitutes your formal consent to participate in this research.

A. Demographics

.
A. <u>**Demographics:**</u>

In this first section, we would like to know a bit more about your background. This will help us get some insight into who takes part in this survey.

Q1. **What is your gender?**

○ Male

○ Female

Q2. **How old are you?**

○ 18-24

○ 25-34

○ 35-44

○ 45-54

○

○ 55-64

○ 65-74

○ 75 or over

Q3. What is your city of residence in Egypt?

○ Cairo

○ Giza

○ Alexandria

○ Other, please specify

[   ]

Q4. What is the highest education level you have achieved?

○ Secondary high school certificate

○ Diploma

○ Bachelor's degree

○ Postgraduate degree

○ Other, please specify

[   ]

B. Values

. B. Your Values:

In this section, we want to know more about certain values and their importance to you.

Q5. Please rate the following statements according to their importance to you:

	Opposed to my values				Neutral				Of supreme importance to me
	-1	0	1	2	3	4	5	6	7
Protecting the Environment (preserving nature)	○	○	○	○	○	○	○	○	○
Social Justice (correcting injustice, care for the weak)	○	○	○	○	○	○	○	○	○
Equality (equal opportunity for all)	○	○	○	○	○	○	○	○	○
Being influential (having an impact on people and events)	○	○	○	○	○	○	○	○	○
	Opposed to my values				Neutral				Of supreme importance to me
	-1	0	1	2	3	4	5	6	7
Being helpful (working for the welfare of others)	○	○	○	○	○	○	○	○	○
Unity with Nature (fitting into nature)	○	○	○	○	○	○	○	○	○

	Opposed to my values -1	0	1	2	Neutral 3	4	5	6	Of supreme importance to me 7
Preventing Pollution (protecting natural resources)	○	○	○	○	○	○	○	○	○
Authority (the right to lead or command)	○	○	○	○	○	○	○	○	○

	Opposed to my values -1	0	1	2	Neutral 3	4	5	6	Of supreme importance to me 7
Peace (a world free of war and conflict)	○	○	○	○	○	○	○	○	○
Respecting the Earth (harmony with other species)	○	○	○	○	○	○	○	○	○
Social Power (having control over others, dominance)	○	○	○	○	○	○	○	○	○
Wealth (material possessions, money)	○	○	○	○	○	○	○	○	○

C. General questions:

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C. General Questions:

In this section, we would like to know your opinion regarding different challenges facing Egypt.

Q6.
In your opinion, how important are each of the following environmental problems facing Egypt?

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
Air pollution	○	○	○	○	○
Water Pollution	○	○	○	○	○
Excessive use of pesticides	○	○	○	○	○
Climate change	○	○	○	○	○
Inappropriate waste disposal	○	○	○	○	○
Building on agricultural land	○	○	○	○	○
Loss of natural resources	○	○	○	○	○
Coastal erosion	○	○	○	○	○

D. Feelings about climate change

. ## D. Your feelings about climate change:

In this section, we want to know more about your feelings about climate change.

Q7. **To me, climate change is:**

Very negative 1	2	3	Neutral 4	5	6	Very positive 7
○	○	○	○	○	○	○

Q8. I see climate change as something that is:

Very unpleasant 1	2	3	Neutral 4	5	6	Very pleasant 7
○	○	○	○	○	○	○

Q9. Overall, i feel that climate change is:

Very unfavorable 1	2	3	Neutral 4	5	6	Very favorable 7
○	○	○	○	○	○	○

E. Experience

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E. Your experience with extreme weather events:

In this section we would like to know more about your personal experiences with extreme weather events in your city of residence in Egypt.

Q10. Considering the last 5 years, how often have you personally experienced the following weather events in your city in Egypt?

	Never	Once	Twice	Three or more
Flash floods (سيول)	○	○	○	○
Heat waves (unusual high temperature)	○	○	○	○
Droughts	○	○	○	○
Storms	○	○	○	○

Q11. In the past five years, have you or anyone you know experienced property damages or injuries as a result of extreme weather events such as flash floods (سيول) or storms?

○ Yes

○ No

F. knowledge about climate change:

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F. Knowledge about climate change:

In this section, we would like to know more about your general knowledge about climate change or global warming.

Q12. **Have you heard of or read about climate change or global warming?**

- ○ Yes, a great deal
- ○ Yes, some
- ○ Not very much
- ○ No, nothing at all

Q13. **How well do you think you understand climate change?**

- ○ Very well
- ○ Fairly well
- ○ Not very well
- ○ Not well at all

Q14.
Please choose whether each of the following is a cause or not a cause of climate change:

	A cause	Not a cause	I don't know
Burning fossil fuels (coal, oil, gas) for heat, electricity, and transportation	○	○	○
The hole in the ozone layer	○	○	○
Nuclear power plants	○	○	○
	A cause	Not a cause	I don't know
Cattle breeding activities (cows raised for meat consumption)	○	○	○
Deforestation (e.g., destruction of rain-forests)	○	○	○
Natural processes such as solar cycles and volcanic eruptions	○	○	○

Q15. **Please choose whether each of the following is likely to decrease, likely to increase or will not change as a result of climate change in the next 50 years:**

	Likely to decrease	No change	Likely to increase	I don't know
Global sea level	○	○	○	○
Melting of glaciers and polar ice caps	○	○	○	○
Areas in the world experiencing droughts	○	○	○	○
Global spread of infectious disease	○	○	○	○
	Likely to decrease	No change	Likely to increase	I don't know
Global average temperature	○	○	○	○
Extreme weather events (Flooding, hurricanes, storms, etc.)	○	○	○	○
Global biodiversity (variety of plants and animals)	○	○	○	○
The hole in the ozone layer	○	○	○	○

Q16. **In your opinion, when will the negative effects of climate change begin to happen in Egypt?**

- ⚪ They have already begun
- ⚪ Will start within a few years
- ⚪ Will start within my lifetime
- ⚪ Will not happen in my lifetime but will affect future generations
- ⚪ Will never happen

Q17. **How likely are you, sometime during your life, to experience serious threats to your health or overall well-being, as a result of climate change?**

Very Unlikely 1	2	3	Neutral 4	5	6	Very Likely 7
⚪	⚪	⚪	⚪	⚪	⚪	⚪

Q18. **How likely do you think it is that climate change will have harmful, long-term impacts on society?**

Very Unlikely 1	2	3	Neutral 4	5	6	Very Likely 7
⚪	⚪	⚪	⚪	⚪	⚪	⚪

Q19. **How serious of a threat do you think that climate change is to the natural environment?**

Not serious at all 1	2	3	Neutral 4	5	6	Very Serious 7
⚪	⚪	⚪	⚪	⚪	⚪	⚪

Q20. **How serious would you rate current impacts of climate change around the world?**

Not serious at all 1	2	3	Neutral 4	5	6	Very serious 7
⚪	⚪	⚪	⚪	⚪	⚪	⚪

Q21. **How serious of a threat do you believe that climate change is, to you personally?**

Not serious at all 1	2	3	Neutral 4	5	6	Very serious 7
⚪	⚪	⚪	⚪	⚪	⚪	⚪

Q22. **How serious would you estimate the impacts of climate change for Egypt?**

Not serious at all 1	2	3	Neutral 4	5	6	Very serious 7
⚪	⚪	⚪	⚪	⚪	⚪	⚪

Q23. **How often do you worry about the potentially negative consequences of climate change?**

Very rarely 1	2	3	Neutral 4	5	6	Very frequently 7
⚪	⚪	⚪	⚪	⚪	⚪	⚪

Q24. **How concerned are you about climate change?**

Not concerned at all 1	2	3	Neutral 4	5	6	Very concerned 7
○	○	○	○	○	○	○

G. Climate Action

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G. <u>Your opinion about climate action:</u>

This final section of the survey is concerned with climate change adaptation. Adaptation refers to actions taken to respond and adapt to the impacts or effects of climate change. This could involve personal actions such as modifying homes to cope with the changes to the weather, or it could be large scale projects such as building flood barriers. Adaptation is different from mitigation which refers to actions taken to reduce the causes of climate change such as using less electricity at home or building renewable energy projects.

Q25. **Which one of the following general approaches would you support, in terms of how people should adapt to climate change in your city in Egypt?**

○ Take no action at this stage

○ Monitor how climate change may be affecting my city but take no further action at this stage

○ Begin preparing for the future impacts of climate change

○ Take urgent action now to adapt to the existing and future impacts of climate change

Q26. **During the next 50 years in your city in Egypt, how much of a priority should be placed upon adapting to the following climate change risks?**

	Very high priority	Fairly high priority	Medium priority	Fairly low priority	Very low priority
Adapting to increased numbers of homes exposed to flash floods (سيول)	○	○	○	○	○
Adapting to increased numbers of homes at risk of sea level rise	○	○	○	○	○
Adapting to increased risk of people becoming unwell due to heat waves (unusual high temperature)	○	○	○	○	○
Adapting to increased risk of infrastructure damage due to flash floods (سيول) and extreme weather events	○	○	○	○	○
Adapting to increased risk of infrastructure damage due to sea level rise	○	○	○	○	○
Adapting to increased risk of water shortages and droughts	○	○	○	○	○

Q27. **Climate change impacts such as sea level rise and heat waves are expected to become more severe in Egypt in the future. Who do you think should be responsible for implementing adaptation**

measures to these impacts? Please rank the following in order of their level of responsibility (drag and drop in the correct ranking):

- Local authorities and municipalities

- The international community

- Individuals and their families

- The government

- Local communities

Q28. **How would you evaluate what the Egyptian government is doing right now regarding adaptation measures to climate change?**

○ Doing nothing

○ Not doing enough

○ Doing the right amount

○ Doing too much

Q29. **How willing would you be to support the following adaptation options to be undertaken by the Egyptian government to better adapt to the impacts of climate change:**

	Not willing at all 1	2	Neutral 3	4	Very willing 5
Invest in flash floods (السيول) protection measures	○	○	○	○	○
Invest in coastal protection against sea level rise	○	○	○	○	○
Invest in building reservoirs to store water during periods of drought or water shortages	○	○	○	○	○
Invest in resettlement of communities at risk of flooding or sea level rise to move to safer places	○	○	○	○	○
Invest in adaptation strategies in the agricultural sector	○	○	○	○	○

Q30. **In your opinion, how capable do you think you are of adapting to climate change?**

Not capable at all 1	2	Neutral 3	4	Very capable 5
○	○	○	○	○

. **Do you have any further comments?**

[ ]

. **If you would like to receive a copy of the summary of research findings please provide your email address below:**

[ ]

Information

معلومات عن الاستبيان للمشاركين:

شكراً على اهتمامك بالمشاركة في هذا الاستبيان. إسمي هيام الشربيني و أنا طالبة ماجستير في الدراسات البيئية في جامعة فيكتوريا في ويلينغتون بنيوزيلاندا. سيتم استخدام المعلومات التي تم الحصول عليها من هذا الاستبيان في رسالتي للماجستير ويمكن أيضاً أن تنشرفي المجلات الأكاديمية و/أو يتم تقديمها في المؤتمرات العلمية.

يهدف هذا الاستبيان إلى دراسة إنطباعات الناس بشأن الآثار المحتملة لتغير المناخ على مصر, ومعرفة تصوراتهم حول التكيف مع تغير المناخ. يشير التكيف مع تغير المناخ إلى الإجراءات المتخذة للاستجابة لآثار تغير المناخ مثل بناء حواجز الفيضانات (السيول) أو تعديل تصميم المنازل لمواجهة التغيرات في الطقس. ينقسم الاستبيان إلى سبعة أقسام تطرح من خلالها أسئلة حول بياناتك الشخصيه، رأيك و معلوماتك و إحساسك بشأن تغير المناخ، تجربتك مع الظواهر الجوية الغير معتادة، قيمك الشخصية، وأخيراً رأيك في اتخاذ تدابير للتكيف مع تغير المناخ في مصر.

تمت الموافقة على هذا البحث من قبل لجنة الأخلاق الإنسانية بجامعة فيكتوريا فى مدينة ولينغتون [موافقة رقم 24565]. إذا كان لديك أي مخاوف بشأن السلوك الأخلاقي للبحث، يمكنك الاتصال بمندوب هيئة التعليم العالي في فيكتوريا: الأستاذ المساعد سوزان كوربت علي رقم الهاتف: 5480 463-4-64+ أوالبريد الالكتروني: susan.corbett@vuw.ac.nz

سيستغرق هذا الاستبيان من 10 الي 15 دقيقة. لا توجد إجابات صحيحة أو خاطئة؛ نحن مهتمون برأيك فقط. سيتم التعامل مع الإجابات التي تقدمها على أنها سرية وستبقى إجاباتك مجهولة الهوية. الباحث و المشرف علي البحث فقط سيطلعان علي المعلومات التي قدمتها والتي سيتم الأحتفاظ بها بشكل آمن، ثم سيتم تدميرها بعد عامين من انتهاء البحث. يشكل تقديمك لهذا الاستبيان موافقتك الرسمية على المشاركة في البحث.

A. Demographics

أ.التركيبة السكانية:

في هذا القسم، نود أن نعرف أكثرعن الخلفية الخاصة بك. سيساعدنا ذلك في الحصول على بعض الإحصاءات حول من يشارك في هذا الاستبيان.

Q1. النوع:

◯ ذكر

◯ أنثى

Q2. السن:

◯ 18-24

◯ 25-34

◯ 35-44

◯ 45-54

◯

Q3 . ما هو محل إقامتك في مصر؟

⃝ القاهرة
⃝ الجيزة
⃝ الأسكندرية
⃝ محافظة اخري, يرجي التحديد

_____

Q4 . ما هو أعلي مستوي تعليمي حققته؟

⃝ شهادة الثانوية العامة
⃝ دبلوم
⃝ شهادة البكالوريوس
⃝ دراسات عليا
⃝ أخرى, يرجي التحديد

_____

B. Values

ب. القيم الخاصة بك:
في هذا القسم، نود أن نعرف المزيد عن قيم معينة وأهميتها بالنسبة لك.

Q5 .
يرجى تقييم العبارات أو القيم التالية وفقاً لأهميتها بالنسبة لك:

	في غاية الاهمية بالنسبة لي 7	6	5	محايد 4	3	2	1	0	معارضة لقيمي الخاصة 1-
السُلطة (الحق في القيادة)	⃝	⃝	⃝	⃝	⃝	⃝	⃝	⃝	⃝
العدالة الأجتماعية (تصحيح الظلم ورعاية الضعفاء)	⃝	⃝	⃝	⃝	⃝	⃝	⃝	⃝	⃝
إحترام الأرض (الأنسجام مع الكائنات الأخرى)	⃝	⃝	⃝	⃝	⃝	⃝	⃝	⃝	⃝
منع التلوث (حماية الموارد الطبيعية)	⃝	⃝	⃝	⃝	⃝	⃝	⃝	⃝	⃝
	في غاية الاهمية بالنسبة لي 7	6	5	محايد 3		2	1	0	معارضة لقيمي الخاصة 1-

في غاية الاهمية بالنسبة لي 7	6	5	4	محايد 3	2	1	0	معارضة لقيمي الخاصة 1-	
○	○	○	○	○	○	○	○	○	التعاون (العمل من أجل رفاهية الجميع)
○	○	○	○	○	○	○	○	○	القوة الإجتماعية (القدرة علي السيطرة على الآخرين، الهيمنة)
○	○	○	○	○	○	○	○	○	الوحدة مع الطبيعة (التلائم مع الطبيعة)
○	○	○	○	○	○	○	○	○	المساواة (تكافؤ الفرص للجميع)

في غاية الاهمية بالنسبة لي 7	6	5	4	محايد 3	2	1	0	معارضة لقيمي الخاصة 1-	
○	○	○	○	○	○	○	○	○	الثروة (الممتلكات المادية، المال)
○	○	○	○	○	○	○	○	○	التأثير (القدرة علي التأثير على الناس والأحداث)
○	○	○	○	○	○	○	○	○	حماية البيئة (الحفاظ على الطبيعة)
○	○	○	○	○	○	○	○	○	السلام (عالم خال من الحرب والصراع)

C. General questions:

ج. أسئلة عامة:

في هذا القسم، نود أن نعرف رأيك بشأن التحديات المختلفة التي تواجه مصر.

Q6.
برأيك، ما مدى أهمية كل من المشاكل البيئية التالية التي تواجه مصر؟

مهمة للغاية	مهمة جداً	متوسطة الاهمية	قليلة الاهمية	غير مهمة علي الإطلاق	
○	○	○	○	○	تلوث الهواء
○	○	○	○	○	تلوث المياه
○	○	○	○	○	الأستخدام المفرط لمبيدات الآفات
○	○	○	○	○	تغير المناخ
○	○	○	○	○	التخلص من النفايات بشكل غير مناسب
○	○	○	○	○	البناء على الأراضي الزراعية
○	○	○	○	○	فقدان الموارد الطبيعية
○	○	○	○	○	تأكل ساحل البحر

D. Feelings about climate change

د. إحساسك تجاه تغير المناخ:

في هذا القسم، نود أن نعرف المزيد عن إحساسك تجاه تغير المناخ.

Q7. بالنسبة لي، فإن تغير المناخ هو شيء:

ايجابي للغاية			محايد			سلبي للغاية
7	6	5	4	3	2	1
◯	◯	◯	◯	◯	◯	◯

Q8. أرى أن تغير المناخ شيء:

سار للغاية			محايد			غير سار علي الإطلاق
7	6	5	4	3	2	1
◯	◯	◯	◯	◯	◯	◯

Q9. إجمالا، أشعر أن تغير المناخ هو شيء:

ملائم للغاية			محايد			غير ملائم علي الإطلاق
7	6	5	4	3	2	1
◯	◯	◯	◯	◯	◯	◯

E. Experience

ه. تجربتك مع الظواهر الجوية الغير معتادة:

في هذا القسم نود أن نعرف المزيد عن تجربتك الشخصية مع الظواهر الجوية المتطرفة أو الغير معتادة في مدينة إقامتك في مصر.

Q10.
في خلال السنوات الخمس الماضية، كم مرة شهدت شخصياً الأحداث الجوية التالية في مدينتك في مصر؟

ثلاث مرات أو أكثر	مرتان	مرة واحدة	لم أشهدها ابداً	
◯	◯	◯	◯	سيول
◯	◯	◯	◯	موجات حارة (أرتفاع غير معتاد في درجة الحرارة)
◯	◯	◯	◯	جفاف
◯	◯	◯	◯	عواصف

Q11.
في السنوات الخمس الماضية، هل تعرضت أنت أو أي شخص تعرفه لأضرار في الممتلكات أو إصابات نتيجة للظواهر الجوية القاسية مثل السيول أو العواصف؟

◯ نعم
◯

و. الآراء والمعرفة المتعلقة بتغير المناخ:
في هذا القسم نود أن نعرف المزيد عن آرائك ومعلوماتك العامة حول تغير المناخ أو ظاهرة الاحتباس الحرارى.

Q12.
هل سمعت أو قرأت عن تغير المناخ أو ظاهرة الاحتباس الحراري؟

○ نعم, قدراً كبيراً
○ نعم, الي حد ما
○ ليس كثيراً
○ لا, لا شيء علي الاطلاق

Q13.
إلى أي مدى تعتقد أنك تفهم ظاهرة تغيُر المناخ؟

○ جيد جداً
○ جيد إلى حد ما
○ ليس جيداً جداً
○ ليس جيداً على الإطلاق

Q14.
يرجى إختيار ما إذا كان كلٍ مما يلي سبباً أو ليس سبباً لتغير المناخ:

لا أعلم	ليس سبباً	سبباً	
○	○	○	حرق الوقود الأحفوري (الفحم والنفط والغاز) للحرارة والكهرباء ووسائل النقل
○	○	○	ثقب طبقة الأوزون
○	○	○	محطات الطاقة النرية

لا أعلم	ليس سبباً	سبباً	
○	○	○	أنشطة تربية الماشية (الأبقار التي يتم تربيتها لأستهلاك اللحوم)
○	○	○	إزالة الغابات (تدمير الغابات المطيرة)
○	○	○	الظواهر الطبيعية مثل الدورات الشمسية والأنفجارات البركانية

Q15.
يرجى إختيار ما إذا كان من المرجح أن ينخفض كلٍ مما يلي، أومن المرجح أن يزيد أو لن يتغير نتيجة لتغير المناخ في السنوات الخمسين المقبلة:

لا أعلم	من المرجح أن يزيد	لن يتغير	من المرجح ان يقل	
○	○	○	○	مستوى سطح البحر العالمي
○	○	○	○	ذوبان الأنهار الجليدية و الجليد القطبي
○	○	○	○	المناطق التي تعاني من الجفاف في العالم
○	○	○	○	أنتشار الأمراض المعدية في العالم

لا أعلم	من المرجح أن يزيد	لن يتغير	من المرجح ان يقل	
○	○	○	○	متوسط درجة الحرارة العالمية
○	○	○	○	الظواهر المناخية الشديده (مثل الفيضانات والأعاصير والعواصف)
○	○	○	○	التنوع البيولوجي (أي تنوع النباتات والحيوانات)
○	○	○	○	ثقب طبقة الأوزون

Q16.
برأيك، متى ستبدأ الآثار السلبية لتغير المناخ في مصر؟

- ○ لقد بدأت بالفعل
- ○ ستبدأ في خلال بضع سنوات
- ○ ستبدأ في خلال حياتي
- ○ لن تحدث في حياتي ولكن ستؤثر على أجيال المستقبل
- ○ لن تحدث أبداً

Q17
في رأيك، ما مدى احتمالية تعرضك خلال حياتك لتهديدات خطيرة على صحتك أو رفاهيتك، نتيجة لتغير المناخ؟

من المحتمل جداً			محايد			من المستبعد جداً
7	6	5	4	3	2	1
○	○	○	○	○	○	○

Q18
في رأيك، ما مدى احتمالية أن يكون لتغير المناخ آثار ضارة وطويلة المدى على المجتمع؟

من المحتمل جداً			محايد			من المستبعد جداً
7	6	5	4	3	2	1
○	○	○	○	○	○	○

Q19
ما مدى جدية التهديد الذي يمثله تغير المناخ علي البيئة الطبيعية في إعتقادك؟

جدي جداً			محايد			ليس جدياً علي الإطلاق
7	6	5	4	3	2	1
○	○	○	○	○	○	○

Q20.
ما هو تقييمك لمدى جدية الآثار الحالية لتغير المناخ حول العالم؟

	جدية جداً			محايد			ليست جدية علي الإطلاق
	7	6	5	4	3	2	1
	⚪	⚪	⚪	⚪	⚪	⚪	⚪

Q21.
ما مدى جدية التهديد الذي يمثله تغير المناخ عليك أنت شخصياً؟

	جدي جداً			محايد			ليس جدياً علي الإطلاق
	7	6	5	4	3	2	1
	⚪	⚪	⚪	⚪	⚪	⚪	⚪

Q22.
ما تقييمك لمدى جدية آثار تغير المناخ على مصر؟

	جدية جداً			محايد			ليست جدية علي الإطلاق
	7	6	5	4	3	2	1
	⚪	⚪	⚪	⚪	⚪	⚪	⚪

Q23.
ما معدل قلقك بشأن العواقب السلبية المحتملة لتغير المناخ؟

	في كثير من الأحيان			محايد			نادراً جداً
	7	6	5	4	3	2	1
	⚪	⚪	⚪	⚪	⚪	⚪	⚪

Q24.
ما مدى قلقك بشأن تغير المناخ؟

	قلق جداً			محايد			لست قلقاً علي الإطلاق
	7	6	5	4	3	2	1
	⚪	⚪	⚪	⚪	⚪	⚪	⚪

G. Climate Action

ز. رأيك في أتخاذ الإجراءات المتعلقة بتغير المناخ:

يتناول هذا القسم الأخير من الأستبيان التكيف مع تغير المناخ. ويشير التكيف إلى الإجراءات المتخذة للاستجابة والتكيف مع آثار تغير المناخ. هذه الإجراءات قد تكون إجراءات شخصية مثل تعديل المنازل للتعامل مع التغيرات في الطقس، أو قد تكون مشاريع واسعة النطاق مثل بناء حواجز الفيضانات و السيول. التكيف يختلف عن التخفيف الذي يشير إلى الإجراءات المتخذة للحد من أسباب تغير المناخ مثل استخدام كهرباء أقل في المنزل أو بناء مشاريع الطاقة المتجددة.

Q25.

أي من الأجراءات العامة التاليه ستدعمها، من ناحية تكيف الناس مع تغير المناخ في مدينتك في مصر؟

- ⊙ أدعم عدم أتخاذ أي إجراء في هذه المرحلة
- ⊙ متابعة و رصد كيف يمكن أن يؤثر تغير المناخ على مدينتي ولكن لا يتخذ أي إجراء آخر في هذه المرحلة
- ⊙ البدء في التحضير للتأثيرات المستقبلية لتغير المناخ
- ⊙ أتخاذ إجراء عاجل الآن للتكيف مع الآثار الحالية والمستقبلية لتغير المناخ

Q26.

خلال السنوات الخمسين القادمة في مدينتك في مصر، ما هي الأولوية التي يجب أن توضع على التعامل مع مخاطر تغير المناخ التالية؟

	أولوية منخفضة جداً	أولوية منخفضة إلي حد ما	أولوية متوسطة	أولوية عالية إلي حد ما	أولوية عالية جداً
التعامل مع زيادة أعداد المنازل المعرضة لخطر السيول	○	○	○	○	○
التعامل مع تزايد أعداد المنازل المعرضة لخطر أرتفاع مستوى سطح البحر	○	○	○	○	○
التعامل مع زيادة خطر إصابة الناس بسبب أرتفاع درجات الحرارة في الصيف	○	○	○	○	○
التعامل مع زيادة خطر تلف البنية التحتية بسبب السيول والظواهر الجوية المتطرفة	○	○	○	○	○
التعامل مع زيادة خطر تلف البنية التحتية بسبب إرتفاع مستوى سطح البحر	○	○	○	○	○
التعامل مع زيادة خطر نقص المياه والجفاف	○	○	○	○	○

Q27.

من المتوقع أن تزداد حدة آثار تغير المناخ مثل ارتفاع مستوى سطح البحر والموجات الحارة في مصر في المستقبل. من برأيك ينبغي أن يكون مسؤولا بشكل رئيسي عن تنفيذ إجراءات التعامل مع هذه التأثيرات؟ يرجى ترتيب ما يلي حسب مستوى المسئولية:

	السلطات المحلية والبلديات
•	الحكومة
•	المجتمع الدولي
•	المجتمعات المحلية
•	الأفراد وأسرهم

Q28.

في أعتقادك, ما الذي تفعله الحكومة المصرية الآن فيما يتعلق بتدابير التعامل مع تغير المناخ؟

- ⊙ لا تفعل شيء
- ⊙ ما تفعله الحكومة ليس كافياً

○ ما تفعله الحكومة هو الكمية المناسبة

○ تفعل الكثير جداً

Q29.

ما مدى إستعدادك لدعم الخيارات التالية التي يتعين على الحكومة المصرية إتخاذها بشكل أفضل للتعامل مع آثار تغير المناخ:

	علي أستعداد تام 5	4	محايد 3	2	لست مستعداً علي الإطلاق 1
الأستثمار في إجراءات الحماية من السيول	○	○	○	○	○
الأستثمار في حماية السواحل من ارتفاع مستوى سطح البحر	○	○	○	○	○
الأستثمار في بناء الخزانات لتخزين المياه خلال فترات الجفاف	○	○	○	○	○
الأستثمار في إعادة توطين المجتمعات المعرضة لخطر السيول أو الغمر البحري للأنتقال إلى أماكن أكثر أمناً	○	○	○	○	○
الأستثمار في أستراتيجيات التكيف في القطاع الزراعي	○	○	○	○	○

Q30.

برأيك، ما مدى قدرتك على التكيف مع تغير المناخ؟

قادر جداً 5	4	محايد 3	2	غير قادر علي الإطلاق 1
○	○	○	○	○

هل لديك أي تعليقات أخرى؟

_____

إذا كنت تريد نسخة من ملخص نتائج هذا البحث, من فضلك إكتب بريدك الالكتروني أدناه:

_____

Public Risk Perception of Climate Change and Perceptions of Adaptation Measures in Egypt

INFORMATION SHEET FOR PARTICIPANTS

Thank you for your interest in this project. Please read this information before deciding whether or not to take part. If you decide to participate, thank you. If you decide not to take part, thank you for considering my request.

Who am I?

My name is Hayam Elshirbiny and I am a Masters student in Environmental Studies at Victoria University of Wellington. This research project is work towards my thesis.

What is the aim of the project?

This project aims to examine the Egyptian public's concern about the potential impacts of climate change on Egypt and explore their perceptions and understanding of climate change adaptation. Climate change adaptation refers to actions taken to respond to the impacts of climate change such as building flood barriers or modifying homes to cope with changes to the weather.

This research has been approved by the Victoria University of Wellington Human Ethics Committee *[Approval number 24565]*.

How can you help?

If you agree to take part I will interview you *[Interview location will be arranged with participant]*. I will ask you questions about your views and opinions about climate change. The interview will take approximately 45-60 minutes. I will record the interview, and then transcribe it word for word later. You can stop the interview at any time, without giving a reason. You can withdraw from the study by contacting me at any point before 20/8/2017. If you withdraw, the information you provided will be destroyed or returned to you.

What will happen to the information you give?

This research is confidential. This means that the researchers named below will be aware of your identity but the research data will be aggregated and your identity will not be disclosed in any reports, presentations, or public documentation. However, you should be aware that in small projects your identity might be obvious to others in your community.

1

Only my supervisor and I will read the notes or transcript of the interview. The interview transcripts, summaries and any recordings will be kept securely and destroyed two years after the research ends.

What will the project produce?

The information from my research will be used in my Masters thesis.

If you accept this invitation, what are your rights as a research participant?

You do not have to accept this invitation if you don't want to. If you do decide to participate, you have the right to:

• Choose not to answer any question;
• Ask for the recorder to be turned off at any time during the interview;
• Withdraw from the study before *[20/8/2017]*;
• Ask any questions about the study at any time;
• Receive a copy of your interview recording (if it is recorded);
• Read over and comment on a written summary of your interview;
• Agree on another name for me to use rather than your real name;
• Be able to read any reports of this research by emailing the researcher to request a copy.

If you have any questions or problems, who can you contact?

If you have any questions, either now or in the future, please feel free to contact either:

Student:

Name Hayam Elshirbiny

University email address:
HayamEssameldi.Elshirbiny@vuw.ac.nz

Supervisor:

Name: Dr. Wokje Abrahamse

Role: Senior Lecturer Environmental Studies

School: Geography, Environment and Earth Sciences

Phone: 04-4635217

Wokje.Abrahamse@vuw.ac.nz

Human Ethics Committee information

If you have any concerns about the ethical conduct of the research you may contact the Victoria University HEC Convener: Associate Professor Susan Corbett. Email susan.corbett@vuw.ac.nz or telephone +64-4-463 5480.

2

Appendix D – Interview Consent Form

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI

VICTORIA
UNIVERSITY OF WELLINGTON

Public Risk Perception of Climate Change and Perceptions of Adaptation Measures in Egypt

CONSENT TO INTERVIEW

This consent form will be held for *1* year.

Researcher: Hayam Elshirbiny, School of Geography, Environment and Earth Sciences, Victoria University of Wellington.

• I have read the Information Sheet and the project has been explained to me. My questions have been answered to my satisfaction. I understand that I can ask further questions at any time.

• I agree to take part in an audio recorded interview.

I understand that:

• I may withdraw from this study at any point before 20/8/2017, without giving any reason, and any information that I have provided will be returned to me or destroyed.

• The information I have provided will be destroyed *[2]* years after the research is finished.

• Any information I provide will be kept confidential to the researcher and the supervisor. I understand that the results will be used for a Masters report and a summary of the results may be used in academic reports and/or presented at conferences.

• My name will not be used in reports, nor will any information that would identify me.

• I would like a copy of the transcript of my interview: Yes ☐   No ☐

• I would like a summary of my interview: Yes ☐   No ☐

• I would like a copy of the transcript of my interview and a summary: Yes ☐   No ☐

• I would like to receive a copy of the final report and have added my email   Yes ☐   No ☐
    address below.

Signature of participant: _____

Name of participant: _____

Date: _____

Contact details: _____

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI

VICTORIA
UNIVERSITY OF WELLINGTON

Public Risk Perception of Climate Change and Perceptions of Adaptation Measures in Egypt

INTERVIEW SCHEDULE

Themes:

a. **Environmental problems in Egypt**
   1. What do you think are the main environmental problems facing Egypt?
   2. Can you tell me about your views on environmental issues, such as climate change?

b. **Feelings about climate change**
   3. What would be the first image that comes to your mind when you think of climate change? How do you think this image can be changed?

c. **Personal experience with extreme weather events**
   4. Do you have any experiences throughout your life with extreme weather events? How did it make you feel? Why do you think these extreme weather events are happening?
   5. Do you have any experiences with damages caused by extreme weather events?

d. **Knowledge about climate change**
   6. How did you become interested in the topic of climate change? Where do you get your information from? Do you usually have conversations with your friends and family about it?
   7. What do you think are the main causes of climate change?
   8. How do you think climate change awareness can be improved?

e. **Risk/Concern about climate change impacts**
   9. Thinking about climate change, how do you think the future will look like for Egypt? What about for your city? How might that affect you and your family?
   10. What climate change impacts do you worry about the most? Why?
   11. What aspects of your life do you think will be affected the most by climate change? (income, health, home, quality of life)

f. **Climate change adaptation**
   12. How vulnerable do you think Egypt is to climate change? What about your city? What about you personally? Who would you see as the most vulnerable in your community and why?
   13. What is your understanding of climate change adaptation?
   14. How can individuals make a difference in addressing climate change in Egypt? What about the government?