Challenges to belief systems in the context of climate change adaptation

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ABSTRACT

Recent climate change is unprecedented and its effects increasingly experienced. Climate change is, however, an abstract concept and the study of the idea of climate change as social construct opens up avenues to investigate the effect of different framings of the concept. This study explores the interrelationship between belief systems and adaptation, with a specific focus on the challenges that this connection illuminates. The organisation of beliefs into a network governs its change, and therefore an understanding of belief systems is vital. Resistance to belief revision in the face of evidence also receives attention and illustrates the complexity of belief systems. The theoretical grounding of climate change is investigated, in order to draw relevant conclusions regarding its link with beliefs. Perception is indicated as a crucial connection.

Applying this theory, three communities' diverse beliefs about climate change was studied using Q-methodology. Participants from townships in the North West Province in South Africa were interviewed using semi-structured interviews, and from this qualitative data a concourse was compiled. Forty statements were selected to broadly represent the topic, and this Q-sample was then presented to participants in a second phase to rank-order based on a system of agreement. These Q-sorts were analysed using PQmethod software and interpreted accordingly. Five distinct semantic patterns were found that explained 58% of the sample’s variance. The two prevalent ideas that came across in these worldview narratives were religion and collectivism. Qualitative analysis added further depth to these results and seven factors that hinder belief revision were identified: a high level of integration, social embedment, importance of belief, perception narrowed by cultural beliefs, perceived frightening consequences, negative authority beliefs, and new knowledge that is seen as threat to identity. Three factors that encourage belief revision are a perception of high controllability, positive referents in authority beliefs, and clear evidence.

Purposive adaptation should ideally support autonomous adaptation, provided that it falls within a sustainable development framework. Participatory communication is recommended as a tool to climate change adaptation, as it acknowledges local cognitions, and encourages joint knowledge production. Utilised in education

programmes, this tool can lead to communities creating solutions for which they truly take ownership. This will not only empower them, but also aid internal accommodation to external change, and increase the perception of controllability.

Key words: climate change, climate change adaptation, beliefs, belief system, Q-methodology

PREFACE

This mini-dissertation is presented in an article format for possible publication in an international accredited journal. Instructions for authors, as well as permissions by the co-authors are included in the annexure. The style of chapter 3 is different from the rest of the document as the instructions to authors have been followed exclusively.

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Chapter 1 Introduction

1.1 ORIENTATION AND PROBLEM STATEMENT

In 1824, Jean-Baptiste Joseph Fourier, a French physicist, first described the asymmetry of the incoming and outgoing energy through the atmosphere later termed the 'greenhouse effect'. According to Hulme (2011:42-43) this was the start of our scientific understanding of anthropogenic climate change[1]. Then John Tyndall discovered the absorptive properties in atmospheric gasses for radiant heat in 1959 and postulated that the level of atmospheric carbon dioxide influences the climate. Ensor and Berger (2009:8) states that climate can be defined as 'long-term (conventionally 20 to 30 years) average weather conditions.

The concept of climate change (not necessarily including the notion of human involvement) was revolutionary at first, but as it became somewhat accepted, it initially wasn't seen as a threat (Hulme, 2011:42-61). O'Brien and Wolf (2010:237) described 'climate change itself' as 'a challenge to worldviews and belief systems' as recently as five years ago.

The idea of climate change, not seen as benign anymore, is now being described as 'disastrous' and 'catastrophic' and the idea of anthropogenic climate change has been established by cultural and political discourses (Hulme, 2007:6). However, the degree to which human involvement influences climate change is still disputed by the general public (Whitmarsh, 2011:690)[2].

Different reasons for this disagreement have been researched. In a study on public perception of climate change in Nigeria, Ohwo (2015:4) found that 43.33% of respondents had inadequate knowledge of climate change. The influence of mass media has been studied widely (Boykoff & Boykoff, 2004; Antilla, 2005; Boykoff & Boykoff, 2007b; Boykoff & Boykoff, 2007a) as a major reason for bias against the idea of anthropogenic climate change in America. Poortinga *et al.* (2011:1022) found

[1] Whitmarsh (2008:330) attributes the start of discourse to Svante Arrhenius, who in 1896 discussed the 'warming potential of carbon dioxide in the atmosphere' quantitatively.

[2] Even scientists do not all agree on the cause and effect of climate change (although 90% do). Hulme (2011:72-108) illustrates why science cannot stand alone in this context.

traditional values and a lower socio-economic background, paired with conservative political views, to be a culprit in a study on climate change scepticism in Britain.

According to Hernes (2012:111) different Gallup polls[3], conducted over the period 2007 to 2008 about various aspects of global warming, indicate that public awareness of global warming is more or less proportionate to the degree of development in a specific country. Out of the two thirds of correspondents who were actually aware of global warming, the biggest percentage of those who believe it to be unrelated to human activities lives in Africa (Hernes, 2012:111).

Another study in the UK, undertaken in 2007, revealed that 46% of the UK public believes that human activity is the main cause of global warming, but that there is a lot of uncertainty and doubt regarding the science that climate change reports are based on. Sixty three percent of the public is of the opinion that more information is needed to form a strong conviction (Hernes, 2012:111).

Weingart *et al.* (2000) analysed communications from 1975-1995 about global warming in Germany. They focussed on climate change discourses in science, politics, and the media, and found commonalities, but also significant divergence in discourse dynamics. They found that similar interpretations of communication from different discourses can lead to erroneous understandings (Weingart *et al.*, 2000:280).

Despite all of this, Hernes (2012:89) maintains that consensus about global warming is growing among scientists, although some models and findings are still being disputed. The Intergovernmental Panel on Climate Change[4] (IPCC), an authoritative voice on Climate Change[5], has collected robust substantiation (95% certainty according to the 2013 report (Jones, 2013)) that human activity is one of the largest contributing factors to the warming of the earth over the past 50 years (Antilla, 2005:338; Boykoff & Boykoff, 2007a:1190).

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[3] Gallup polls undertake independent polling and is often referenced as a reliable and objective measurement of public opinion (Boundless, 2016).

[4] The Intergovernmental Panel on Climate Change (IPCC) was founded 25 years ago to 'provide authoritative assessments on the emerging problem of climate change' (Jones, 2013) .

[5] 'Comprehensive. Authoritative. Conservative. Those words summarise the world's most rigorous and important scientific report in history: the 2013 Intergovernmental Panel on Climate Change (IPCC) climate assessment…The Nobel Prize-winning IPCC has put together an amazingly authoritative and comprehensive report….'(Masters, 2013).

This discrepancy between public perception and scientific data gives rise to questions regarding adaptation. The need to study the human aspect of climate change emerges almost as a prerequisite for adaptation studies, for without knowing, understanding, or believing the science, people will not act accordingly. O'Brien and Wolf (2010:237) reason that these beliefs can only be realistically addressed once they are fully understood. Schipper (2007:10) also emphasises the need for research that studies the human element in climate change in her studies on the linkages between development and climate change adaptation.

Changes in the way that the relationship between humankind and the environment is understood are prone to take place as change in the environment becomes more apparent (O'Brien & Wolf, 2010:233-234,237). Turner and Clifton (2009:183,187) documented the indigenous peoples of British Columbia's observations over many years and found that they are painfully aware of the accelerated pace of climate change. Piccolella (2013) obtained similar findings in Africa and India. In the past, historical observations and indigenous knowledge had been enough to adapt to a fluctuating climate, but this is quickly changing.

With climate changing more rapidly, extremes in weather becoming commonplace, and an ever increasing population size, communities now face many new challenges. Intensive agriculture and deforestation additionally lead to a loss of biodiversity. The know-how necessary for coping with these conditions now lies outside of the accumulated indigenous knowledge (Ensor & Berger, 2009:3).

In the IPCC's third and fourth Assessment Report climate change adaptation is defined as: 'the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities' (Brugger & Crimmins, 2013:1832). Socio-ecological systems theory informed this definition with systematic and quantitative studies in mind. Brugger and Crimmins (2013:1831) refer to the layman's definition as being closer to just 'living with climate change'.

Adaptation is more specifically about behaviour modification and systemic adjustments for reducing negative impacts, but O'Brien and Hochachka (2010:90) reminds us that it is also more than that. Responses to standing beliefs, values, and worldviews can be

contested by change and the study of responses and how it adjusts is important on an individual and societal level.

The Intergovernmental Panel on Climate Change (containing the 'factual basis of the issue of climate change' (Obasi & Dowdeswell, 1998:viii)) and other climate change studies were initially notably biased toward economic and technical realities of the phenomenon (Bergmann, 2009:98; Berrang-Ford *et al.*, 2011:25; Brugger & Crimmins, 2013:1830). These studies were used as the base for intervention and adaptation strategies (for example the Stern Review that favours economic concerns). Social science journals only really started publishing articles on climate change from the early 1990s and onwards (Hulme, 2011:72-141)[6], addressing the human element Schipper (2007:10) refers to.

Hulme (2011:4) approaches climate change equally as a physical and social phenomenon. He asserts that the *idea* of climate change becomes a very relevant construct as people are increasingly faced with the 'observable realities of climate change', sombre scientific predictions, and the fact that they themselves are agents of this change. Climate change 'takes on new meaning and serves new purposes' in different disciplines and through the media (Hulme, 2011:xxvi).

As a construct possessing this kind of plasticity, climate change can be moulded according to different ideological projects. Hulme uses 'concepts, tools and languages of the sciences, social sciences and humanities, and the discourses and practices of economics, politics and religion' (Hulme, 2011:xxvi), which according to Rosenfield's[7] taxonomy counts as transdisciplinary research.

To better understand the human aspect of climate change, the trend in (and petition from) the social sciences has indeed been to use a more holistic methodology (Pendergraft, 1998:645; Schipper, 2007:9; McNeeley & Lazrus, 2014:509). As Hernes (2012:89-90) writes: "(T)here is not one, but several crises – indeed a *confluence of*

[6] Although research on public perception of climate change has been ongoing for close to three decades, according to Wolf and Moser (2011:547).

[7] Rosenfield (1992) defines multidisciplinary research as researchers working 'in parallel or sequentially from a disciplinary-specific base to address common problems'. Interdisciplinary research is when 'researchers work jointly but from disciplinary-specific basis to address a common problem'. Transdisciplinary research (the highest level of integration) is researchers working 'jointly using a shared conceptual framework drawing together disciplinary-specific theories, concepts, and approaches to address common problems'.

crises – climatic, environmental, social and political …These crises are not likely to be effectively addressed or solved unless they are considered as a whole and tackled simultaneously."

Hulme (2011:15-16, 343) traces the dualistic approach that divides cultural and scientific meaning to the Western Enlightenment. He proposes an indigenous or traditional (local ecological knowledge) view as more holistic and scientific institutions are increasingly recognising the significance of collaboration between different types of knowledge (Pretty, 2011:127). Another example of holistically-minded research is participatory mapping. Piccolella (2013:2) explains how people visualise their relationship with land and resources in this method. It has been developed to genuinely and actively involve the rural communities in development projects.

Integral theory (see table 1), is an example of a move towards holism also in recent research on climate change. It explores four different dimensions of human activity: interiority/exteriority and individual/collective form the two axes of the model.

Table 1-1: The integral model (Adapted from O'Brien & Hochachka, 2010:95).

	Interior	**Exterior**
Individual	(Experience) I	(Behaviour) it
Collective	(Culture) we	(Systems) its

O'Brien and Hochachka (2010:95) assert that by transforming the interior domains, the exterior will naturally follow suit. For example technological interventions and changes in a system can only by effective (systems and behaviour) if understood (experience) and

used (culture). Furthermore, people will only make use of interventions if they are motivated to do so.

They (O'Brien & Hochachka, 2010:3-4) further testify that the subjective study of interior constituents is "a necessary complement to objective research and actions taken in response to climate change". One such study, which has been encouraged by O'Brien and Wolf (2010:235) (argument made above) is the study of individuals' perception of climate change, but in order to do so a person's view on reality needs to be studied. Research in this vein has not received a lot of attention in climate change adaptation literature.

Kuhn (1962:122) contends that a paradigm is presupposed by interpretation and that not even sensory experience can be fixed and neutral. McNeeley and Lazrus (2014:506) affirm that the way the risk of climate change is perceived by people depends on 'their social interactions and cultural worldviews comprising fundamental beliefs about society and nature'. Lorenzoni and Hulme (2009:383) showed that a person's former belief about something affects the way that he/she interacts with that object/situation and that interpretation is hugely based on the degree of trust in the source of information.

Cultural values and experiential domains inform adaptation, but also vulnerability, in very different ways. The well-being of peoples affected by climate change depends on their perceptions of the change, just as much as on the material outcomes, and discussions on vulnerability need to include how changes are valued subjectively (O'Brien & Wolf, 2010:232). Vulnerability should be an underlying feature of adaptation. Schipper (2007:3) argues that for a definition of adaptation to be complete, it needs to acknowledge the fundamental roots of vulnerability. Vulnerability can generally be defined as 'the propensity or predisposition to be adversely affected' (Lavell *et al.*, 2012:5). The International Strategy for Disaster Reduction (ISDR) defines it more specifically as 'conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards (Birkman, 2006:12).

Vulnerability in the context of climate change can be considered from an outcomes based perspective that estimates the different costs and yields of adaptation. A view that aims at comprehending practices that is already established in a community (Kelly

& Adger, 2000:327; O'Brien *et al.*, 2004:2; Ensor & Berger, 2009:14) is, however, more desirable in a study like the present one, which focus on the human aspect of climate change.

The dynamism of vulnerability is encapsulated in this so-called 'starting-point' approach, first described by Kelly and Adger (2000:327); potential change as part of an interaction with political, social, economic and environmental circumstances within a community. It occasions a broader scope, incorporating environmental and social processes as well as the interaction they have on one another.

From whichever angle climate change adaptation is viewed, there emerges a continuing need to study the human element thereof - social processes, individual understandings and integrations of systems. Specifically the study of belief systems, as underpinning perception can be identified as a gap in current research.

The question of how the phenomenon of climate change and belief systems interacts is a complex one, as climate change is perceived and interpreted in a myriad ways according to culture and personal values and beliefs. Maybe this is one reason why some people are resistant to change even when they believe the anthropogenic base of recent climate change (Gifford, 2011:294).

Research that has been done focusing specifically on beliefs and climate change include the study of belief in climate change and how the dynamics thereof create risks in business organisations (Bleda & Shackley, 2008). Shackley has also been involved in studying the effect of public perception of weather events on belief in anthropogenic climate change (Bray & Shackley, 2004). Vainio and Paloniemi (2013) have published on the effect of belief in climate change on action. Haden *et al.* (2012) studied the attitudes and beliefs that motivated farmers to mitigate and adapt to climate. Finally, Thagard and Findlay (2010) investigated the relationships between belief revision, coherence, and emotion when people change their minds about climate change. Of these articles, only Thagard and Findlay uses the concept belief in the same way and in the same relationship to climate change, as what has been suggested in the above writing.

There exists a vast body of literature on the structure of beliefs and how they are organised into belief systems (amongst others Rokeach (1960), Loubser (2013b) and

Shah (2003)). Hernes (2012) wrote extensively on change in attitude, specifically regarding climate change. By selectively looking at these, and other, sources, the research will focus on the interaction of belief system and climate change adaptation – specifically at how changes in climate challenge belief systems and how belief systems challenge climate change adaptation.

In the light of the above background and arguments the problem under investigation in this thesis is the diverse perceptions and beliefs on climate change that makes policy formulation and implementation so challenging. Research on the link between belief systems and climate change adaptation is lacking and therefore further investigation is necessary.

1.2 RESEARCH QUESTIONS

The following research questions can consequently be asked:

1. What are belief systems?
2. What is the theoretical grounding for climate change adaptation?
3. Which challenges are caused by a community's belief system regarding climate change adaptation?
4. What recommendations can be made regarding the challenges of belief systems towards adapting to climate change?

By answering these questions the study will be structured according to the objectives.

1.3 RESEARCH OBJECTIVES

The research will aim to shed light on the link between belief systems and climate change adaptation. In order to reach this aim the following are the objectives of this study:

1. To gain an understanding of belief systems.
2. To establish the theoretical grounding of climate change adaptation.
3. To determine which challenges are caused by a community's belief system regarding climate change adaptation.
4. To make recommendations regarding the challenges of belief systems towards adapting to climate change.

The aims will be achieved by building on the foundation of the central theoretical statement.

1.4 CENTRAL THEORETICAL STATEMENT

The organisation of beliefs in a belief system governs the change that it undergoes and therefore the following theoretical statement applies to this study.

Beliefs are 'propositional attitudes' with a 'substantive relation to truth' (Shah, 2003:448). This 'doxastic deliberation' is the basis for belief and transforms the normative question *whether or not to believe something* into the factual question *whether or not something is true* (Shah, 2003:449). Beliefs arrange into a system - ideally cohesive - that can be visualised as a sphere, because not all beliefs rank equal in importance (Rokeach, 1960; Rokeach, 1968; Rokeach, 1979). The most primitive beliefs are located in the centre and are the most resistant to change. Different beliefs (for example religious ground motives, worldviews, philosophical frameworks, paradigms and scientific theories) group together and belief systems can be pre-theoretical (like worldviews), theoretical (like theories) or both, i.e. partially pre-theoretical and partially theoretical (like paradigms) (Loubser, 2013b). Furthermore, single beliefs can be mobile, changing function as it moves between domains, or stagnant, within a system (Wolterstorff, 1976:65-66).

External environmental change prompts a re-evaluation of truth. Climate change adaptation implies both the amelioration of adverse effects of climate change on people's well-being and seizing new opportunities created by this change (Eriksen *et al.,* 2011:2).

1.5 METHODOLOGY

In the study of the human elements of climate change and climate change adaptation there has been a reach into different 'knowledges' (Berkes, 1999; Pretty, 2011) - such as local ecological knowledge, indigenous knowledge and scientific knowledge – as well as joint knowledge production (Hegger & Dieperink, 2014). The trend has been to reach back into history, but also horizontally across different levels of thought; to synergise systems of knowing and to integrate perspectives and disciplines. In short, for a holistic study as far as possible.

Further the research area covered by belief systems applied in a climate change context is inherently transdisciplinary (Schneider, 1997; O'Brien & Hochachka, 2010), a characteristic of cybernetics. Rosenfield (1992) defines transdisciplinary research as ‘using a shared conceptual framework drawing together disciplinary-specific theories, concepts, and approaches to address common problems’.

Approaches such as holism, emergentism, systems thinking, cybernetics, complex systems and systems theory come to mind. All of these are complements to reductionism and implies a world where the sum of reality is more than just the parts.

This broad philosophy informed the current study. A literature review forms the theoretical base that the empirical investigation builds on.

1.5.1 LITERATURE REVIEW

According to Bryman (2012:102) a literature review should give an overview of the study field ‘through reasonably comprehensive assessment and critical reading of the literature”.

The literature that is outlined has been chosen to attempt answering the first two research questions, as well as inform the fifth. They are as follows: what are belief systems? What is the theoretical grounding for climate change adaptation? And what recommendations can be made regarding the internal and external challenges of belief systems towards adapting to climate change?

Google scholar, the North-West University’s library catalogue (including journals, JSTOR, EbscoHost and Emerald) and SACat had been used in order to find primary sources on anthropogenic climate change and responses to it. An understanding of belief systems and climate change adaptation had been gained by consulting several books and journal articles. Other core literature includes working papers from the Tyndall Centre for climate change research and reports by the IPCC.

1.5.2 EMPIRICAL INVESTIGATION

The empirical investigation used the theoretical foundation that had been built up around belief systems and climate change adaptation to position the new data obtained within the broader discourse.

This study formed part of a bigger research project by SANCOOP (South-Africa – Norway – co-operation on Climate Change, the Environment and Clean Energy) that explores the relationship between belief systems and climate change adaptation.

1.5.2.1 Research design

The research strategy of mixed methodology was used, with a strong leaning towards qualitative research. Q-methodology was used as a tool to analyse the qualitative data. It uses quantitative analysis methods derived from statistics, but is not antithetical to qualitative research. The nature of this method has been debated and Stenner (2011) argues against its classification as a mixed method (he suggests 'qualiquantology'). In the current study, Q-methodology stands alongside semi-structured interviews and other qualitative methods, but the Q-method quantifies this qualitative data.

A cross-sectional design with case study elements (Bryman, 2012:69) was used. A case study is concerned with the intricacies and the specific nature of a case (Stake, 1995:96), and in this study the data is definitely specific to the three communities. The fact that these are semi-rural communities, specifically located in the North-West province, narrows the experiences and responses of and to climate change. Belief systems are also determined in large part by the social structure in which the individual finds him/herself.

However, the focus of interest is not the 'case in its own right' as Bryman (2012:68) advises, but rather the 'body of quantifiable data' which are examined 'to detect patterns of association' (Bryman, 2012:58).

1.5.2.2 Sampling

This study made use of nonprobability samples. Availability sampling was used, as a complete sampling frame of the three communities under investigation is not practicable. Monette *et al.* (2013:131) state that one of the main reasons for using samples is that the group being studied might be too large to make a study of it feasible.

1.5.2.3 Instrumentation

Semi-structured interviews, also called non-scheduled-standardised interviews, were used. A set of open-ended questions were asked to all respondents and the interviewer had relative freedom to fashion the interview according to circumstances. The order of

questions and exact wording are not critical for a successful interview and the interviewer is allowed to probe for more information when relevant (Monette *et al.*, 2013:176).

Q-sorting, not unlike phenomenology, tries to study subjectivity in an objective way. The preparatory phase is the collection of a concourse, which is a collection of self-referential statements. These statements were selected from the data obtained in the semi-structured interviews and therefore a smaller sample, called the "Q sample"[8], was again selected. The participants had to rank order the Q sample according to guidelines given by the instructor and rate each statement according to a grid with a normal distribution pattern (Meier, 2004).

1.5.2.4 Data collection

The interviews were done on three consecutive days, in three different locations in the North West province, South Africa, namely Ikageng, Jouberton and Ventersdorp. Thirty respondents were chosen per site in collaboration with the contact person or gatekeeper of the community. After the interviews had been transcribed, 40 statements were selected from the data for a Q-sort, and Q-sorting grids were compiled.

The second phase consisted of Q-sorting interviews. 15 respondents from each site were randomly selected for this. They had to sort the 40 statements according to the degree that they agree with each, using a Likert scale system ranging from -3 (completely disagree) to +3 (completely agree) in a free distribution pattern.

Phase three entailed a rank sorting of the same statements based on level of agreement into a forced distribution pattern, using a quasi-normal distribution. Eight participants per site were involved.

1.5.2.5 Data analysis

The PQMethod software program (version 2.35) was used to analyse the Q-sorts from phase 3, and in this way quantify data from the interviews[9] in an objective and technical

[8] These 40 statements are included as annexure 2.

[9] The qualitative data from the interviews was coded according to the number of the interview, the interviewer's initials, and the name of the community.

manner (Van Exel & De Graaf, 2005:8-9). The different responses were grouped together into different factors, or distinct semantic patterns.

The interpretation of the data included the writing of a worldview narrative for each factor. Two participants from each factor, whose sort was defining for that factor, were asked to choose from the different narratives the one which resonates with them most. This acted as one form of triangulation. The qualitative and quantitative phases of the empirical data, as well as the literature study and empirical data acted as further triangulation.

Tashakkori and Teddlie (2009:27) define triangulation as 'combinations and comparisons of multiple data sources, data collection and analysis procedures, research methods, investigators, and/or inferences that occur at the end of a study'.

The triangulation informed the conclusion of the study.

1.5.2.6 Limitations and delimitations

The most obvious limitation for a largely qualitative study design that uses non-probability sampling, such as this one, is that the results cannot be generalised.

Another limitation is the abstractness of climate change concepts, which makes communication difficult (Ensor & Berger, 2009:24), especially within a community that is on average not highly educated.

Ethical clearance (NWU-00334-14-A7) has been obtained for the SANCOOP: CLIMATE & BELIEFS project (7/11/2014 – 16/11/2019) from the research ethics committee of the North West University. Participation is purely voluntary and participants can withdraw at any time. Confidentiality is guaranteed in the informed consent forms which were signed by participants after the researchers made sure that all the information contained therein was fully understood.

1.6 SIGNIFICANCE OF THE STUDY

The study of belief systems in the context of climate change has been identified as a gap in current and available research. This study has significance in affording a better understanding of obstacles to climate change adaptation from an internal perspective. General guidelines have been established by this study which can in future be used as

guidance for similar studies within different communities. The identification of challenges to adaptation can be utilised for more effective policy formulation and implementation.

1.7 CHAPTER LAYOUT

This mini-dissertation takes the form of four chapters and an academic article presented for possible publication in an international accredited journal. Chapter 1 provides background to the study and presents the problem statement, research questions, research objectives and central theoretical statement. The research methodology is explained in detail, and the chapter concludes with an explanation of the significance of the study and the chapter layout.

Chapter 2 is a literature review and provides a theoretical grounding for the concepts *belief system* and *climate change adaptation*. Chapter 3 is the academic article presented for possible publication in *Environmental Values*. It consists of an abbreviated version of the literature, the Q-sort results and findings, and a condensed version of the general findings. Chapter 4 contains the conclusions and recommendations. Each objective is looked at in turn, and the chapter is concluded with an overall conclusion and recommendations for further study.

Chapter 2 Literature Review

2.1 Introduction

This chapter presents selected literature on belief systems and climate change adaptation. The first two objectives of this study will be reached by delineating the use of these two constructs in the context of the study. The aim is to establish a theoretical foundation on which the rest of the study can be built.

2.2 Belief systems

As O'Brien and Wolf (2010:237) rightly points out, beliefs cannot be addressed if they are not understood. In the following sections beliefs and belief systems are investigated, starting with the definition of a single belief and moving to the architecture of belief systems.

2.2.1 Beliefs: definition, functions and types

Wyer and Albarracín (2005) describe the typical accepted concept of beliefs as 'estimates of the likelihood that the knowledge one has acquired about a referent is correct or, alternatively, that an event or state of affairs has or will occur'. It can also be termed as 'an estimate of subjective probability' or 'the certainty that a proposition is true' (Wyer & Albarracín, 2005:273,274).

Rokeach (1968:113) defines a belief as any unconscious or conscious proposition that can be surmised from a person's words or actions and that are able to follow the expression "I believe that…" He (Rokeach, 1968:2-3) warns that beliefs cannot be directly perceived, because what a person stated may not be a true representation of his/her actual beliefs.

Beliefs are appraisals that our cognitions are correct and as such influence judgments and can be influenced by perceptions (Wyer & Albarracín, 2005:276). In turn beliefs, especially foundational beliefs, also influence our perceptions (Lorenzoni & Hulme, 2009; Hulme, 2011:145-146; Hernes, 2012:121).

Rokeach (1968:113-114) describes a belief as consisting of three components: the cognitive (descriptive, evaluative or prescriptive), the affective (different intensities of

positive or negative emotion that becomes manifest when that belief is challenged) and the behavioural. These three components should ideally be harmonious, whether within a single belief, or between two or more beliefs in a system or subsystem, as people generally endeavour to keep their conscious beliefs as coherent and consistent as possible[10].

There are different types and functions of beliefs. When a belief qualifies something as true or false the belief is descriptive or existential. When it qualifies something as good or bad it is an evaluative belief. When it qualifies something as desirable or undesirable it is a prescriptive or exhortatory belief (Rokeach, 1968:113).

Wolterstorff (1976:11-16,91) distinguish between control beliefs, data beliefs and data background beliefs. The first category refers to authentic commitment, the second to theory and the third to the devising of theory. There is an interaction between control beliefs and data beliefs.

Loubser (2013a) categorises beliefs into pre-theoretical structures, theoretical structures or a combination of both. It could be argued that control beliefs, as well as data background beliefs to a certain extent, are pre-theoretical in nature and data beliefs theoretical. Loubser (2013a:13) points out that both Polanyi and Dooyeweerd's theories acknowledge commitment or control beliefs as the core of meaning in abstract deliberation. Commitment, 'authentic commitment' or control beliefs thus guide or control arguments, thoughts and the structuring of new information.

Worldviews entails categorising the world and the relationships within it. It explains the place of people in their milieu in such a way as to make the most sense out of things (Loubser, 2013a:16). A worldview is therefore another conceptualisation of a guiding commitment with pre-theoretical nature i.e. foundational belief.

Fundamental frameworks with a pre-theoretical nature cannot necessarily be expressed in theoretical terms, and they may even be held subconsciously. Premises for beliefs are held within these frameworks with or without conscious decision and a truth that transcends perceptible reality is formed (Loubser, 2013a:15). All beliefs, including belief

[10] This is however not the case with beliefs that are not fully exposed, as will be described later in this chapter.

subsystems such as attitudes and values, can be held either consciously or unconsciously (Rokeach, 1968:124).

Hulme (2011:145-146) notes that foundational beliefs about the place of and interrelationship between people, nature, and God/gods, can influence the perception we have of climate change, and affect the way we classify solutions. People hold very different beliefs regarding human dignity and responsibility, the value of nature and ecosystems, as well as 'humanity's ultimate purpose and destiny' (Hulme, 2011:144-145). These beliefs influence who or what we blame when something goes wrong. According to him foundational beliefs are generally either human or cosmos centred, the latter assigning greater power to forces outside human control.

According to Thagard and Findlay (2010:331), values serve as backbone for beliefs. For example some of the underlying values of global warming critics are individual liberty, economic stability, and technology, which leads them to claim that the IPCC's findings are uncertain, that the free market and property rights will encourage sufficient environmental responsibility, and that global warming will ultimately be solved by technology.

It can be said that beliefs arrange into systems according to function and type, with core beliefs forming the foundation, while acting as a frame where more peripheral beliefs can attach. The architecture of these systems has consequences for belief flexibility, decision making, and ultimately behaviour.

2.2.2 Frameworks

Thagard (1992:20-21) proposes that (beliefs of) knowledge organises into concept-like structures called frames and that beliefs can be added or deleted from a set (e.g. "judged to be known"-set). Beliefs are organised by means of concepts into conceptual systems with different relations between concepts. Hernes (2012:113) adds that conceptual frameworks and constructs of causal relations are logically linked to each other in a network, so that a change to one belief causes a rearrangement of the whole web. Rokeach (1968:2-3) however argues that the system need not be logical, although it will be organised in a specific psychological form.

Loubser (2013a:1,9) puts forward that belief clusters can be made up of assumptions, premises, presuppositions, theories and axioms. When these clusters are embedded in

pre-scientific or scientific structures they are called frameworks and have both a personal and collective nature. Rokeach (1968:123) describes a system of beliefs as a multi-dimensional organisation of all of a person's beliefs - regarding the self, as well as the physical and social world he/she lives in.

There are several subsystems within a belief system, differing in size and extent. These subsystems can be organised around a specific event, context or object and is intertwined with other subsystems. Marsh and Wallace (2005:8) add that coherent cognitive frameworks are developed around predicted central events in order to help one cope with it realistically. Attitudes are described as such a learned subsystem; specific towards and object and/or situation[11]. Rokeach (1968:112) defines an attitude as 'a relatively enduring organisation of underlying beliefs' (cognitions/expectancies/hypotheses) about an object or situation that prompts a preferential response of some sort. Belief systems fulfil the need to 'understand the world insofar as possible, and to defend against it insofar as necessary' (Rokeach, 1960:400).

A value is similar to an attitude in the sense that it is also a disposition, but it is more basic, as attitudes are built upon it. Unlike attitudes, values are not organised around something or someone specific, but are abstract and as such, idealistic. Rokeach (1968:124) considers a value as a central type of belief that directs desirable behaviour and 'end-state existence'. Desirable behaviour or ideal modes of conduct is referred to as instrumental values and ideal 'end-state existences' is referred to as terminal values. Values can be positive or negative. Some positive examples are justice, compassion, and honour (instrumental) as well as happiness, freedom, and equality (terminal).

Rohan, according to O'Brien and Wolf (2010:3), found that the organisation of values form the building blocks of a person's conscious beliefs about the world. These worldviews are associated with cognitive constructs and can change as such. As people construct schemas, there is a completion principle process in play (Wyer & Albarracín, 2005:287). The consistency that is aimed for in a belief system, is firstly a strive for consistency with self-esteem and only afterwards with logic and reality (Rokeach, 1968:164).

[11] A situation attitude is referred to in personality psychology as 'trait concepts' and in sociology as 'role concepts' and even group norms, social pressure, legal constraints and social structure (Rokeach, 1968:118).

On a sociological level, a system of 'beliefs, techniques, and so on shared by the members of a given community' is called a paradigm[12] (Kuhn, 1962:175). In science this can be described as a 'disciplinary matrix'. It contains shared obligations to beliefs and values, symbolic generalisations and other collective commitments (Kuhn, 1962:181). A paradigm is a specific kind of belief system then, but a communal system instead of a personal one.

Communication can be very challenging without communal systems. Differently defined ideas, from different personal belief systems are often assumed to be similar. The exchange of these ideas can be problematic. Klapwijk argues against the entrapment of ideas into one framework and argues that ideas can be changed according to different worldviews (Loubser, 2013a:19). This seems crucial for meaningful communication between members of different cultures for example.

A deeper look into the function and structure of attitudes and values as types of beliefs will afford better insight into possible belief frameworks.

2.2.2.1 Attitudes and values as types of belief subsystems

Within the total belief system, attitudes, values and value systems play different roles structurally and functionally. A value has, in addition to its cognitive, affective and behavioural components, a motivational element, which makes it a very dynamic concept (Rokeach, 1968:158). Values determine attitudes, which in turn determine behaviour [13].

According to Rokeach (1979:2) values acts as criterion for, amongst others, designation of causality. When a value is internalised into a system it upholds the surrounding structure by acting as a standard: it develops and maintains different attitudes, it guides actions, comparisons and moral judgments, and it justifies actions and attitudes of oneself and others. This guidance works across different situations and objects, and towards end goals, it is an imperative to action and people tend to want to propagate it (Rokeach, 1968:160).

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[12] Note that this is not the only way in which Kuhn defines a paradigm. For a more detailed account, cf. Loubser (2013b).

[13] As an analytical tool values have the advantage of being few enough to measure meaningfully. A further advantage is its use in interdisciplinary research, because of the centrality of the concept across many different disciplines (Rokeach, 1968:158).

Hulme (2011:143) concurs that beliefs have a weighty impact on attitudes and behaviour (and he adds politics to the list). For him a person's beliefs influence both the vision of an ideal future world as well as an expectation of the most likely future.

Different components in an attitude-belief system are interconnected. Attitudes are for example functional in aiding the formation, retrieval and changing one's beliefs. They are narrowly linked to conscious thought processes. It follows that uncertainty arises when the original information on which a specific attitude was forged on is no longer accessible (Marsh & Wallace, 2005:2).

Rokeach (1968:131) describes attitudes as acting as a frame of reference, a structure around which knowledge can be organised. It is a prejudgment, possibly biased and possibly triggering emotion when challenged. As such, even when faced with evidence, an attitude may resist change.

2.2.3 Changes in beliefs

As noted above, peripheral belief clusters join in networks of varying complexities with different connections between them. Clustering is motivated by an array of factors, but a belief is not tied to one cluster, as it can migrate. The external world is constantly changing, so in order to adapt, one's beliefs should change accordingly. Changes in beliefs can cause alterations to belief systems.

Belief change has been extensively described within Artificial Intelligence (A.I.) research and there are many formal computational models explaining it (for example those by Gärdenfors (1988) and Westlund (2011)). Belief change is also explored from within psychology and philosophy (for examples the theories of Kuhn (1962), Rokeach (1960), and Wyer and Albarracín (2005)). The aim here is to give an overview of the natural process of changing beliefs, not a normative, but a descriptive one, albeit abstracted.

The term 'belief revision' comes from the discipline of A.I. and holds certain connotations. For example the 'main intuition behind the belief revision model is a kind of epistemic conservatism' (Westlund, 2011:213). In this writing 'belief revision' is not used in this limited way, but rather as a synonym to 'change in belief'. According to the classic description originally by Gärdenfors, the epistemic state of a person is "a consistent set of sentences that can change by expansion and contraction". Revision is a change of belief that is then neither expansion nor contraction (Thagard, 1992:19;

Thagard & Findlay, 2010:334). Kuhn (1962:43-65) asserts that the rejection of one paradigm is just the other side of accepting another. Such a decision is made after the two paradigms had been compared with each other and with nature.

Loubser (2013a:28) equals (belief) change as 'variations in the presuppositions, content and convictions embedded in epistemic frameworks'. Importantly she adds that the variations can be intrinsic or peripheral, where the first denotes 'more profound change' and the latter 'causing only superficial change', thereby echoing Rokeach's theory of change within belief systems. It is underpinned by three assumptions regarding beliefs, the first one being that all beliefs are not equally important to a person (Wyer and Albarracín (2005:276) also note that people feel more strongly about some beliefs than others). Secondly, the strength with which a belief resists change depends on its centrality. Lastly the more central a belief is located the more difficult it will be to change and once changed, the more extensive the consequences will be for the rest of the system (Rokeach, 1968:3).

2.2.3.1 Instances and justifications for belief revision

Whether beliefs are erroneous or not, they can be reviewed through psychological and sociological processes of change. Hernes (2012:112) remarks that a strong sense of identity does not exclude an inquiring mind. Continuity between reality as observed and beliefs regarding this reality is aimed for, and when there's a breach in continuity the whole interconnected system of beliefs are destabilised and in need of reorganisation. He applies the effect of extreme weather events caused by climate change to this notion, distinguishing between natural disasters and changing weather patterns (Hernes, 2012:114). The first causes an abrupt gap between 'presumption and perception' and the latter 'a specific moment of realisation' preceded by a slower process of change.

If more and more evidence are gathered in favour of a change in belief the result is ultimately a gestalt switch of sorts. There comes a tipping point where the relations of explanatory coherence as a whole result in the adoption of new views and the rejection of some old ones (Thagard & Findlay, 2010:336).

Cognitive strain is caused when part of the system undergoes change and cause an inconsistency. Inconsistencies may lead to a complete reorganisation of the system

(Rokeach, 1968:117-118). Belief revision happens when there is either an incompatibility that emerges in the body of belief, which can be for example a logical contradiction, or when there is a lack of a compartment for a new piece data. Either the belief, or in more drastic cases, the commitment will then be reviewed (Wolterstorff, 1976:88).

A stimulus only activates some parts of the belief system and only with a certain level of intensity (Rokeach, 1968:83). For example a situation or object activates specific belief-dispositions. A change in outlook can involve either a change in the content of beliefs or a change in the organisation of beliefs. The latter may be a result of education, therapy or development and can fully stand alone, in other words a simultaneous change to content is not necessary. An example of this is a shift from a literal to a figurative understanding of something. It can also be a change in the variables of belief organisation such as differentiation or integration (Rokeach, 1968:135).

Variables of cognitive system organisation include differentiation (complexity), integration (which in part determines differentiation), centrality and time perspective. If something is not functionally integrated, it is compartmentalised. Time perspective can be narrowly or broadly defined and contains notions of the past, present, future, as well as interrelations between them. Another variable is the specificity or generality of a concept, which is a function of the degree of differentiation, integration and isolation of one belief to another. The last variable is breadth or narrowness, which refers to 'the spectrum of relevant social reality actually presented within the whole' and which is independent of degree of differentiation (Rokeach, 1968:117-118).

2.2.3.2 Models for belief revision

Different conceptual representations of belief systems and belief revision have been created in an effort to explain and predict real belief systems, because it cannot be observed directly. In the next section four of these models are briefly investigated.

2.2.3.2.1 Explanatory coherence model

Thagard and Findlay (2010:330) uses an explanatory coherence model to explain belief revision in terms of climate change, and an emotional coherence model to explain the resistance to seemingly obvious conclusions, such as the anthropogenic cause thereof. Explanatory coherence theory is based on seven principles: symmetry, explanation,

analogy, data priority, contradiction, competition and acceptance. Amongst other things, the principle of explanation entails that the amount of hypotheses it takes to explain something is inversely proportionate to its degree of coherence (Thagard & Findlay, 2010:332-333).

To create a model using the theory of explanatory coherence concepts/statements are written down so as to illustrate relationships between them. A relationship can be either coherent or incoherent and multiple relationships are possible. For example Thagard and Findlay's highly simplified view of the controversy regarding climate change.

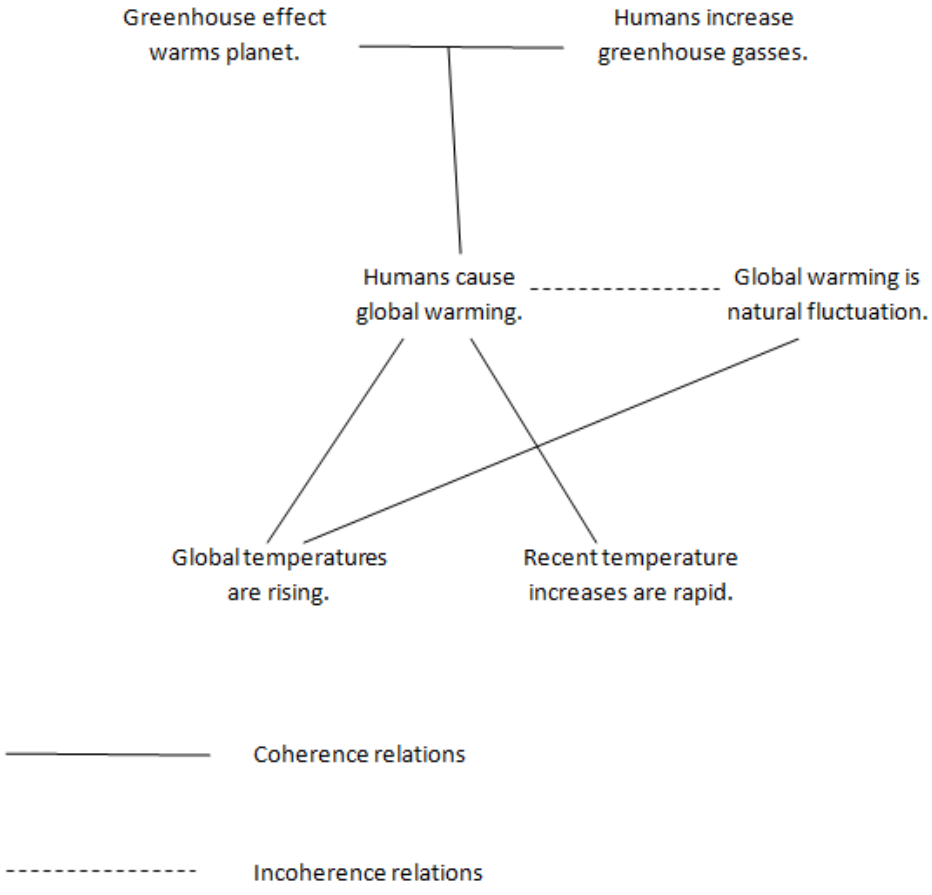

Figure 2.1: Thagard and Findlay's highly simplified view of the controversy regarding climate change (Thagard & Findlay, 2010:332-333).

Resistance to belief revision is explained by the influence of emotional values, which are 'a perfectly legitimate part of decision making as psychological indicators of the costs and benefits of expected outcomes' (Thagard & Findlay, 2010:337). When these are included into the above figure more incoherence relations are added to the

statement ‘humans cause global warming’. In this way more evidence is necessary to accept that human activities cause global warming.

2.2.3.2.1 Rokeach’s model

Importance of beliefs is termed in relation to connectedness, for which there are four criteria. An existential belief will be more connected to other beliefs than a non-existential one. Shared beliefs regarding self-identity or existence will have more connections functionally than those same types of unshared beliefs. Beliefs that are learned by direct encounter will be more connected than derived beliefs. Lastly, when a belief is more or less arbitrary it will have fewer connections and consequences than when it is about something more substantial than merely taste (Rokeach, 1968:5-6).

Beliefs are further categorised into five classes of beliefs by Rokeach (1968:6-12). The first three classes are pre-ideological in nature: (i) primitive beliefs with 100% consensus, (ii) primitive beliefs with no consensus, and (iii) authority beliefs, both positive and negative. Beliefs in the fourth class are derived and those in the fifth class are inconsequential.

The criteria for connectedness can be applied to these classes of beliefs to order them in terms of centrality. Interestingly, intensity of belief, as well as verifiability is independent of centrality (Rokeach, 1968:13). According to the criteria of arbitrariness, the fifth class of beliefs (inconsequential beliefs) are less central than the rest. According to the criteria of belief derivation, the fourth class (derived beliefs) are less central than the third class (authority beliefs).

Non-primitive beliefs are those beliefs that get differentiated from primitive beliefs as a child grows up and realises that many beliefs that he/she took for granted are not shared by everyone. Rokeach (1968:9) describes the function of these beliefs as serving ‘the purpose of helping the person to round out his picture of the world, realistically and rationally to the extent possible, defensively and irrationally to the extent necessary’.

The most pervasive non-primitive beliefs are those regarding authority. Each person has positive and negative reference persons or groups, whom he/she trusts to have or to not have the correct information/beliefs. These referents are determined by education and social structure and built up through direct encounters.

The criterion for existentialism determines that the third and fourth classes of beliefs (authority beliefs and derived beliefs) are less central than the first two, which are primitive beliefs. Primitive beliefs with a 100% consensus are more central than those without any consensus by qualification of the criterion for shared beliefs.

The class of zero consensus primitive beliefs is often learned through adverse experience that is either intense or accrued and are psychologically incontrovertible. With regards to these type of beliefs people feel that nobody else knows what they do and therefore do not attach any value to their concurrence.

Primitive beliefs with 100% consensus are the most central, and therefore important, beliefs that a person can have. This class is made up of uncontroversial basic beliefs about the nature of self, and physical and social reality. They are axiomatic in character and are learned from direct encounters with the object of belief. Object-, person-, and self-constancy are the essence of primitive beliefs. Rokeach (1968:7) also describes it as ‘a minimum guarantee of stability’.

According to this model, the centrality of a belief will determine its resistance to change. However, if a more central belief is changed, the consequences will be much greater, with outwards spiralling effects.

2.2.3.2.2 Rokeach’s value-attitude system

Figure 2.2 is drawn according to Rokeach’s description of the mental organisation in a value-attitude system. The system can be assumed to be mostly internally consistent. A change anywhere in the system will cause connected parts to also change and in this way lead to behavioural change (Rokeach, 1968:162-163).

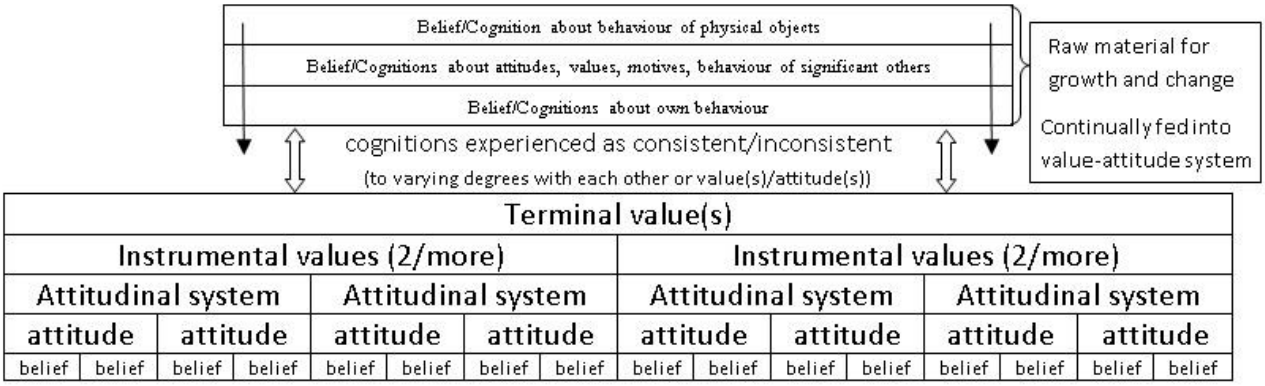

Figure 2.2: A graphic representation of Rokeach's value-attitude system.

Terminal values are the most central structure in this complex and therefore inconsistencies thereof, first of all within itself and then with other structures, will cause the biggest change (both in magnitude and lastingness). Rokeach (1968:167) predicts that discrepancies involving these values to be emotionally charged, remembered best, to last longer and to cause changes in the rest of the value-system, as well as connected attitudes. The outcome of all of this is behavioural change.

States of inconsistency can be induced by behaving in a way that is discrepant with one's values, learning new information about something/somebody that doesn't line up with previously held beliefs or becoming aware of existing inconsistencies within the self. The reason why inconsistencies within a value-attitude system might be unnoticed could be compartmentalisation or 'an uncritical internalisation of contradictory values and attitudes' (Rokeach, 1968:167-168).

2.2.3.2.3 Hernes's model

Hernes (2012:117-140) gives ten questions that determine the mechanisms of change. These ten questions are not really a model as such, but still explain belief revision and do so in relation to climate change specifically.

The first question is whether someone's beliefs square with the facts. This is a basic test of logic where you compare the empirical consequences of running an idea through a chosen explanatory model, with the facts. If it compares negatively you'll want to review the belief. The second question asks how the event affects you. The more

directly it affects you and the bigger the scale of the effect, the bigger the psychological impact will be and the more likely you are to reorient your assumptions and attitudes.

'Does it add up?' is the third question, and refers to the importance of consistency between our beliefs, values, attitudes and behaviour. There are three axioms of harmonisation to be utilised here. The first implies that beliefs are hierarchically organised. Certain beliefs are taken as premises. When there's uncertainty about a belief one needs to refer back to the belief that it descended from. The second axiom refers to attitude and behaviour consistency and the third to a consistent horizontal network of beliefs or attitudes.

The fourth question determines how you cope with discrepancies, because beliefs are sometimes not changed even though an answer is inconsistent. Reasons for this include selective perception, selective memory and rationalisation or reinterpretation. Question five pertains to the availability of templates for interpretation, because beliefs that are strung into 'coherent ideological wholes' are easier to accept.

Question six asks whether you are alone. Attitudes and beliefs are links between people in social networks because 'common beliefs are human bonds'. Over time beliefs become cognitively embedded in a logical web. These cognitive networks are shared, therefore the beliefs are also socially embedded into an interpersonal network. This 'double embedment' of a belief leads to 'intellectual conversions' to 'entail social rearrangements and *vice versa'*, because discords are dissolved by logic and boundaries of social groups. Opinion leaders play an important role, because their change of mind will have more repercussions on the social network than anybody else's.

'Is the issue controversial?' is the seventh question. Controversy affects both levels of double embedment. 'The main issue becomes more sharply defined; the stakes are heightened because they are expanded: not just confined to what has occurred, but what are its causes, who is to be blamed and what it to be done…'

The eighth question is about whether politics are polarising the issue. When controversy leaks into the political field it affects civic outlook. Polarisation happens when two political parties have opposite views on the issue and it's prioritised by the general political agenda.

The nature of change of the issues and their adherents over time is at issue in question nine. It's all about social dynamism and how different views affect each other. For example, if change was event driven, the consciousness of it declines over time. Additionally different age groups are influenced differently by events and older people's attitudes cannot vicariously be transferred to the younger generation. The last question raises the very controversial issue of pecuniary interest.

Belief systems can resist change for various reasons, such as emotional interference or simply a tightly knit cohesive set of beliefs. As Wyer and Albarracín (2005:286) notes, a high degree of coherence of beliefs correspond to an increased resistance to change. The next section explores further reasons for resistance to belief revision.

2.2.3.3 Resistance to belief revision

Beliefs usually have motivational roots, which mean that they are created for a specific purpose. Examples of such purposes include a motivation to be accurate and consistent, to uphold a positive self-image, to achieve closure, to believe in a moral world, and to evade ambiguity. The main motive underlying many beliefs is the general motive to 'construct a representation of oneself and the world that permits one to cope effectively with life situations and, therefore, to lead a happy and successful life'. Self-perception and the perception one has of the world should ideally approximate reality in order to predict and interpret social events accurately (Wyer & Albarracín, 2005:306).

Information that conflicts with one's constructed motive-based representation of the world and oneself is difficult to accept because it may require amendments to one's beliefs. Furthermore these beliefs might be closely associated with further beliefs which will in turn need to be adjusted. People are therefore sometimes hesitant to accept this new information and try to accommodate it in different ways. Reinterpretation, counter-arguing, bolstering, compartmentalisation, and transcendence are all methods in which new information can be resisted. Bolstering refers to the selective retrieval and review of information that justify a belief for other reasons. Compartmentalisation refers to the division of the new information's referent into components and ascribing the information to an unimportant one. Transcendence is the placement of the information's implications into a broader conceptual framework that makes it less important (Wyer & Albarracín, 2005:307).

Thagard and Findlay (2010:342) writes: “Deviations from rational belief revision in the form of emotion-induced rejection of the best explanation of a wide range of evidence can be understood in terms of intrusion of emotional political values into the assessment of the best explanation”.

Resistance to new information will only occur when the cognitive effort is less to do so than to accept its repercussions. The centrality of the affected belief plays a crucial role in determining whether or not this is the case. The more central a belief is the more associated beliefs are attached to it that will also have to change and therefore greatly increase the effort necessary (Wyer & Albarracín, 2005:307). For this reason people compromise when they respond to belief-relevant experiences and find a balance somewhere between accuracy and desirability depending on their personal tolerance threshold. An individual’s beliefs are guided at least partially by wishful thinking (Wyer & Albarracín, 2005:308-309).

Dispositions, attitudes and beliefs are components of yourself or what you are, and the core of your identity is stability. The words ‘mindset’, ‘personality structure’ and ‘character’ all presuppose relatively fixed identities. The human mind is filled with notions of reality based on personal experience which guide our living strategies. People tend to stay “true to themselves” in the sense that their behaviour aligns with how they see themselves (Hernes, 2012:112-113).

In addition to acting as barriers to belief revision, factors like emotion and self-perception can have other influences on beliefs as well.

2.2.3.4 The relationships and differences between beliefs and emotion, knowledge, perception, time, as well as culture

Emotion, knowledge, perception, time and culture each stands in a relationship to beliefs. It is important to distinguish between these factors and note their relationships to beliefs.

2.2.3.4.1 Emotion

One of the reasons why a challenged belief can trigger affective reaction is that it raises questions about a person’s ability to correctly assess reality. We care deeply about the correctness of our beliefs (Rokeach, 1968:116).

Hernes (2012:96-116) notes that emotional responses are elicited by abrupt event impacts that challenge beliefs. A sudden disruption in the belief system causes feelings of vulnerability and threatens a person's sense of security. Estimation of the probability of the occurrence of a negative event are often based on the anxiety one experiences when thinking about that event, especially if the anxiety is caused by a concern for the occurrence of the event (Wyer & Albarracín, 2005:305).

2.2.3.4.2 Knowledge

Woolman (2006) distinguishes between different ways in which something can be known – through perception, reason, emotion, faith, language, and creativity. You can know something empirically, logically, by authority, memory, practice (know how to), conscience, moral belief, introspection, empathy, faith, and instinct.

There are also different ways of obtaining knowledge: either through direct experience, internally generated (from performing cognitive operations on previously held knowledge – inferred/concluded), or mental images from descriptions. These type of (subjective) cognitions can be stored as new knowledge (Wyer & Albarracín, 2005:275).

The way we acquire knowledge has changed during the information revolution into the current knowledge economy (Coady, 2012:2). We are becoming more reliant on experts as our body of belief expands and becomes more complex (Coady, 2012:28).

2.2.3.4.3 Perception

Beliefs are interconnected with perception. Lorenzoni and Hulme (2009) argue that people see what they believe. In other words, the authority of current projections is measured by prior beliefs. Hernes (2012:121) agrees that our perceptions correspond to held beliefs, even more than to actual reality. Kuhn (1962:113) suggests that perception itself requires a paradigm and that what someone sees 'depends both upon what he looks at and also upon what his previous visual-conceptual experience has taught him to see.'

Coady touches upon the issue of whether or not we actually have control over what we believe. Beliefs are determined by evidence, but also attitude towards that evidence. He opines that you do have control insofar you choose what evidence to gather and whether or not you choose to believe it (Coady, 2012:12-13).

2.2.3.4.4 Time

Judgments are calculated as and when necessary, but because ‘similar bodies of knowledge’ are used, judgments tend to be more or less consistent over time. Different beliefs stated at different times does not necessarily entail a conscious alteration to those beliefs, but may be a sign of another subset of knowledge that was used (Wyer & Albarracín, 2005:274). Beliefs are changeable according to occasion (Wolterstorff, 1976:11-16).

Whether or not beliefs themselves are part of a ‘stable memory system’ has been debated, with those opposed to this view proposing that beliefs are pragmatic and purely derived from whatever knowledge comes to mind at the moment it’s required. Theories to explain the process of this scenario have been expounded, although there is not complete agreement on the degree to which these different units of knowledge interrelate (Wyer & Albarracín, 2005:278,313). The following four presuppositions are generally accepted: recentness, frequency, strength of association, and schematic processing. In other words the likelihood of using a specific unit of belief-relevant knowledge depends on how recently you have acquired or used the information, how frequently you have used it, how strongly it is linked to the issue at hand, and whether or not it forms part of a more general schema regarding this issue (Wyer & Albarracín, 2005:281).

2.2.3.4.5 Culture

Dooyeweerdian religious ground motives are based on three fundamental questions regarding, amongst others, the origin of all meaning, and unity and coherence in a diverse reality. According to Loubser (2013a:11) a culture’s communal ground motive drives their development. Cultural, institutional and social forces also restrict the realisation of combinations of values in a value system, despite variations caused by different personalities (Rokeach, 1968:161).

Wyer and Albarracín (2005:285) refer to several studies which concluded that people aim for logical consistency among their opinions and beliefs. Insofar as beliefs are not thought of in relation to each other they need not be consistent, but if people are asked to state syllogistically linked beliefs, any inconsistencies there may be becomes apparent. In this case people tend to eliminate or reduce these belief inconsistencies by

changing one or more of the relevant beliefs. Interestingly though, this effect of straightening out inconsistencies was primarily found among those belonging to Western cultures.

Another culturally learned difference regarding belief management is how we focus on the information presented to us. Westerners tend to focus on desirable aspects of events and exclude negative aspects as far as possible. Asians are more inclined to focus on the avoidance of negative facets and consequently do not focus much on desirable aspects (Wyer & Albarracín, 2005:312).

The expression of functions such as emotion, knowledge, perception, and time are affected by culture. Many factors in climate change adaption are also not universal, but rather specific. Different approaches resonate with different communities and cultures.

2.3 Climate change adaptation

Adaptation has large intrapersonal and interpersonal components. In addition, and sometimes as precursor to physical changes, adaptation implies mental change. In this regard it links closely to the study of beliefs.

2.3.1 Definition

Adaptation (in climate change terms) has been defined as 'the process or adjustments through which people reduce the adverse effects of climate on their health and well-being, and take advantage of the opportunities that their climatic environment provides (Eriksen *et al.*, 2011:2). The IPCC defines it as 'the adjustment to practices, processes and systems in order to ameliorate negative effects and take advantage of opportunities associated with climate change' (IPCC, 2007). Two things stand out from these definitions: amelioration and opportunity.

In a special report on climate change adaptation the IPCC (2012:5) distinguishes between adaptation to climate change in human systems and in natural systems. Social system adaptation is 'the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities', and adaptation in environmental systems is 'the process of adjustment to actual climate and its effects', adding 'human intervention may facilitate adjustment to expected climate'.

Hernes (2012:156) notes that the natural system is becoming more and more integrated with the human system as interventions by people impact on nature and natural forces manifest in human society. As an approach to planning, adaptation is concerned with the adjustment of human systems in totality, so as to reset external boundaries in a sustainable way, not only adjusting the problematic mechanisms. Accordingly 'policies, institutions and attitudes that establish enabling conditions' should be targeted first and then infrastructure and technology (Schipper, 2007:6).

For adaptation to be successful according to this approach, flexibility of 'social networks, cultural traditions, and activities that provide food and income' is paramount to prevent perceptible impact on the social system. Vulnerability needs to be addressed and Schipper (2007:6) mentions 'differential access to resources based on gender, age, belief systems or other characteristics, state of environment in which people live, viability of livelihoods in existing economic systems' in the context of climate change. Schipper (2007:6) normatively defines adaptation then as a reduction in vulnerability and the creation of sustainable strategies.

Adaptation according to Ensor and Berger (2009:26) is made up of three approaches namely vulnerability reduction (specified to a particular hazard), resilience strengthening (applied to a wide range of hazards), and adaptive capacity building. Vulnerability to climate change hazards should be seen in a broad environmental and socio-political context. The clarity of available knowledge about hazards determines the blend of resilience strengthening, adaptive capacity building, and vulnerability reduction (Ensor & Berger, 2009:165-166).

O'Brien and Hochachka (2010:2) emphasise that adaptation needs to include 'interior changes' additional to systemic and behavioural changes that reduce the negative impacts of climate change. Authentic personal and cultural changes i.e. 'a changed sense of self' can ultimately position someone as a valuable contributor to society instead of being a passive receiver. Values, beliefs and worldviews are in other words extremely important, as is the capacity to respond to challenges to them.

Aspects of adaptation according to Shaffril *et al.* (2013) include environmental awareness, attitudes and beliefs, local environmental knowledge, attachment to place, formal and informal networks and attachment to occupation. Adaptation is ultimately action, and beliefs are 'predispositions to action' (Rokeach, 1968:113).

Hulme (2011:326) urges ‘to reveal the creative psychological, ethical and spiritual work that climate change is doing for us’. He suggests that if ‘the ways in which climate change connects with foundational human instincts’ is understood, it will ‘open up possibilities for re-situating culture and the human spirit at the heart of our understanding of our changing climate.’

Climate change is a transformative process with location and culture specific outcomes (O’Brien *et al.*, 2007:76). Human security in a climate change context can be achieved when people have the options, the capacity and the freedom to mitigate, end, or adapt to risks posed affecting their social, environmental or human rights (GECHS, 1999). The way climate is defined influences the way climate change is looked at. Hulme (2011:355) advocates for a ‘deeper and more intimate’ understanding.

Climate change adaptation implies adaptation to climate change, but climate change doesn’t hold the same significance or meaning to everybody. Studying people’s perception of hazards in general and climate change in particular will illuminate the concept climate change adaptation.

2.3.2 Perception of hazard

Climate and climate change is an abstract construct that refers to average weather patterns. It cannot be experienced directly (Hulme, 2011:3-4). When people speak about how climate has changed over the course of their life they are most likely rather referring to variations in weather.

That which is considered important and disastrous are not universal (O’Brien *et al.*, 2007:77) and need to be determined for each situation. When the perception of either individual agency of the controllability of an event is low, the result will most likely be inaction (Wolf, 2011:25).

According to (Hulme, 2011:193) the classification of the degree of danger of climate change depends on approach. A bottom-up approach results in an ‘internal’ definition of danger, which entails that the perception or experience of a risk by people is that which makes it real. In contrast, a top-down approach and thus an ‘external’ definition of danger implies scientific risk analysis and experts who decide how serious the situation is. An external definition of risk will be framed in terms of physical and social vulnerability. An internal definition revolves around the perceived and experienced costs

and how to influence lives and livelihoods in a community (Dessai *et al.*, 2004:14). An internal definition is therefore 'ultimately determined by what is valued' (Wolf, 2011:25). Considering vertical relations Ensor and Berger (2009:21-22) note that the upwards flow of information can contribute to an understanding of the local reality and the downwards flow to the transfer of recent pertinent scientific knowledge.

Climate change hazards can be categorised into discrete recurrent, discrete singular, and continuous hazards. Droughts and storms are examples of the first category. For discreet singular hazards they give the example of climatic regime changes related to shifts in ocean circulation. Long-term (several years or decades) changes in average temperature or rainfall counts under continuous or incremental hazards (Ensor & Berger, 2009:13).

The United Nations declared the basic rights of life, liberty, security, mobility, and progeny universal in 1948, but climate change may violate just that (Hulme, 2011:147) and the most vulnerable people are usually those affected first and most severely.

2.3.3 Vulnerability, capacity and resilience

Vulnerability

According to Ensor and Berger (2009:13) strategies for climate change adaptation will depend on our perception of vulnerability, which in turn is underpinned by our understanding of climate change, which is influenced by the generation and dissemination of knowledge. Climate change vulnerability assessment is specific to a particular threat and is concerned with the anthropological and environmental factors of where the vulnerability is defined (Ensor & Berger, 2009:26).

There is two main approaches to vulnerability in the climate change literature: 'end-point' and 'starting-point' (Kelly & Adger, 2000). O'Brien *et al.* (2007) employ this but rename it to outcome vulnerability and contextual vulnerability. The way they interpret it can be seen in figure 4 (O'Brien *et al.*, 2007:75).

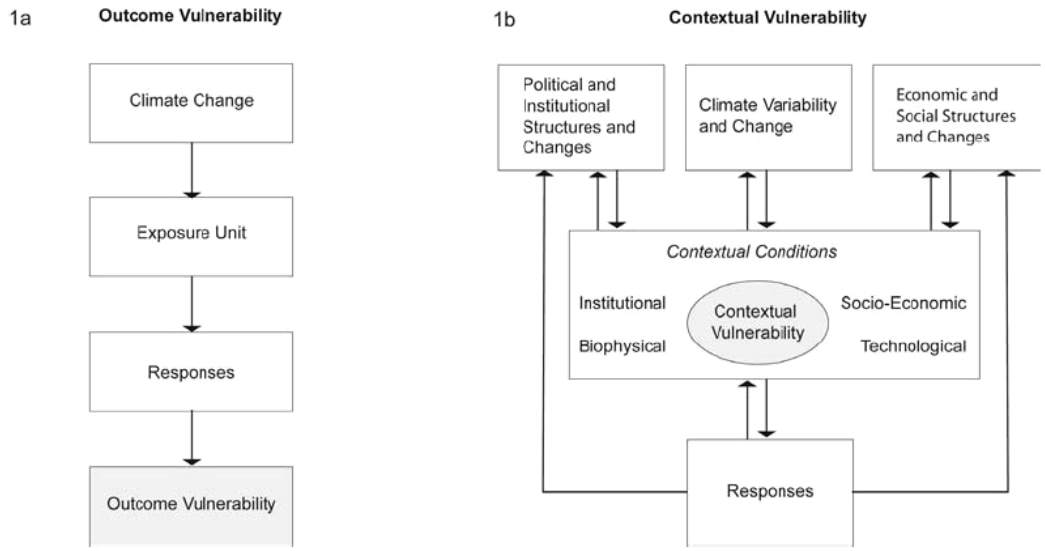

Figure 2.3: Frameworks depicting two interpretations of vulnerability to climate change: (a) outcome vulnerability; (b) contextual vulnerability (O'Brien *et al.*, 2007:75).

Adaptation, within the 'starting-point' approach, is essentially measures to reduce the causes of vulnerability, within the context of the projected threat, while impacts on livelihood are addressed (Ensor & Berger, 2009:16). Biophysical, social, political, environmental, economic and cultural factors need to be taken under consideration.

Vulnerability according to this approach is regarded in the present. It is the incapability to handle external changes or pressures. Vulnerability 'is considered a characteristic of social and ecological systems that is generated by multiple factors and processes' (O'Brien *et al.*, 2007:75). It is about changing the milieu in such a way that people can respond better to conditions of change when climate change is manifested. Further it emphatically includes equity and justice concerns (O'Brien *et al.*, 2007:76).

In outcome or 'end-point' vulnerability 'any residual consequences that remain after adaptation has taken place define the levels of vulnerability' (O'Brien *et al.*, 2007:75). In other words, the impact of the problem is vulnerability, which can be indicated in quantitative terms or qualitatively described in terms of relative change. The IPCC's definition of climate change vulnerability in terms of exposure, sensitivity, and adaptability is an example of outcome vulnerability (IPCC, 2012).

In this study contextual vulnerability is used. Poverty stricken communities have a harder time mediating climate change, because of a lack of resources to rely on in times of environmental strain. They also have little say over policies controlling resources. The rural poor often rely heavily on natural resources and that makes them even more vulnerable (Ensor & Berger, 2009:2). Access to information and services is a further problem. Flow of information, shared cognitions and traditional knowledge and ways of knowing can provide valuable clues regarding vulnerability, and is directly linked to adaptive capacity and resilience.

Non-physical aspects of adaptive capacity and resilience

The ability to respond to climate fluctuation, manipulate change, as well as initiate transformations in the system are all part of what can be referred to as adaptive capacity according to Ensor and Berger (2009:17). Tangible (e.g. biological and monetary resources) and intangible assets (e.g. skills and opportunities) contribute to this capacity, which positively correlates with resilience. Resilience is defined as the 'ability to absorb or cope with the unexpected'. Together, adaptive capacity and resilience lowers vulnerability (Ensor & Berger, 2009:17). According to Anon (34) adaptation is the result of a reduction in vulnerability as a result of the realisation of adaptive capacity.

Traditions, social ties, cultural ceremonies and stories are ways through which people pass their knowledge and abilities on. It is also the way through which adaptation happens – supplying both social support structures and technical solutions (Ensor & Berger, 2009:2-3). A society's inherent adaptive capacity is tied to its ability to act collectively (Anon:35) and adaptive capacity is highly varied between regions (Wolf, 2011:22).

Discourses on fear of climate change is created culturally (Hulme, 2011:68). Perception of climate change impact influences adaptive capacity (Wolf, 2011:22). Similarly perception of opportunities influences the interpretation of adaptation. Information control and motivation of stakeholders can increase the visibility of opportunities (Ensor & Berger, 2009:24). Access to information, the capacity to learn, and ultimately the ability to innovate in order to respond to and shape changes, build adaptive capacity (Ensor & Berger, 2009:26).

Improving literacy is a step in the direction of improving access to information. Education, in general, develops skills such as decision making, leadership, and interpretation of information. This is important because information is also mediated by social networks (Ensor & Berger, 2009:27). Resilience can be improved when communities are involved in decision making and they have the opportunity to engage with authority (Ensor & Berger, 2009:23). Generating context-specific information can add value to a bottom-up definition of the perceived problem (Hulme, 2011:193).

Policy is a mediating factor in knowledge production and dissemination. Through policy, network infrastructure can be made provision for, the distribution of assets regulated and protection given against non-state actors. If managed correctly it will be a two-way route of communication, with communities having a say in different aspects of policy (Ensor & Berger, 2009:28).

2.3.4 Adaptation on the community level

Social capital is made up of relationships, agreements and networks between social groups and its individuals (Anon:35). Adger (2003:392) divides it into bonding and networking capital; the first points to camaraderie and kinship, the latter to relationships between people who share interests but not necessarily backgrounds.

Knowledge and social networks are key players in community level adaptation, and social networks hold several components of adaptation together (Ensor & Berger, 2009:27). Trust and reciprocity are emphasised as the building blocks of networking capital and relationships are conduits for the exchange of material and non-material resources (Adger, 2003:392). It is the medium in which counsel is passed around and the breeding ground for learning and altering stratagems. Understanding climate change, communicating individual and community needs, establishing a platform for 'experienced-based' knowledge, and ascertaining the significance of scientific information all happen within these networks and are used as a key base for decision-making, in preference to 'analytically-based reasoning' (Ensor & Berger, 2009:19, 22).

Social networks, along with socioeconomic characteristics, local knowledge, and non-climatic pressures are mentioned by Wolf (2011:23) as having a core share in the shaping of adaptation measures. A certain network of relations and interactions establish a specific distribution of resources, power and information that adaptive

capacity and resilience depends on. With several stakeholders involved, the nature of this set of social connections is important, because they form economic, social and political structures that will define (encourage or inhibit) the actions of individuals or groups (Ensor & Berger, 2009:21).

One event can cause different attitudes from related fields to shift. Hernes (2012) describes it as a 'collective conversion' because people also respond to each other's reactions. An abrupt realisation or reminder of the dangers of pollution through a specific event can lead to a broader awareness of the negative influence of industrialisation on the environment for example. Scientific interpretation of an event and the communication of these interpretations are important tools for the public to understand and integrate new knowledge. These 'shared accounts' will lead to a change in mindset over time, and a confluence of these explanations will lead to a cohesive plot (Hernes, 2012:96-116).

There is still a very limited understanding of how climate change motivates adaptation, because of a lack of knowledge on what different cultures deem as dangerous (Wolf, 2011:25). Knowledge production (including what is excluded) is influenced by the conceptualisation of a problem. Discourses that shape the conceptualisation is bound to the researcher, their institution, their discipline (O'Brien *et al.*, 2007:76) as well as outside factors such as stakeholders with pecuniary interests. Tapping into indigenous knowledge can be a key to unlock some answers in the link between climate change adaptation and motivation.

2.3.5 Indigenous knowledge

Perceptions, beliefs, traditions and cultural identity all play a role in shaping responses to risk. According to (O'Brien & Wolf, 2010) a values-based approach highlights these. A values-based/belief system approach invites community decision making to adaptation and can prove that cultural factors can be a limit to adaptation (Adger et al., 2008). These subjective limits can be identified by finding out what a culture values (Adger et al., 2009).

Traditional ecological knowledge had been almost newly discovered in the 1980s, as for the first time it substantially 'enchanted' scientific ecological thinking, which came from a tradition with a 'static, mechanical, disembodied' worldview that can be traced back to

the Enlightenment era (Berkes, 1999:3-4). Earlier, anthropologists had given a lot of attention to the study of folk taxonomies in ethno-science, but many experts from different scientific areas now come to recognise the value of indigenous knowledge in contemporary science (Berkes, 1999:4).

Indigenous resource management systems should be seen as 'adaptive responses that have evolved over time' (Berkes, 1999:159). Adger *et al.* (2009:315, 321) advises to particularly pay attention to indigenous assessment of value and power dynamics when making decisions regarding adaptation.

A *knowledge-practice-belief complex* describes the multi-levelness of indigenous/traditional knowledge. Berkes (1999:13-14) distinguishes between four interrelated levels. Represented as concentric circles, the innermost circle represents knowledge that is based on empirical observation and motivated by survival instincts - local knowledge on plants, animals, landscape and soil. The second circle relates to systems of resource management that includes local knowledge (core circle), but also methods, procedures and devices of interrelations. On the third level social institutions govern how practices are coordinated and ensure smooth cooperation between different people(s) through social rules and codes. The worldview is the all-encompassing fourth circle, it 'shapes environmental perception and gives meaning to observations of the environment' (Berkes, 1999:14). It includes ethics, religion and belief-systems in general.

The interrelation between these levels is illustrative of a more holistic, organic and collectivistic approach. Holders of traditional worldviews may therefore prioritise adaptation strategies that stress group identity and the need to belong, that sustain traditional sources of revenue, acknowledge local knowledge and safeguard cultural identity (Adger *et al*., 2009).

So far, it has been made clear that adaptation happens from within a community, but as was mentioned earlier, adaptation is also facilitated from the outside. Policy and institutional structures can be shaped to increase adaptation in sustainable ways. Decision-making in this regard should ideally be guided by context specific information.

2.3.6 Practice/Action

Adaptation approaches are context specific and Ensor and Berger (2009:28) proposes a two-dimensional model representing the 'adaptive space' to aid in decision making. 'Vulnerability to the hazard' is plotted against 'state of knowledge related to the given climate hazard'. This last axis includes the existence, precision, and trustworthiness of available knowledge as well as the degree of uncertainty attached to it.

When both clarity and vulnerability is high there should be a focus on vulnerability reduction. When clarity is high, but vulnerability low, development activities should receive priority. In the space between, adaptive capacity and resilience building should receive the most attention (Ensor & Berger, 2009:30).

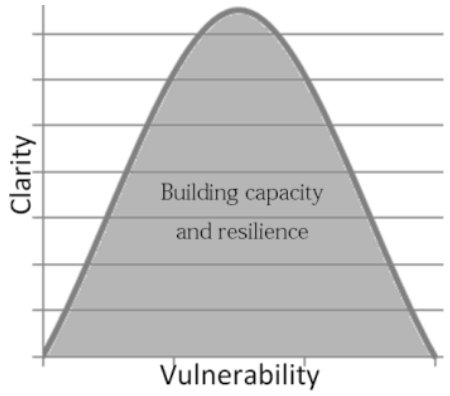

Figure 2.4: The adaptation space (Ensor & Berger, 2009:30)

The adaptation space illustrates strategies for moderating harm, but seizing opportunities (IPCC, 2007; Eriksen *et al.*, 2011:2) should not be treated as the lesser half of adaptation. Indicators of culture (social forms) are things like shared beliefs, collectively held metaphors, and folklore (Ensor & Berger, 2009:33). They are helpful in identifying viable opportunities, as the options for adaptation are limited by that which resonates with a culture.

Eriksen *et al.* (2011:1) emphasise the need for adaptation that is also sustainable. Sustainable strategies include measures that need to be taken to ensure 'social justice and environmental integrity'. A deep-seated societal change is necessary. He identifies four normative principles: (1) vulnerability needs to be seen in its wider context, (2) the fact that 'differing values and interests affect adaptation outcomes' needs to be

recognised, (3) local knowledge should be integrated into adaptation responses, and (4) ‘potential feedbacks between local and global processes’ should be considered (Eriksen *et al.*, 2011:1).

2.4 Conclusion

As adaptation to climate change necessitates changes in livelihoods and lifestyle, ‘existing notions of culture may be challenged’ (Ensor & Berger, 2009:33). It will probably not be an easy linear route, but rather cause dramatic changes in behaviour, culture, experience, and systems. Climate change adaptation will likely also include changing beliefs and even worldviews (O'Brien & Hochachka, 2010) and as Hernes (2012:116) so aptly reminds us: ‘a change in outlook is investing in a new identity and sociality’.

Well-being is linked to culture because of a shared sense of what is important, and choices are made in the context of culture. However, the reason and manner in which change surfaces determine the nature of response. If changes are prepared for and accommodated from within they are less likely to be taken as a threat to be resisted (Ensor & Berger, 2009:33). It is here where belief systems and climate change adaptation meet.

The next chapter consists of an article, prepared for scholarly publication, that presents findings about challenges to and by belief systems in terms of climate change adaptation.

Chapter 3 Academic article

Challenges to belief systems in the context of climate change adaptation

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This paper focuses on the social aspects of climate change and explores the interrelationship between belief systems and adaptation. The links and interaction between external and internal realities is examined from the perspective of contextual vulnerability, with a focus on the multifaceted structure of belief systems. Diverse perceptions of climate change and beliefs from three townships in the North West province of South Africa were collected and analysed using Q-methodology, finding five distinct worldview narratives. These narratives were named: naturalist/collectivist, religious, religious determinist, activist/collectivist, and government/structural thinker.

Key words: climate change adaptation, belief systems, Q-methodology, vulnerability

Introduction

As people's realities often reside within the walls of their own experience, adaptation to external stimuli is buffered. Perception is coloured by filters such as beliefs and therefore in order to study responses to environmental change, the study of internal processes is very helpful. Discourses on belief systems and climate change adaptation are prompted by the discrepancy between scientific data and public perception on climate change (Weingart *et al.*, 2000; Boykoff & Boykoff, 2004; Antilla, 2005; Boykoff & Boykoff, 2007b; Boykoff & Boykoff, 2007a; Poortinga *et al.*, 2011; Ohwo, 2015) .

Climate change is very much a physical reality, with scientific measurements taken of a myriad subcomponents of the phenomenon, but the mental construct of climate change is not the physical reality. The construct 'climate change' as a social phenomenon can be framed according

to diverse ideological perspectives (Hulme, 2011:xxvi). Transdisciplinary, holistic research has been encouraged to better understand the anthropological bearing of climate change (Pendergraft, 1998:645; Schipper, 2007:9; McNeeley & Lazrus, 2014:509). Hernes (2012:89-89) argues that climate change is but one of a convergence of crises that include political, social and environmental dilemmas and that these dilemmas should be looked at simultaneously to avoid an impending disaster. The eco revolution accompanying the climate movement can for example also be viewed as a peace movement to prevent resource wars, recognising our 'addiction', or conditioning, to fossil fuels. Climate change is also intertwined with urgent short term concerns such as water shortages and sharply rising food prices (Kings & Wild, 2015).

Looking at climate change in this way illuminates the connections between climate change adaptation and belief systems. One component of adaptation is the changing of beliefs and the reorganisation of belief systems. The pressure that climate change and belief systems exert on each other is noteworthy in this regard, however, there are more linkages. For example, regulating adaptive policy in such a manner as to take context specific perceptions (shaped by belief systems) into account. Clearly belief systems and climate change adaptation are interrelated. Laying these interrelations bare can provide valuable guidance for the adaptation process and therefore it is fitting to investigate these two concepts more closely.

The structure and function of belief systems

Climate change presents humanity with a multi-factored challenge, therefore internal subjective components of crises, such as beliefs, should be studied in concert with objective research and active engagement in climate change (O'Brien & Hochachka, 2010:3-4). This is likely to determine the buy-in of an idea. It is also true that beliefs can only be addressed effectively when they are understood well (O'Brien & Wolf, 2010:237). In order to understand specific beliefs, it is necessary to first study what beliefs are, how they work, and under which circumstances they change.

A belief has three components that, if held consciously, a person strives to keep more or less in harmony: the cognitive, the affective and the behavioural (Rokeach, 1968:113-114). Not all beliefs have equal impact on human beings and different authors have visualised networks of beliefs in different ways. This architecture of beliefs offers explanations of how and why changes in beliefs occur and also why, in the face of overwhelming evidence, they sometimes don't.

Wolterstorff (1976:11-16) divides beliefs into three categories based on their origin and function. Lying at the centre of a belief system and regulating the organisation of more peripheral beliefs, control beliefs represent a person's authentic commitment. Data background beliefs are those beliefs held about devising theory and data beliefs are the theory itself. Loubser (2013a:13) looks at the organisation of beliefs and distinguishes between pre-theoretical, theoretical, and combination structures. An example of a structure that is both theoretical and pre-theoretical is a paradigm. According to Rokeach (1968:124), pre-theoretical structures can be held either consciously or subconsciously. Control beliefs and data background beliefs both fall into this category, while data beliefs are theoretical (and conscious).

Not all beliefs are equally important (Wyer & Albarracín, 2005:276). The most central and therefore connected beliefs are axiomatic and derive directly from object encounters; these are also the minimum guarantee for stability and include basic beliefs such as person, object and self-constancy (Rokeach, 1968:7). Connectedness and importance or centrality of beliefs are correlated, although both intensity and verifiability stand independent of centrality (Rokeach, 1968:5,13). Shared beliefs (beliefs held by many others as well) and existential beliefs are central, and so are beliefs that spring from direct experience (Rokeach, 1968:6). Non-primitive beliefs are distinguished from primitive ones as those that differentiate as one matures to round out one's world picture 'realistically and rationally to the extent possible, defensively and irrationally to the extent necessary' (Rokeach, 1968:9). Rokeach also identifies authority beliefs,

which are beliefs about positive referents that a person trusts to have the correct information. These beliefs are determined by social structure, education and experiences, and also include negative referents, which are seen as having incorrect information.

Knowledge beliefs are organised via concepts into conceptual systems (Thagard, 1992:20-21). According to Hernes (2012:113) if one belief changes, it can cause a rearrangement of the whole network, because constructs of causal relations are logically linked, while Rokeach (1968:2-3) warns that these connections are not necessarily logical. Inconsistencies sometimes only become apparent with the realization that a new belief causes a logical contradiction, or when there is no specific compartment for a new belief (Rokeach, 1968:117-118). In this case either the belief, view or commitment will be revised (Wolterstorff, 1976:88). Unnoticed inconsistencies within a belief system can be explained by either compartmentalisation or 'an uncritical internalization of contradictory values and attitudes' (Rokeach, 1968:167-168). Consistency is most important within our self-esteem framework and only then according to logic and reality (Rokeach, 1968:164).

Beliefs are created for a purpose and therefore have motivational roots (Wyer & Albarracín, 2005:306). If an emotional charge accompanies a belief it will be used often and more easily (Marsh & Wallace, 2005:11). We tend to follow the path of least resistance in these very dynamic frameworks and an emotion-induced rejection of best explanation (Thagard & Findlay, 2010:342) can be this easier route. One is also prone to infer certain propositions according to a completion principle (Wyer & Albarracín, 2005:287), as uncertainty is unfavourable in a coherent framework.

If new information causes the coherence of the belief system to increase, you will be likely to change a pre-existing belief (Thagard & Findlay, 2010:333). Changes usually entail content, but it can also refer to an organisational change only. An example of this would be a shift from a literal to a figurative perspective (Rokeach, 1968:135). Thagard and Findlay (2010:336) refer to

a Gestalt switch or a tipping point for change. With climate change, it is sometimes a slow process. Weather patterns are observed casually over time and gradually, but with a specific moment of realisation, change is recognised (Hernes, 2012:114).

Beliefs are built on values according to Thagard and Findlay (2010:331), who explain global warming critics' trust in the free market, property rights, and technology to encourage environmental responsibility and solve global warming on their underlying values of liberty, economic stability, and technology. Values are cognitive constructs that lie at the core of our conscious beliefs (O'Brien & Wolf, 2010:3) and are decisive factors in designating causality (Rokeach, 1979:2). Values are abstract and idealistic. A hierarchical organisation of values are learned and acts as a guide in conflicts between different end-state existences or modes of behaviour (Rokeach, 1968:124,161; Rokeach, 1979:2). They form a unifying structure for beliefs by maintaining attitudes, guiding actions and moral judgments, and justifying oneself and others' behaviour throughout different situations (Rokeach, 1968:160). It is a prejudgment and sometimes emotionally charged, which explains why evidence might not be sufficient for change (Rokeach, 1968:131). In these terms, values can be equated to Wolterstorff's authentic commitment: a person's authentic commitment or control beliefs are the guide by which all new information is structured and it gives meaning to information. A worldview can be said to have the same function, as it categorises the world and relationships in it (Loubser, 2013a:16).

The reason that a value is such a dynamic concept is because of its motivational element (in addition to the cognitive, affective, and behavioural elements that a belief and an attitude also share) (Rokeach, 1968:158). Attitudes are intertwined subsystems that operate as a relatively stable framework to organise underlying beliefs around an event, a context or an object, with the function of helping one manage by easing one's decisions (similar to values, it can act as prejudgment). In this way coherent cognitive frameworks develop (Marsh & Wallace, 2005:8).

An attitude becomes more prevalent when more values anchor it, and determine the nature and scope of behaviour accordingly.

Kuhn (1962:122) noted that one's perception and interpretation are biased in favour of one's current beliefs[14] and Lorenzoni and Hulme (2009:383) stated that interaction with an object or situation is largely determined by beliefs about it. Regarding climate change: the fundamental view one has about nature and society, including social interactions, help determine one's risk perception of it (McNeeley & Lazrus, 2014:506). Foundational beliefs about the relationship between God, humankind and nature influence both perceptions of climate change and the categories for solutions, because it affects who we blame. It affects how we value ecosystems, nature and human dignity and how we judge humanity's purpose and destiny (Hulme, 2011:144-146).

The relevance of perception to adaptation extends to every aspect of its definition, including risk perception, perception of vulnerability, and perception of capacity. Perception is an important link between beliefs and adaptation.

Climate change adaptation

Climate change adaptation in social systems is defined by the IPCC (2012:5) as 'the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities'. Eriksen *et al.* (2011:2) define climate change adaptation as reducing climate's adverse effects on well-being and health, while seizing opportunities from the climatic environment. The amelioration of negative consequences together with the utilisation of opportunities seems to saturate most definitions of adaptation. Adjustment includes systemic, behavioural, as well as internal cultural and personal changes (O'Brien & Hochachka, 2010:2).

[14] Kuhn discusses beliefs in terms of paradigms. In the sense referred to here a paradigm can be defined as a communal belief system with shared obligations to values and other symbolic generalisations.

Change can be threatening and unless it is internally accommodated and prepared for, it may very well be resisted (Ensor & Berger, 2009:33).

Adaptation can be viewed from two perspectives that should ideally line up in the end and complement each other. Autonomous adaptation is the natural process of responding to change from within a community. On the other end of the spectrum is purposeful adaptation; which is policy, regulations, and other ways of control external to the community. There is a very important flow of information between the community and the government in this regard. An upwards flow contributes to a local map of reality and a downwards flow conveys relevant scientific discoveries (Ensor & Berger, 2009:21-22). For the public to understand new knowledge and integrate it into their framework of reality, science needs to be interpreted and communicated. In this way a shared account is created that leads to a shift in mentality, which will be strengthened into a unified narrative if different accounts converge over time (Hernes, 2012:96-116).

Knowledge is an important part of adaptive capacity, which is studied as part of the process of adaptation (in other words autonomous adaptation). The capacity to adapt encompasses many different abilities, resources, processes, practices, and systems, and is countered by vulnerability. Vulnerability and adaptation are inversely related and therefore vulnerability is an essential latent component of adaptation (Schipper, 2007:3). The way in which vulnerability is defined influences the way that adaptation is perceived within the context of study. For this reason the use of vulnerability within the current study is delineated below.

The United Nation's International Strategy for Disaster Reduction (UNISDR) defines vulnerability as 'conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards' (Birkman, 2006:12). Psychological factors are arguably included under social factors, but intentionality is missing from this definition (Wisner, 2015). Wisner (2004:11) propose

‘characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard’. This definition shifts the focus to non-physical attributes. O'Brien and Wolf (2010:232) stress that vulnerability is determined in large part by how changes are appraised. Birkmann (2013:39) puts vulnerability as internal risk factor at the core of a widening concept of vulnerability, increasing in scale and complexity. At the core it is strategically positioned to cause a ripple effect. Of course both internal and external aspects are relevant, but it does appear that internal aspects are neglected in official definitions.

Kelly and Adger (2000:327), O'Brien *et al.* (2004:2) and Ensor and Berger (2009:14) recommend using a contextual definition of vulnerability, viewing vulnerability from a starting-point approach, rather than from a possible outcome. It is a definition that takes into account a community’s current situation and aims to understand established practices within a community, taking into consideration the interaction of social, political, economic, and environmental processes. In this study vulnerability is considered contextually with an emphasis on intrinsic vulnerability. With this definition in mind adaptive capacity can now be considered in more detail.

According to the IPCC, adaptive capacity is ‘the ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences’ (IPCC, 2014:1758). Importantly, adjustment includes overcoming challenges to standing beliefs and worldviews (O'Brien & Hochachka, 2010:90).

The International Union for Conservation of Nature (IUCN) created a list of characteristics for individual and community adaptive capacity. On the individual level this includes risk perception, coping ability, interest to change oneself, capability to reorganise, learn and plan, environmental knowledge and awareness (including beliefs and attitudes), equity perception in resource access, attachment to place and occupation, formal and informal networks, family features, employability, financial situation (including access to credit and diversity of income),

and access to information about climate change (including skills development and technology) (Marshall *et al.*, 2010:12-15). On a community level adaptive capacity is made up of the ability to learn, experiment and reorganise, community assets (including social and human capital), flexibility, gender relations, social norms and environmental institutions, the presence of corruption, and markets (Marshall *et al.*, 2010:16-18).

Availability of knowledge is an important aspect which has already been touched upon, and that has to be addressed from a policy level. Willingness to learn depends on the flexibility of a belief system. Functional and structural aspect of individual and communal belief systems are indeed intertwined with many aspects of adaptive capacity. For the purposes of this study, risk perception, social capital, and indigenous knowledge will be considered in more detail.

Natural adaptive responses have developed in the form of indigenous resource management (Berkes, 1999:159), but as environmental changes become more pronounced, humankind's relationship with their environs evolve (O'Brien & Wolf, 2010:233-234,237). Accumulated indigenous knowledge is fast becoming obsolete, or at the very least vastly insufficient, in this fast changing landscape. Paired with an ever increasing population growth, additional problems such as loss of biodiversity only confirms the bleakness of the situation (Ensor & Berger, 2009:3).

Although climate change is an abstract concept, manifestations such as erratic weather patterns and frequent record high temperatures (Kings, 2015) are categorically observed all over the world (Turner & Clifton, 2009; Piccolella, 2013). Flexibility of human systems such as social networks, livelihoods, and cultural traditions are instrumental in mitigating impact and promoting successful adaptation (Schipper, 2007:6). In traditional worldviews, cultural identity is often important. From a policy level perspective, the local assessment of power dynamics and value in decision making is especially important when considering new adaptation strategies (Adger *et al.*, 2009:315, 321).

Danger can be defined internally from a bottom-up approach and is then made real by the people's perception, in contrast to an external scientific valuation (Hulme, 2011:193). In this manner risk perception happens within a social network. If it differs from the external valuation, a gap in communication can be identified. Perception of capacity is pivotal for action. Wolf (2011:25) warns about inaction when either the perception of individual agency or controllability is low.

Adger (2003:392), focusing on the community asset, social capital, divides it into bonding capital, pointing to kinship and camaraderie, and networking capital. It is this latter type that is of special importance in adaptation and it points to relationships based on shared interests, without necessarily shared backgrounds. Mutuality and commitment builds up relationships that act as channels through which material and non-material resources are exchanged. In terms of bonding capital, to change one's beliefs may sometimes mean investing in a new intercommunity and identity (Hernes, 2012:116). People also react to each other's responses leading to a possible 'collective conversion'. An event can for example cause a broader awareness of an issue and lead to the change of diverse attitudes from associated areas (Hernes, 2012).

Within contextual vulnerability, adaptation means taking measures against the causes of vulnerability surrounding the anticipated disaster and negative impact on livelihoods (Ensor & Berger, 2009:16). Vulnerability is engendered by a variety of processes and factors within a social or ecological system (O'Brien *et al.*, 2007:75). Justice and equity should be paramount in the process of empowering people to respond better to change by altering their situation or surroundings (O'Brien *et al.*, 2007:76).

Within developing countries, added pressure from climate change can stall development by shifting the focus from sustainable development to adaptation. Schipper (2007:10) advocates for an adaption to climate change that is 'a paradigm for development, where adaptation is fostered by a process of sustainable development and vulnerability reduction, rather than through explicit

adaptation policies (Schipper, 2007:3). Policy mediates both knowledge production and distribution: asset distribution can be regulated, protection to non-state actors can be granted and network infrastructure can be provided. Ideally it is a two-way route, where communities' voices will be heard in policy formation (Ensor & Berger, 2009:28).

A lack of access to resources and very little say in policies that control these resources, cause poor communities to struggle with mediating climate change (Ensor & Berger, 2009:2). Mediation is however also influenced by the perception of opportunities and impact, which are influenced by information management, capacity to learn and motivated stakeholders (Ensor & Berger, 2009:24; Wolf, 2011:11). Building adaptive capacity should ideally lead to innovation in responding to and shaping changes (Ensor & Berger, 2009:26).

Human interventions have increasing influence on nature's impact on human society which leads to a denser integration of human and natural systems (Hernes, 2012:156). External boundaries of the human system need to be reset in a sustainable and holistic manner, broadening the focus to more than immediate quandaries, targeting 'policies, institutions and attitudes that establish enabling conditions' before turning to technology and infrastructure (Schipper, 2007:6).

Perceptions of climate and beliefs

Keeping this idea of fairness and justice in mind when intervening from the outside, the inner workings of autonomous adaptation as specifically influenced by belief systems should be studied to contextualise policy. The above background and conceptualisation indicates that adaptation can be hampered by belief systems, but does not make clear exactly how this happens. An empirical study of how climate change challenges beliefs, and in turn how belief systems challenge climate change adaptation, gives insight into this process.

Beliefs about the self, the climate and humankind's relationship to the environment can be studied by means of Q-methodology, since it is particularly suited for studying subjectivity

(Meier, 2004). It is a Gestalt procedure that indicates a social construction of sorts, where the focus falls on a specific arrangements of themes (and in this case beliefs) favoured by a group of participants (Watts & Stenner, 2005:70-71).

Perceptions of participants from three rural communities in the North West were sampled. This province is an important agricultural region, but plagued by droughts. Thirty (30) participants from each site were randomly selected and contacted with the help of a community gatekeeper. These communities are poor, with most participants living in housing structures in informal settlements that do not provide adequate protection against the natural elements. On top of that informal settlements are often built in exposed areas (Griffin, 2012).

The government of South Africa considers climate change as 'one of the greatest threats to sustainable development' and the effects of climate change are disproportionately felt by the poor (DEA 2011:9). Population growth, being situated in an increasingly water scarce area, social and economic problems and continuously changing water-management priorities and structures, all add pressure to an already dire situation (Dennis & Dennis, 2012:417).

Qualitative data was captured through semi-structured interviews consisting of two basic questions: 'What do you think about the climate?' and 'Do you think your beliefs about the climate can change?' Q-methodology was then used as a quantitative tool to analyse this data. From the concourse, forty (40) statements were identified from the interviews for use as the Q-sample. These statements had to be "broadly representative" (Watts & Stenner, 2005:75), but also condensed in format. The concourse is a representative collection of statements covering all possible opinions about the chosen subject that the respondents might have (Van Exel & De Graaf, 2005:4), Brown (1993) describes it as 'the flow of communicability surrounding any topic'.

In phase two, 15 of the original respondents were randomly selected to do a Q-sort according to a free distribution grid. The grid was arranged in a Likert scale with seven options, ranging from -3 (strongly disagree) to +3 (strongly agree), with 0 as neutral. For the Q-sorting in phase three, less participants (this time seven or eight per site) were used. They had to rank each item 'in a fixed quasi-normal distribution' and 'along a simple, face-valid dimension' (Watts & Stenner, 2005:77). As Van Exel and De Graaf (2005:7) recommend, an interview was done after each Q-sort.

When it comes to the interpretation, there are different perspectives on the data-set (Watts & Stenner, 2005:81). Things like setting up the final Q-set and interpretation of the factors can almost be seen as an art, but the analysis of data is technical and objective. It consists of the following five stages: creating the correlation matrix, factor analysis, determining factor loadings for each Q sort, factor rotation and finally the calculation of factor scores and difference scores (Van Exel & De Graaf, 2005:8-9). The factor score leads to a composite or idealised Q-sort for each factor. The Difference scores leads to the identification of distinguishing statements. The factors, which are interpreted into summarizing accounts, represent operant clusters of subjectivity (Van Exel & De Graaf, 2005:1) and in this way people, not tests, are correlated.

No single story exists, therefore inconsistency and complexity should not surprise (Previte *et al.*, 2007:142). The benefits Q-methodology according to Billard (1999:365) is its use of reflexivity, raising consciousness, empowering the participants and the creation of 'locally situated understandings'. These effects were observed and strengthened by hosting a small workshop on climate change after the phase three of the project which involved the Q-sorting interviews.

Results of the Q sort: the five factors

The five factors (see below) that emerged from the Q sort explain 58 per cent of the sample's variance. The first factor is the most prevalent, with a 20 per cent contribution, followed by 12

per cent from factor 2, 10 per cent from both factors 3 and 4, and 6 per cent from factor 5. Four defining sorts were flagged for factor 1 and 2 each, two for factor 3 and 4 and one for factor 5. Factor 1 and 4's sorts have the closest correlation in terms of factor scores. All the sorts fit multilaterally and indicate that no participants fit purely into any one factor.

Here follows a summary of each factor, using significant statements from the sorts to create a short narrative. Each factor was named according to the unifying theme that explains the factor's array best as per the author's interpretation.

Factor 1 Naturalist/collectivist

Climate change is nature's way of reshaping itself. It's part of our daily life and influences us emotionally as well our environment via the growth of crops and production of food. The problems caused by climate change should be addressed now to prevent future disaster. We can do it by coming together and discussing it.

I feel strongly that climate change is not a punishment for our sins, nor is it caused by traditional healers or the fighting of the ancestors. Educating people will not cause bad luck or anger the ancestors.

Factor 2 Religious (contradictory in terms of human agency)

God is in control of everything and he created the climate (it is not affected by traditional healers or fighting of the ancestors). There's nothing wrong with the climate, it is natural and unpredictable. Our behaviour has no influence on it, but we have to respect the environment. It was better in the older days and returning to those ways (living closer to nature and others) might improve the situation. At the same time: I do believe technology can have an influence. I also strongly believe that young people can teach older people about the climate. I am open to change my beliefs and learn more.

Factor 3 Religious determinist

God is in control of the climate, but we as humans have a big influence on it: fossil fuels and pollution is related to climate change. It is a problem, because climate influences our crops and food production- it plays an important role in our lives.

The climate was better when I was younger and the next generation will have it even worse than we do today if we don't do something about it now – it is not the government's responsibility. To change beliefs is difficult. I am convinced of my beliefs and the only way that I will change it, is if I see proof to the contrary. Climate change may be a sign that the world is ending, but maybe we can fight it with technology.

Factor 4 Activist/collectivist (technology/human)

The climate is definitely changing and it is because of the burning of fossil fuels and pollution, we ought to switch to sustainable technologies. Everybody has the right to know about these issues. We should stand together and unite. It is people who just want to make money that harm the environment. Climate change is not a sign that the world is ending and population growth doesn't affect it.

Factor 5 Government/structural (contradictory in terms of time)

I'm open to change my beliefs; we learn new things all the time. We have to find solutions to climate change, because the climate plays an important role in our lives: laws to protect the environment should be drafted and the government must give people information about climate change. The next generation won't be influenced by our behaviour today. It will not help to return to the ways of the past, young people can rather help older people to catch up on knowledge regarding climate change. Because of their beliefs, it might be difficult to educate some people. The climate is complicated and unpredictable. It's possible that traditional healers can cause climate change.

Additionally looking at selected statements in isolation, can shed further light on the functioning of belief systems in this context. The statements that specifically relate to the participants' perceptions of belief-revision have been included in table 3-1, and will be discussed below.

Table 3-1: Q-sort values for statements about belief-revision.

Nr.	Statement	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
33	It is difficult to educate people about climate change because of their beliefs.	0	-1	0	-2	2
34	It is possible to change my beliefs when someone else tells me to.	-1	-2	-2	0	-2
35	In order to change our beliefs about the climate, we must sit down and discuss the matter.	2	1	1	1	1
36	My beliefs can change if I see in reality that things are different from what I believe.	2	2	2	0	2
37	My beliefs about the climate can change when I feel less vulnerable.	0	0	-2	0	0
38	I am open to change my beliefs, because I learn new things all the time.	1	2	0	0	3
39	It is not possible to change my beliefs.	-1	-1	1	0	-2
40	The climate influences how people feel emotionally and that may cause changes in their beliefs.	1	0	-1	-1	0

These statements don't offer polarising views, with the exception of statement 38 for factor 5. A reason for the lack of polarising viewpoints might be because personal beliefs are not often considered consciously and therefore are not available for critical analysis. For this reason it is somewhat abstracted and it is practically not engaged with. In communities that traditionally have a more concrete worldview, this might mean that abstractions are not prioritized. Four out of the eight statements about the participants' views about beliefs rank in the eight most agreed upon statements, which indicate that people tend to hold similar neutral views about their way of believing.

Another way to study beliefs is to look at concrete examples thereof. By selectively studying statements concerning the cause of climate change, time orientation, solutions to climate change

(also indicative of beliefs about human agency and opportunities), and meta-beliefs (the participants' perceptions of beliefs), specific patterns of belief can be observed. The first factor strongly defines what climate change is not causally attributed to: traditional healers, fighting of the ancestors, and punishment for people's sins; although it shies away from pinpointing what the cause might be. Participants whose sorts load high on this factor seem to be fairly conscious of the whole spectrum of time (past, present, and future), but emphasise the now in terms of action. They feel strongly that solutions need to involve the community as a collective, and this collectivism is also manifest in their statements on beliefs. It is only as a group, and by seeing that reality is different from what they believe, that they expect their beliefs to change.

Participants from factor 2 ranked factors about cause and beliefs most strongly. God is seen as the primary cause of climate change, with technology playing a secondary role, and they feel that beliefs can be changed through education. Participants seem to be slightly past oriented and perceive that returning to ways of the past will be the best solution for climate change.

According to Q-sorts representing factor 3, God, as well as fossil fuels and pollution are the definite causes of climate change. This factor reveals a broad consciousness of time with high rankings in statements implying past, present, and future time conceptions. Statements that can be categorized under *possible solutions* and *the impact of human agency* ranked neutral. Factor 3 participants are seemingly closed to changing their beliefs, except if the reality clearly proves them wrong.

The fourth factor displays a strong regard for technology, pollution and fossil fuels as causes of climate change. The participants in this factor feel strongly about collective action in the present and recommend the use of sustainable technology. Their time orientation is focused on the here and now. Rankings on belief statements are prevalently neutral, but indicate an awareness that it can be difficult to change. In correspondence with their concrete attitude and collectivist approach, personal belief statements are all ranked at zero, while statements including elements

of action (for example educate and discuss) and referring to groups of people, are more decidedly ranked.

Factor 5 participants see climate change as either natural, or possibly caused by traditional healers. They have a future time orientation (although their agreement with the statement 'the next generation will not be influenced by our current behaviour towards nature' is contradictive) and feel strongly about finding solutions to climate change problems. Beliefs were ranked decisively, especially in comparison to the rankings made by other factors in this regard. This can be indicative of a deeper structural consciousness, which would correspond with their beliefs about government. The government is seen to be responsible for climate change intervention by drafting laws to protect the environment. These participants are very open to changes in their own beliefs, although they regard others' beliefs as more set.

Perceptions of cause and risk

Qualitative analysis from the interviews will add further depth to the Q sort results. Beliefs regarding cause are linked to perceptions of controllability, which is related to action, and for this reason important for adaptation. For instance, participant 01-SS-Ventersdorp[15] illustrates how a high perception of controllability translates into belief flexibility, when he says *'if they say yes, there is a solution for you to go and change the tsunami, I would…I would change what I know about tsunami, I would go and try to change it'*. Participant 01-BJ-Ventersdorp states that the time that his *'perceptions towards heat and everything can change'* will be when there are *'mechanisms in place' that 'protect us against the climate change'*.

The majority of people linked pollution and industrialization to climate change, but not necessarily in a logical or linear (causal) fashion. For example respondents would mention the air that they breathe being polluted, leading to sickness, leading to climate change.

[15] The qualitative data from the interviews was coded according to the number of the interview, the interviewer's initials, and the name of the community.

Participant 06-KM-Ventersorp talks about open rubbish dumps in residential areas and how they cause odours which is bad for our health and the climate. For her it is a sign that people no longer respect each other or the environment. Many participants mention the ozone layer as well, linking global warming to too much sun that enters. Overall it seems that climate change is part of a bigger, more inclusive concept pertaining to general well-being.

Sometimes, however, climate change is comprehended more rationally, with an appreciation of the wider consequences. For example participant 03-SS-Ventersdorp refers to droughts influencing farmers, which in turn leads to higher market prices for food. Taking into account that more severe droughts are the biggest visible effect of climate change in the area, surprisingly few participants mention it. Examples given to illustrate climate change include more erratic patterns of rainfall and temperature, and earlier seasonal changes. Unpredictability is seen as recent, especially by older people who often related how they used to be able to predict certain weather events, but cannot do so anymore.

Naïve understandings sometimes involve fear. As participant 03-RM-Ikageng mentions *'. . . if we cut out traditional rituals, we will be hit by floods, we will be hit by a huge climate change because now everything no longer happens normally, we have already changed it.'*

Beliefs regarding causality can be a window into underlying values (cf. the structure and function of belief systems) and therefore should be expected to be difficult to change. As categories for solution and attitudes are determined by this, a premium placed on tradition and traditional beliefs can cause a resistance to unfamiliar adaptive measures.

Climate change as hazard is perceived in different ways. Feelings of helplessness are illustrated by the following quote:

Instead of adapting they challenge the environment and-- Technically, they challenge those who know. . . . So, they resist adaptation but somewhere, somehow they are forced to adapt because there is nothing that they can do. . . . Cannot afford those . . . Air conditioners or those air cons. .

. . Although mentally they resist adaptation but… they just adapt. But some adapt, some challenges, some they just-- They don't know what to do (04-AB-Jouberton).

Some participants are neutral or even positive about climate change, for example participant 04-KM-Jouberton mentions that winter is now more tolerable, but change is seen as a threat by others. Participant 04-GP-Ventersdorp mentions how clouds have changed: *'The clouds are scary . . . . Sometimes He (God) just scares us and we just have to accept (it).'*

Such emotional responses may be the result of a disturbance in the belief system following unsettling climate events. This may lead to additional feelings of insecurity (Hernes, 2012:96-116) and cause defensive action in the form of resistance to belief revision. Affect also influences risk perception. Wyer and Albarracín (2005:305) connect the anxiety one feels about an event to the approximation of the likelihood of that event. Risk perception influences a community's motivation to change, which can include a change in beliefs (Wyer & Albarracín, 2005:305).

Belief processes

I have a strong belief because the things that we see, that has been happening at all of our times but up until a recent years it seems as if there are changes most of the time the clouds are showing the signs of the rain but when we are expecting the rain it does not rain, so we take that it is the change of life that people and the process of our life at the present moment, in the past there was no killings, wars, things like that right now bloodshed and killings it seems as if have brought a huge change in the process of our cause (05-RM-Ventersdorp).

This quote illustrates how two beliefs can be linked. The participant observed gradual changes in the weather that she couldn't explain, while during the same time moral decay was witnessed. Both of these observations likely lead to the same feeling of things not quite being right, and were therefore linked in a causal way. This will be possible only when the explanation is consistent with the central structuring component of the belief system. It is one possible way in which beliefs are formed.

Established beliefs narrow the possible explanations of a phenomenon. Participant 02-SS-Jouberton talks about older people with strong traditional beliefs and how *'if something is done*

about the climate change, they will believe that the ancestors are happy and they will continue pleasing them'. When the opposite happens and climate change gets worse they will still believe that the ancestors are responsible – this time being angry because they haven't pleased them.

A belief is more established when it is integrated into a belief system, and will consequently resist change, as the following quotation illustrates:

I believe, I know like most of the time in studies- I read and I take something inside in my own way. So I won't change my beliefs because it's something that I know. Something that I've learning when I grow up (01-AB-Ventersdorp).

Naïve scientific explanations of climate change can be held next to more traditional views. Participant 04-RM-Ventersdorp explains climate change as caused by people in factories which cause a lot of *'smokes'* that then *'leads to increased heat'*, but also by *'that something that stays in the river, that I will not be able to say it by name'*. Beliefs that are seen as contradictory are either changed, or arranged in a hierarchy. Participant 01-RM-Ventersdorp used to believe that climate was natural and controlled by God, but says that he changed these beliefs because he now believes climate is controllable. Participant 03-KM-Jouberton says that she doesn't *'undermine anything' and 'do believe that . . . smoke pollutes air'*, but she *'believe(s) mostly in God'*.

Cultural identity forms a barrier in terms of authority beliefs (cf. the structure and function of belief systems), as *'the white people'* don't understand culture *('westernised people do not have cultures or traditions'* according to 05-SS-Jouberton) and therefore could not possibly *know* in the same way. Grasping this concept intuitively, participant 02-SS-Jouberton suggests that the only way that some people's beliefs about climate might change is if your trick them: *'...call a sangoma (traditional healer) . . . and convince them to convince the older people and tell them the ancestors say it.'*

As African, yeah we have rituals . . . you have to burn wood for cooking or doing whatever you have to do . . . so there's a lot of smoke. When comes to the fact that you have to tell a person that you know what you're doing is not good for the environment so what and so forth, that

person will not be convinced by what you're telling them . . . they'll raise the fact that, no you seem like to be forgetting that I'm an African. I'm not westernised or something (05-SS-Jouberton).

The black community, because our culture will teach us another thing and then when we see things in television information, it will be something like "Nah, this is a white man's perspection (sic)" . . . . it challenges- That why when you come to us, you tell us about climate change, it won't be easy for us to believe you. Because based on how we grew and how we were taught- that, ah, ah, ah-- this is the cultural way. Because of, we see nature differently, as (than) the white man. (04-AB-Jouberton).

The quotes above further illustrate how culture can be a very real barrier to change. In a similar vein, the issue of knowledge as power was touched on. Participant 04-AB-Jouberton shares his belief that religious beliefs were used during the colonisation of South Africa to pacify the indigenous people, while robbing them of precious raw materials. That is to say that when you change someone's core beliefs, it becomes easier to influence them.

Specialist knowledge can create the illusion of control. Participant 01-RM-Ventersdorp deduced that meteorologists control the weather because they know what the weather will be like and therefore *'it's no longer . . . natural'*.

Climate change and climate change education is a necessary process that holds its own challenges. The following quotation illustrates how the structure of a belief system can resist information based on presentation.

But not to convince; because if you try to convince man, sometimes people become very personal and people will think not that you are taking them for granted. And you think that you are the alpha and omega about whatever you are trying to let their minds be changed (04-SS-Ventersdorp).

As was pointed out earlier (cf. the structure and function of belief systems), consistency with self-esteem receives priority over other types of consistency in a belief system. If identity is challenged, the belief system will act in irrational ways to protect it. In this regard Adger *et al.* (2009) urge that local knowledge should be acknowledged and cultural identity should be safeguarded in planned adaptation. If identity is challenged, an emotional response is elicited and more coherent relationships between new and existing beliefs will be necessary for belief change (Thagard & Findlay, 2010).

There is a real willingness to learn amongst many of the participants, who sees a change in outlook as prerequisite to adaptation. Participant 01-SS-Ventersdorp notes the importance of flexibility of belief, recommending that *'we must always believe that — there's what we call probability in life . . . . you must always be prepared for disappointment'*. He stresses the communal effort needed, advising that *'we must — as people . . . change our mind-set . . .we must now starting to adapt or put our mind-set in the very same place'*. Some participants mentioned schooling and even internet-based information, but a specific need for accessible and relevant information in the community was expressed more than once.

Factor-specific challenges and opportunities

Participants from each factor will experience different challenges, because of their different worldview narratives. Factor 1 and 4 might experience culture and social fragmentation to be more of a barrier because of their emphasis on collectivism. Both of these factors place emphasis on seeking a solution, without attaching explicit importance to beliefs. In contrast to Factor 1 and 4, Factor 5 also emphasises solutions and human agency, but does so while simultaneously acknowledging the importance of beliefs and systems, which suggests a bigger-picture view. Factor 3 displays the biggest resistance to belief change, which is probably a result of religious determinism. Factor 2 seems more optimistic and open to change. Factors 2 and 4's belief systems are possibly less integrated because of contradictory views (in terms of human agency and time perception respectively as indicated in their narratives) and by using that as leverage, could be changed.

Opportunities form an integral part of adaptation and can be customized according to each factor's beliefs. Climate change can be utilised as an opportunity to gather the community to unite around a cause for factor 1. For factor 2 learning through technology and for Factor 3 learning about technology might be a prospect. Factor 4's profile lends itself to building a large

network influencing more human ways of life and a socially responsible economy. Factor 5 participants will be able to collaborate with government.

Conclusion:

Adaptation should ideally be guided by governing bodies externally in support of adaptation processes within a community. According to the National Climate Change Response White Paper, South Africa faces 'future drying trends and weather variability with cycles of droughts and sudden excessive rains' (DEA 2011:8). However, in advising policy one should keep in mind the distinct views, even within one community, and consider how one can address each effectively. The systems and structures that will advance the unity of the community should be prioritised and perhaps contested issues should be sidestepped. Eriksen *et al.* (2011) advise that vulnerability in its wider context should be kept in mind, as well as the way different values will affect adaptation outcomes.

Elements shown to increase resistance to belief revision are a high integration of established beliefs concerning climate change, social embedment of beliefs, a high importance attached to certain beliefs, a narrowed perception (because of cultural beliefs), perceived frightening consequences, negative referents stating a contrary belief, and threat to ego or identity. Properties that facilitate belief change are perception of controllability, clear evidence, and a willingness to learn.

On a more global level, when it comes to the issues surrounding climate change, our way of thinking needs to change and the start of that process lies in mapping where we currently are. This study has attempted to create such a map. It explored possible challenges created by the interrelationship between climate change and belief systems in order to make better decisions in terms of adaptation.

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Chapter 4 Conclusions and recommendations

4.1 Introduction

The climate has been changing at an unprecedented rate, leaving rural communities suddenly at a loss of effective adaptation strategies, as traditional knowledge becomes insufficient. Rural communities struggling with socio-economic hardships are faced with this additional challenge, which urges them to re-examine their relationship with the environment. Climate change adaptation is greatly influenced by beliefs about self (including ability, agency, and identity), the nature of climate change, and the world in general. These beliefs form part of a complex system of which the structure governs change. As diverse perceptions and beliefs of climate change encumber the formulation and implementation of policy, a better understanding will afford greater efficiency in governing climate change adaptation. The aim of the study was therefore to determine how belief systems are challenged in the context of climate change adaptation.

This aim was reached by firstly doing a literature study (cf. chapter 2) in order to gain a better understanding of the structure and function of belief systems, as well as to establish the theoretical grounding of climate change adaptation. Behavioural changes necessitated by climate change adaptation will likely cause more and more changes in culture and other social systems, including beliefs. Internal preparation for change can ease the disruptiveness of the process. By delineating these constructs, the linkages between beliefs, belief systems, climate change, and climate change adaptation could be further investigated.

Beliefs and perception mutually influence each other, and well-being depends on perception of change. Subjective valuations should be included in vulnerability conceptualization, and investigations into the roots of vulnerability should be included in adaptation discourses. Vulnerability can be calculated in terms of the costs and yields of adaptation, but should ideally be viewed more dynamically. Taking the interaction between the different dimensions of a community into account and comprehending established practices, allows for interventions that focus on process rather than product. This is crucial for participatory methods of communication and governance, which is implied with a focus on the social construction of climate change. Internal and external

realities that do not correspond with each other will thwart the motivation to embrace interventions and change will be limited.

An empirical study based on these findings was conducted to gather information on specific beliefs about climate change in three rural communities in the North West province of South Africa. These subjective views were studied through use of Q-methodology. Qualitative analysis based on the initial interviews from which the concourse was extracted provided additional insight into the Q-sort results. The findings from the empirical study were included in chapter 3 in the form of an academic article that was also prepared for submission to an international accredited journal. Observations of climate change by the study populations testify of different perceptions and experiences, amongst which are helplessness, fear, and indifference. Beliefs regarding cause, possible solutions and flexibility of beliefs were also divergent.

This concluding chapter will start with a summary of the main findings from the first three study objectives. These findings informed the final study objective which is to provide recommendations regarding the challenges of belief systems towards climate change adaptation.

4.2 Objective 1: To gain an understanding of belief systems.

This objective was achieved in chapter 2 by means of a literature study. A short summary of the main findings is given here.

Beliefs have cognitive, behavioural and affective components and they arrange into a complex structure according to a person's experience. Central beliefs form the core of a belief framework, around which beliefs of different function and type arrange. Various connections, with diverging levels of complexity, form between these beliefs. Centrality and connectedness of beliefs are related. Indicators of centrality are beliefs that are axiomatic, derived by direct experience, existential and/or shared. A belief is however not set in this system; it can migrate according to function, change the arrangement of its surrounding beliefs, or jump between collections of beliefs. Clusters of beliefs that organise around objects or situations are called attitudes, which act as prejudgments and help ease decision making.

Organising and upholding the system is a stable, tightly cohesive group of beliefs with motivational components that acts as a standard for more peripheral beliefs. It is

abstract, idealistic, and justifies a person's behaviour and self-projections, as well as designating causality. This nucleus is referred to as foundational or control beliefs, or as a terminal value system. Terminal values (directing desirable end-state existence) are part of a broader value system that includes instrumental values that direct desirable behaviour.

Data background beliefs and authority beliefs are determined by education, social structure, and direct experience. These beliefs mediate new beliefs. Changing beliefs accommodate new perceptions and understandings, and helps one adapt to a changing world. Prior beliefs become the measuring stick for what we observe and project. Discontinuity between observed reality and beliefs regarding reality can cause the destabilisation of the whole belief system.

Because of the complexity and flux of systems, some uncritical assimilation of new beliefs, and certain structural principles of organisation (such as compartmentalisation), inconsistencies occur subconsciously. Original motivations for standing beliefs might be forgotten, and time, emotion, and context play a role in the moment of belief formation (and possibly also in the moment of belief retrieval).

When an inconsistency is brought to the consciousness it is likely that beliefs will be changed, depending on culture and relationship to identity. Change is also likely when no compartment is available for a new belief. These changes can either be in terms of content or organisation. A belief is generally changed when coherence relations shift conviction in favour of a new piece of information as it surpasses the amount of incoherence relations to the rest of the belief system.

As one grows up, beliefs that round out one's world picture should preferably be rational and realistic, but as is necessary for self-preservation, it is sometimes irrational and defensive. The main reason for forming many beliefs is to create a self-representation that enables a happy life by coping with life situations successfully. This usually means that the representation one has should be close enough to reality for accurate predictions and interpretations. Other possibilities of motives for beliefs include maintaining a positive self-image, maintaining a positive image of the moral world, avoiding ambiguity, and being precise and reliable. Consistency in self-esteem takes priority over consistency in logic and reality.

Beliefs/perception on the behaviour of physical objects, the attitudes, values, motives and behaviour of others and the behaviour of self are fed into your belief systems continually and tested for consistency with each other and your own motives, attitudes and values. Behaviour can cause inconsistency when it differs from attitude.

Templates to interpret new beliefs facilitate belief change, as beliefs interwoven into ideologically coherent units are more easily accepted. The more tightly coherent a set of beliefs are, the more resistant to change it will be. Logical webs of shared beliefs are doubly embedded because it is entrenched in both cognitive and social networks, it is impossible to change the one without changing the other.

Resistance to belief revision can take the shape of counter-arguments, compartmentalisation, transcendence (implications added to broader conceptual framework to downplay its importance), reinterpretation and bolstering (selectively retrieving and reviewing contrary proof).

4.3 Objective 2: To establish the theoretical grounding of climate change adaptation.

This objective was also reached through a literature study (cf. chapter 2). The main findings are summarised below.

Adaptation consists of two main components: moderating harm on the one hand and seizing opportunities on the other. It entails the adjustment of processes, systems and structures in a way that ideally supports sustainable development, and as such aims to reduce causes of vulnerability. Climate change adaptation is aimed at actual or expected climate outcomes and therefore implies an ability to plan ahead. Local valuations and perceptions drive this process. Perception is an important link between beliefs and adaptation, as the perception of vulnerability, hazard, capacity, cause, and controllability influence adaptation.

Seizing opportunities depends in part on adaptive capacity. It is also influenced by perception, as this influences the interpretation and mediation of adaption. Adaptive capacity includes social, cultural, and psychological flexibility, which lowers vulnerability. Vulnerability is viewed in terms of current socio-economic, environmental, and political

contexts. Considering social justice and environmental integrity, differing values and interests should be taken into account, local knowledge integrated and a local global connection established in adaptation governance.

Within a contextual vulnerability approach the different causes underlying vulnerability to the projected threat of climate change are dealt with, and include biophysical, social, political, environmental, economic, and cultural roots. The incapacity to handle extra pressure has an impact on livelihoods and therefore hampers adaptation, but although these external realities cannot always readily be changed, internal aspects can be addressed. A social and ecological system that includes equity and justice concerns can offer external aid to vulnerable communities because an enabling environment facilitates utilisation of strengths and optimal functioning. Poverty usually means very little say in policy, a bigger dependency on natural resources, restricted access to information, and no backup resources.

Indigenous resource management systems are adaptive responses that have developed over time based on local empirical knowledge and different ways of knowing. Social institutions hinged on these resource management systems function as forms of governance, and is embedded in a worldview which developed from it. This worldview influences the rest of the knowledge-practice-belief complex (cf. 2.3.5) as every aspect is interrelated. Decision making regarding adaptation that considers the dynamics within the indigenous knowledge system will be more effective. Community decision making will be based on what is valued and will therefore aid adaptation.

As climate change is an abstract concept, its description is of utmost importance. A bottom-up definition emphasises local experience and perception, while a top-down definition will favour risk analyses by experts. Different delineations suggest different meanings, which elicits different reactions. Knowledge production and distribution influence local understandings of climate change. It can be mediated by policy, but happens naturally by means of storytelling, traditions, social ties, and cultural ceremonies. Access to knowledge is an important consideration for information that is externally fed into a system.

Resilience is the ability to cope with the unexpected and will increase when a community actively engages with authority and the decision-making process. Adaptive capacity is the ability to respond to fluctuation. It includes tangible and intangible assets.

The latter includes things like tradition and social networks. Social networks regulate the flow of material and non-material resources through different power structures. In this capacity it acts as a platform for knowledge that is experienced-based, and determines the significance of scientific information. Strategies for learning, understanding, decision-making, and communication of needs are also included.

Culture is indicated by shared metaphors, folklore and beliefs, and individual choice is restricted to the selection of options that a culture allows. Group identity serves the human need to belong, and policy that safeguards cultural identity should be encouraged.

4.4 Objective 3: To determine which challenges are caused by a community's belief system regarding climate change adaptation.

Objective 3 was reached by the empirical study and described in the article (as presented in chapter 3), but a more comprehensive report of the qualitative findings as it relates specifically to challenges will be given here. The format that will be followed is a theoretically contextualised explanation followed by one or more quotation(s) from the phase 1 interviews.

4.4.1 Factors increasing resistance to belief revision

Seven factors that encumber changes in beliefs were identified and will be illustrated in this section.

4.4.1.1 Integration

The more integrated a concept is, the more difficult it will be to change. A concept is compartmentalised when it is not functionally integrated (Rokeach, 1968:117-118), and this could allow inconsistencies to go unnoticed (Rokeach, 1968:167-168). When inconsistencies are made conscious it destabilises the system, so well-integrated ideas are more established.

> *I believe, I know like most of the time in studies-- I read and I take something inside in my own way. So I won't change my beliefs because it's something that I know. Something that I've learning when I grow up. (01-AB-Ventersdorp)*

4.4.1.2 Social embedment

Over time cognitive networks are shared in an interpersonal network and become socially embedded. Belief change then requires social reorganisation. Different age groups have different experiences and will not be influenced by events in the same way (Hernes, 2012).

> *You see when an elder tells you something, it is the right thing and it will always stay right. Nothing you say will change their mind. (01-RM-Ikageng)*

4.4.1.3 Importance of belief (determined by underlying values)

One of the factors influencing resistance to belief change is importance of belief (Rokeach, 1968) as not all beliefs are held equally (Wyer & Albarracín, 2005:276).

> *. . . it's going to be difficult because according to me in order for old people to listen to you, you have to convince them, you have to prove that this is like this. You see so I think if we can always be... be... be there to accommodate, be there for our elders it's then we can be able to make them aware because if you practice something it is easy to be followed you see. So our elders, yes it can change, but don't forget that they are the kind of people that still believe in ancestors and what and what and what you see. So we can be able to educate them but it's going to be a long . . . You see, because they are strong believers of their tradition. (05-RM-Jouberton)*

4.4.1.4 Perception narrowed by cultural beliefs

Beliefs influence perceptions (Lorenzoni & Hulme, 2009; Hulme, 2011:145-146; Hernes, 2012:121). For example the foundational belief regarding humanity's place in the world can influence climate change perception and narrow down possible solutions (Hulme, 2011:145-146). Selective perception can be a reason that inconsistency in beliefs are not noticed (Hernes, 2012). Confidence in predictions are measured by beliefs (Lorenzoni & Hulme, 2009). Environmental perception is shaped by worldview (Berkes, 1999:14).

> *Once things have changed if something is done about the climate change, they will believe that the ancestors are happy and they will continue pleasing them, but when it comes to maybe something ever happens about the climate change, they will go back to that mentality that the ancestors are angry and stuff, so they will keep on doing the very same thing over and over. (02-SS-Jouberton)*

> *Yeah, like climate change, for example. They'll probably take a storm not as a result of what we've been doing, but they would rather think, you know, I need to slaughter a cow or we as a community need to do this so that we can get this a*

bit better, you know. I don't think--well now, it's way different, you know, but there are still those people that believe that it's not really the climate; it's something to do with the gods, or whatever, not being happy with us, and that kinda stuff you know. (04-SS-Ikageng)

4.4.1.5 Perceived frightening consequences

Resistance to new information expends cognitive effort, but is done when the effort is more to accept the consequences of such a new piece of information will bring (Wyer & Albarracín, 2005:307). New information will be seen as less of a threat when these changes are supported and prepared for (Ensor & Berger, 2009:33). To fill out one's picture of the world irrational and defensive beliefs are sometimes necessary (Rokeach, 1968:9).

They don't believe in they don't believe that err someone in this living land will do something about that because once we tell them about these layers that have been damaged they'll tell you that we provoking the gods. (02-SS-Jouberton)

4.4.1.6 Negative authority beliefs

Culture is indicated by shared beliefs, metaphors and traditional narratives, which can be used to reveal feasible opportunities for that specific culture (Ensor & Berger, 2009:33). It limits the combination of values that will be expressed in a belief system (Rokeach, 1968:161), which can act as indication for the subjective limits to adaptation (Adger *et al.*, 2008; Adger *et al.*, 2009).

As African, yeah we have rituals, ja. And in the rituals it means that you have to burn wood for cooking or doing whatever you have to do. Ja, so there's a lot of smoke. When comes to the fact that you have to tell a person that you know what you're doing is not good for the environment so what and so forth, that person will not be convinced by what you're telling them. Ja, because they'll raise the fact that, no you seem like to be forgetting that I'm an African. I'm not westernised or something. (05-SS-Jouberton)

The black community, because our culture will teach us another thing and then when we see things in television information, it will be something like "Nah, this is a white man's perspection". (04-AB-Jouberton)

So, ja… it challenges-- That why when you come to us, you tell us about climate change, it won't be easy for us to believe you. Because based on how we grew and how we were taught-- that, ah, ah, ah-- this is the cultural way. Because of, we see nature differently, as (than) the white man. You understand? (04-AB-Jouberton)

4.4.1.7 Motive of presentation of new information perceived as threat to ego or attempt to control

Self-esteem consistency in a belief system is more important than logic and reality (Rokeach, 1968:164). To 'construct a representation of oneself and the world that permits one to cope effectively with life situations and, therefore, to lead a happy and successful life' motivates many beliefs (Wyer & Albarracín, 2005:306). New information that is in disagreement to these beliefs is resisted because of the consequences it will have on one's identity beliefs. People's behaviour generally correspond to their view of themselves (Hernes, 2012:112-113). When a belief is challenged people have an emotional reaction in proportion to the affective component of the belief challenged (Rokeach, 1968:113-114). People are also emotionally invested in whether or not their beliefs are correct. When beliefs are challenged, it questions their ability to correctly gauge reality (Rokeach, 1968:116). When emotional values cause resistance to belief revision they add more incoherence relations between a new piece of information and existing beliefs. More evidence will then be necessary (Thagard & Findlay, 2010:337). Disruptions in a belief system endanger one's sense of security and leads to feelings of vulnerability (Hernes, 2012:96-116).

> *But not to convince; because if you try to convince man, sometimes people become very personal and people will think not that you are taking them for granted. And you think that you are the alpha and omega about whatever you are trying to let their minds be changed. (04-SS-Ventersdorp)*

4.4.2 Factors decreasing resistance to belief revision

Three factors that create a favourable climate for belief change have been identified and are as follows:

4.4.2.1 Perception of controllability leads to the motivation to change

If perception of controllability or individual agency is low, the motivation to change will also be low (Wolf, 2011:25).

> *It's natural. Something that is in nature. You don't have to ask "how"--something that occurs naturally so. (01-AB-Ventersdorp)*

When perception of controllability is high:

. . . if they say yes there is a solution for you to go and change the tsunami, I would…I would change what I know about tsunami, I would go and try to change it, understand? (01-SS-Ventersdorp)

. . . because we have measures that can protect us against the climate change, the heat and such that we are experiencing at the stage so I think if we have mechanisms in place then that is when I think my perceptions towards heat and everything can change. (01-BJ-Ventersdorp)

4.4.2.2 Authority beliefs

As far as non-primitive beliefs go, authority beliefs are the most central kind. It entails the maintenance of positive and negative referents. These referents are the people or entities that someone trusts to have the correct beliefs (or in the case of negative referents, the incorrect beliefs). Authority beliefs develop through education, social structures, and direct encounters (Rokeach, 1968). It is one way of knowing (Woolman, 2006).

I think the only thing that has to be done is to trick them, call a sangoma traditional doctor you call them and convince them to convince the older people and tell them the ancestors say it, that's the only way, to trick them. (02-SS-Jouberton)

Climate is controlled by God, God created all things in the world. God is the creator, he created climate. According to people who know these things--. Everything is under the supervision of and under the control of God. For climate to change it is caused by God, God knows why and how it changed, not men, it just that the knowledge we have--. (02-KM-Ventersdorp)

4.4.2.3 Clear evidence

First-hand experience is the ultimate determiner for beliefs.

Well you know, the perceptions will easily change if facts are presenting themselves . . . (01-BJ-Ventersdorp)

But to change your belief? It's very challenging. Now how can one change someone's belief? I think it is the theoretical part of the teaching, whereby you take man, you take him to the practical thing that you are talking about, that he or she must see. As you have heard, seeing is believing. That is all that you can do to change man's thinking. (04-SS-Ventersdorp)

. . . but I do not believe in such things, because I have never experienced that my brother, I have never heard anyone informing me that they have made the rain to start and I have never went to a traditonal doctor to bring the rain or to stop the rain. I do not really believe in that. (03-GP-Ikageng)

4.4.3 Other factors

This section presents factors with more general effects, in other words not directly linked to belief revision as such.

4.4.3.1 Control of beliefs mediated by (i) attitude towards evidence (ii) authority / data background beliefs

According to Coady (2012:12-13) attitude towards evidence determines belief. A person has a choice in what evidence he/she gathers, as well as what evidence is taken as true. In this way the content of one's beliefs can be controlled by oneself.

Data background beliefs (Wolterstorff, 1976) and authority beliefs (Rokeach, 1968) also control what we believe as truth, for example cultural beliefs.

> *I'm a person that believes in culture and I know that old things are different from current things, but you can tell your brain. Immediately once you've told your brain, nothing can change it because that will be what you believe in. (01-GP-Ikageng)*

> *Because what I believe in -- if, if I stick to one thing I stick to it there is no way I can change. Even if, even if, if a person were to come and say to me so an so and so, I will never change my mind. If I believe in one thing I stick to it. You see? (01-KM-Ventersdorp)*

4.4.3.2 Time aspects that control available beliefs for comparison: (i) recentness (ii) frequency

Time perspective is one of the variables of organisation in the cognitive system. It contains interrelated concepts of the past, present, and future (Rokeach, 1968:117-118).

Beliefs are either pragmatic and formed according to circumstance based on the knowledge that comes to mind at that moment, or it is part of memory in a more stable system (Wyer & Albarracín, 2005:278,313). If it's the former, the following principles apply: the recentness of use or acquisition, the frequency of use, the linkages with the issue at hand, and the inclusion or exclusion into a broader schema pertaining to the issue determines the likelihood that a piece of belief-relevant knowledge will be used (Wyer & Albarracín, 2005:281).

According to me, beliefs sometimes it's because you grew up with them or something or the church that I go to we believe in 1,2,3 maybe it becomes traditional. . . . Maybe I'm a traditional person at home, so I would be attending my parent's church, then when I get there I get told that there is no such thing as ancestors so that would... my mind would then often change because I would always be in church because it's something that I like. I will be focusing more on church that I end up forgetting about the tradition back home. (07-GP-Ventersdorp)

4.4.4 Q-sort findings

Five unique semantic patterns emerged from the Q-sorts, with the first one being most prevalent (explaining 20% of the sample variance). These patterns present five unique worldviews: naturalist/collectivist, religious, religious determinist, activist/collectivist, and government/structural thinker. Overall the two broad streams of thought that can be identified are collectivistic and religious (the fifth factor represents only 6% of the variance).

4.5 Objective 4: To make recommendations regarding the challenges of belief systems towards adapting to climate change.

Internal aspects of climate change adaptation include aligning external events with personal and communal worldviews. Beliefs about cause, control, scientific knowledge, human responsibility and agency, and solutions determine action. Based on the literature review and empirical findings, the following recommendations can be made:

Purposive adaptation should not be seen as separate from sustainable development, and autonomous adaptation should be supported only if it doesn't oppose this. Disaster risk assessment (DRA) can be helpful here, as it entails facilitating community-led identification of a community's capacities. According to Forbes-Biggs (2011:13) it is a formalised process that identifies and prioritises threats and vulnerabilities, so as to reduce the risk of disaster. Participants discovering their own solutions mean that they take ownership of problems, and in interactive collaboration with facilitators this could lead to the discovery of new opportunities (Mercer *et al.*, 2008:173).

Internal accommodation and preparation to change is a crucial part of adjustment in adaptation, lest it be resisted. If climate change is perceived as frightening or overwhelming, adaptation can thus be more difficult. If change is blindly fought, vulnerability increases. Adaptive capacity would include the ability to adjust and seize

opportunities in response to climate change consequences. This implies a flexible belief system and the ability to alter existing beliefs.

There is a very real willingness to change, and a desire to learn among participants, as can be illustrated by the following quotations:

> *(Can you change your beliefs?) Yes. They can change if maybe someone, anyone can come and give a different perspective about the conditions that affect the environment. Then maybe I can think otherwise, differently hopefully. Like now when all these things are happening right under our noses and our environment is getting polluted, there is no one who is coming forth to educate us further about it. (01-RM-Jouberton)*
>
> *It's just that there needs to be ways that we can know because I don't have any information about how we can deal with the things that affect the ozone layer. (05-KM-Ventersdorp)*
>
> *If I want to change my mind about the climate, maybe if someone can teach me more about this climate, how does it work--. (02-AB-Ventersdorp)*

These opinions imply a reliance on external information. Once new information is internalised it will be further spread throughout the system via formal and informal social networks. Youth is perceived as a window of opportunity in terms of learning, while older people are seen to be more rigid in their beliefs:

> *Yes they (beliefs) can change, but the only way for them--. For us to change--. For us to change them is to go out there and spread the message teach young people about how harmful that thing is to the environment. (01-KM-Jouberton)*
>
> *We can change this belief on youth people but not on old people because of we young people today, we got lot of information from our books and we have prove, in geographing--, geography studies gives us information regarding the weather and the causes of weather. Then we the current generation we can change our belief definitely now since I have completed my matric (grade 12) there's was a lot of changes. Because that thing that there are snakes and all these things, it does not work on us but the problem is that our old people will--, but those who are educated will change their minds but our grandmothers over the age of sixty (60) it will be a process, because during their generations the was no information that we possess today. So I believe on youth information will change but not on old people, because we have been taught geography at school and floodings beliefs, but as for old people these things were happening in their times without someone with relevant information and awareness. This is why nowadays they still live according to those beliefs, but as for us, the moment we attend school we are told about and provided with relevant information that has prove from school and we see it and we can believe it and it is happening even now. Things like flooding is caused by this and this and this, and that and that. For old people the minute you told them about books, they say we are too educated, then, old*

people it will take them time, but the times are also changing and we have new beliefs--, old people beliefs we do not believes them. (02-RM-Ventersdorp)

Value organisation is learnt to aid in conflict resolution as one matures. Age seems to correspond to a rigidity of this organisation and therefore education is best aimed at the young. Information should be presented as part of a logical ideological whole in order to be more easily accepted. The perception of controllability leads to increased motivation and belief flexibility. This stands out as the most important factor at the crossing point between beliefs and adaptation.

Participatory communication ensures more control over knowledge production and dissemination. Creation and distribution of knowledge can be influenced by policy. Contributing to policy formation will help communities negotiate climate change on their own terms. Managing information and motivating multiple stakeholders shape the perception that the community has of opportunities and consequences.

Participatory communication is ideal as a teaching/learning tool. It avoids teaching from a position of power and offers no threat to identity (individual or communal). Development communication creates a favourable environment for valuations of opportunity and risk, distribution of knowledge, as well as social change, and key stakeholders are engaged to support sustainable development (Mefalopulos, 2008:5).

Assessment should be continuous. Within the participatory paradigm reality itself is seen as a process and the emphasis of communication is on its fluidity (Huesca, 2002). Modes of communication is determined by level of literacy, cultural context, resources available, and other community preferences (Moemeka, 2000:133; Mefalopulos, 2008:125). Participatory content creation, in true development communication fashion, can aid in the acquisition of skills, especially things like digital literacy (Watkins & Nair, 2008), as was identified as opportunity for some of the factors in the empirical study.

Participatory communication has been described as disruptive of “the hegemonic control of dominant discursive spaces by creating entry points for subaltern worldviews” (Dutta, 2011:257). A sensitivity to and interaction with indigenous knowledge and culture lies at its core, while encouraging skills development (Waisbord, 1999). Participating with authenticity, commitment, and trust can lead to positive change in the power distribution of a society (Servaes, 1995), in a dialogical act of emergence into personhood within a community and wholeness as a person (Thomas, 1994).

Local appraisals and underlying forces of power are important considerations in policy decisions. Cultural beliefs and norms are indicative of this, and a careful study of taboos and local social customs should inform the writing of policy. These beliefs are socially embedded and challenging them would result in defensive behaviour or a destabilisation of the social network, which would weaken an adaptive capacity asset. Networking capital can be strengthened by participatory communication practices. In the end an interface between local and global processes should be sought.

Vulnerabilities to the changing climate in the North West province are mainly insufficient protection from extreme weather events because of inadequate housing and infrastructure in the townships, and food and water security. The biggest internal vulnerability is perception of control.

Information on what can be done should be made widely and easily available, opportunities to contribute should be created and encouraged, and socio-economic upheaval should be facilitated – from the outside by creating a favourable environment and by training and facilitating the development of current skills into business opportunities.

4.6 Conclusion

A holistic approach is necessary when viewing climate change as both a physical and social construct. Climate change as an idea has only started receiving attention from the social sciences relatively recently. In this approach internal and external realities are recognised, collaborations between different types of knowledge are encouraged, and participatory methods are promoted. The study of beliefs as a structuring agent of inner reality has received very little attention in conjunction with climate change and climate change adaptation. This study aimed to fill that gap and examined the interaction between belief systems and climate change adaptation. The challenges that climate change exerts on belief systems, and belief systems exert on climate change adaptation were specific focuses of the study.

The central theoretical statement established that changes in belief are governed by the organisation of belief systems. The study was then structured around four objectives, namely to gain an understanding of belief systems, establish the theoretical grounding for climate change adaptation, determine challenges caused by a community's belief

system regarding climate change, and make recommendations regarding the challenges of belief systems towards climate change adaptation. The methodological approach was holistic and transdisciplinary, attempting to view different types of knowledge with equal regard and integrating perspectives.

Beliefs were defined with regards to function, type and properties, and in the organisation of beliefs systems these aspects proved to determine placement. If the belief system is visualised as a sphere, the core beliefs are the most integrated. Within the larger whole, groups of beliefs form around objects and situations and act as predispositions to action. The centrality of beliefs, or groups of beliefs, is correlated with their connectedness and directly proportional to the degree in which they are existential, shared and derived from direct experience. Directive beliefs such as values or data control beliefs have structuring influences on more peripheral beliefs.

Communal beliefs are shared beliefs specific to a community, and because they are embedded in both cognitive and social networks, changes to them will have consequences to group identity. The different ways in which beliefs are changed, as well as the principles governing that change, were investigated. Some reasons for change were found to be a realisation of incoherence between different beliefs, and the lack of a fitting compartment for a new belief. Different models were explained and resistance to belief revision in the face of evidence was investigated. Emotional ties to outdated information, or experiencing information as a threat to identity causes people to oppose new evidence. The influence of emotion, types of knowledge, perception, time and culture revealed the complexity of belief systems and their function.

As people's impact on nature intensifies, there is an increasing integration of human and natural systems. A holistic approach to climate change adaptation, that includes mental adjustments, is recommended as opposed to trying to fix single problems in isolation. Addressing underlying causes that is at the root of several risk drivers and creating enabling conditions for sustainable development was found to be regarded as the biggest priority by experts in the field.

Purposive adaptation can be unpacked as vulnerability reduction, resilience strengthening, and capacity building. Beliefs about oneself and the world determine one's capacity to respond, and the way climate change is defined shapes adaptation. Similarly definitions of disaster, importance, and vulnerability are not universal and

determine action. Social networks, local knowledge, socio-economic characteristics and non-climatic pressures were identified as important for shaping adaptation measures.

In the empirical study of perceptions of beliefs and climate from three communities in the North West province, five unique semantic patterns were found. They can be summarized as naturalist/collectivist, religious, religious determinist, activist/collectivist, and government/structural thinkers, and show a propensity for collectivistic and religious modes of reasoning. In the context of climate change seven factors were identified as impeding belief revision: a high level of integration, social embedment, importance of belief, perception narrowed by cultural beliefs, perceived frightening consequences, negative authority beliefs, and new knowledge that is seen as threat to identity. Factors that improve openness to belief change include a perception of high controllability, positive referents in authority beliefs, and clear evidence.

In the Introduction, communication was identified as a limitation, and language barriers and the abstractness of the concepts indeed proved to be challenging in some of the interviews. A significant principle that emerged from this study is the importance of community-defined functional concepts (such as vulnerability, capacity, and hazard). This leads to a higher level of ownership and perception of controllability. In combination with climate change education, this could also mean that probable changes are prepared for. A definite need for such education was repeatedly stated, and can be seen as an opportunity for intervention from governing bodies. Intervention should support natural processes and local knowledge, facilitating conceptual change rather than stepping in to dominate. Participatory communication is a fitting tool to utilize in the process.

4.7 Recommendations for further studies

The link between identity and belief change emerged as a prominent dynamic, and further study in this regard can add valuable and more specific insights to the process of belief revision. Resistance to belief revision is especially relevant, and an in-depth study of indigenous knowledge and emotion can further illuminate context specific factors in this regard. Acknowledging different contexts is vital in studies such as this one, as the difficulties in for example policy implementation can often be traced to cultural idiosyncrasies. In the effort to create a picture that is ever more complete, further

context specific studies in the relationship between beliefs and climate change is encouraged.

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ANNEXURES

Annexure 1 Environmental Values- Instructions for Authors

Environmental Values - Instructions for Authors

Environmental Values brings together contributions from philosophy, economics, politics, sociology, geography, anthropology, ecology and other disciplines, which relate to the present and future environment of human beings and other species. In doing so we aim to clarify the relationship between practical policy issues and more fundamental underlying principles or assumptions.

The journal provides a forum for original academic papers that are accessible to people from other disciplines, and also those who operate outside the academic community. To this end, contributors should avoid needless technicality. They should also bear in mind the requirements of an international readership when making reference to localised places or events.

Manuscripts should show engagement with on-going intellectual debates, and awareness of the current literature. Authors should especially make sure they are cognizant of papers published in recent issues of *Environmental Values* that are relevant to their topic. Authors should avoid excessive quotation from their own previous works: failure to do so can result in work being classified as self-plagiarism. All quotations from author's own publications and from outside sources must be acknowledged and fully referenced.

Submissions must be original and not currently under consideration for publication elsewhere. We aim to reach a decision on publication within three months of receipt of the submission.

Specific Guidance

File Format. Submissions must be uploaded to our online system in Microsoft Word or Rich Text format.
Word Limit. Unless otherwise agreed, submissions should be no more than 8,000 words in length including notes and bibliography, and no more than 28 pages long, including any diagrams, tables etc. when formatted as specified below. Discussion articles (comments on published papers and author replies) should be no more than 4,000 words and book reviews no more than 1000 words. Manuscripts of excessive length will not be considered.
Page Layout. A4, font Times Roman 12pt. Double spaced. Any tables or figures at the

end. Avoid excessive use of subheadings and text formatting for emphasis (underlining, bold, italics).

English. Manuscripts should be in English and be of an acceptable standard in that regard (if in doubt please have a native speaker read your manuscript prior to submission).

Anonymous Manuscript. To allow blind refereeing, please ensure that your manuscript is anonymous by removing your name and any self-identifying references.

Abstract. A summary of around 100 words, and a list of four or five 'key words' should be provided.

Footnotes, if any, should be numbered consecutively through the text.

Bibliographic citations can appear in text or notes. These should include the author's last name and the title or year of publication, and may include a page reference: (Aldred, 2006: 142).

A separate list of references should be provided, in alphabetical order. Please do not abbreviate journal titles. The following style should be employed:

Aldred, J. 2006. 'Incommensurability and monetary valuation'. *Land Economics* **82**: 141–161.

EPA 2000. *Who Cares About the Environment?* Sydney: Environmental Protection
Authority, http://www.epa.nsw.gov.au/community/whocares (accessed 16 October 2002).

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Rolston III, H. 1989. *Philosophy Gone Wild*. Buffalo, New York: Prometheus Books.

Holland, A. 1997. 'Substitutability: Why strong sustainability is weak and absurdly strong sustainability is not absurd'. In J. Foster (ed.), *Valuing Nature? Economics, Ethics and Environment*, pp.119–134. London: Routledge.

Spelling, punctuation and grammar should conform to British usage and the following conventions:

Spell out numbers one to ten only
0.301 cubic metres, 38 hectares, 14 mm, 28 degrees
44 per cent (44% in notes), 14 degrees
£246, £1 10s, 5s 3d, A$256,300, US$10 million
1 December 1946 (in text), 1 Dec. 1946 (in notes)
1950s, the fifties
Use single quotes, except for quotes within quotes
Italicise foreign words on first appearance
Map 1, Figure 25, Chapter 2, Appendix 1, Volume 1, Note 1 (citations in text)
fig. 1, vol. 1, n. 1 (in notes)
Omit points after lower-case contractions containing last letter of singular and after plurals. E.g. Dr, St, Mt, Ltd; ed./eds; c. (circa); encl./encls (enclosure/s).

No points for capitalised abbreviations (e.g. UK, USA)
Small caps for BC, AD, BP
World War One
the nineteenth century, mid-nineteenth century
the south-east, South-east Asia

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Annexure 2 Factor arrays with categorised statements

Nr.	Statement	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Statements regarding participants' concept of climate						
1	The climate is a natural part of the world we just have to accept and live with.	0	3	-1	-1	1
2	The climate is not complicated.	0	-1	1	0	-2
3	The climate is unpredictable.	0	2	0	0	2
4	The climate is not changing.	-1	-2	-3	-3	-1
5	There is something wrong with the climate.	0	-1	1	2	2
18	The climate was not better when I was younger.	-2	-1	-3	-1	-1
Statements regarding the nature of climate and causal connections						
6	Climate change is not a sign that the world is ending.	1	1	-1	1	-1
7	Natural disasters happen when nature wants to reshape itself.	2	1	-2	-1	0
8	The climate is determined by God.	-2	3	3	0	-1
9	Climate change is not punishment for the sins that people commit.	3	0	0	1	-1
10	Climate change is caused by the fighting of the ancestors.	-3	-3	-1	-2	-2
11	Traditional healers cause the climate to change.	-3	-3	0	-1	1
12	The climate is affected by the behaviour of people.	1	-2	0	1	0
13	Increasing population growth causes climate change.	1	1	0	-2	1
14	Climate change is not caused by technology.	0	-2	0	-2	0
15	Climate change is related to the burning of fossil fuels and pollution.	1	0	3	3	1
16	The climate influences the growth of crops and the production of food.	3	2	3	2	0

24	Educating people about climate change will anger the ancestors and cause bad luck.	-3	-2	-1	-2	-2
Statements regarding people's relationship to the environment						
17	People are trying to make money, that's why they are damaging the environment.	0	0	-1	2	0
19	We can solve environmental problems by returning to the ways of the past.	-1	2	-2	1	-3
20	The next generation will not be influenced by our current behaviour towards nature.	-2	0	-3	0	2
28	It is possible for humans to control the climate through technology.	0	0	1	-1	0
30	It is difficult to care about climate change because of economic pressures.	-1	1	-1	1	1
31	The climate does not play an important role in our lives.	-2	-1	-3	-3	-3
32	We do not have to respect the environment.	-2	-3	-2	-3	-1
Statements regarding responsibilities and rights						
21	We must act now to prevent the climate problems of the future.	2	1	2	2	0
22	Young people can help older people catch up with new knowledge about the climate.	0	3	1	2	3
23	We have the right to know about climate issues that affect us directly and indirectly.	2	0	2	3	1
25	It is not the duty of the government to inform people about climate change.	-1	-1	2	-1	-3
26	We can address climate problems by drafting laws that protect the environment.	1	0	1	1	3
27	We can solve climate problems when we stand together and unite.	3	1	1	3	0
29	Using sustainable technology is not good for the climate.	-1	0	0	-3	-1
Statements regarding metabeliefs						
33	It is difficult to educate people about climate change because of their beliefs.	0	-1	0	-2	2
34	It is possible to change my beliefs when someone else	-1	-2	-2	0	-2

	tells me to.					
35	In order to change our beliefs about the climate, we must sit down and discuss the matter.	2	1	1	1	1
36	My beliefs can change if I see in reality that things are different from what I believe.	2	2	2	0	2
37	My beliefs about the climate can change when I feel less vulnerable.	0	0	-2	0	0
38	I am open to change my beliefs, because I learn new things all the time.	1	2	0	0	3
39	It is not possible to change my beliefs.	-1	-1	1	0	-2
40	The climate influences how people feel emotionally and that may cause changes in their beliefs.	1	0	-1	-1	0

Annexure 3 Factor Q-Sort Values for Statements sorted by Consensus vs. Disagreement (Variance across Factor Z-Scores)

No.	Statement	No.	1	2	3	4	5
35	In order to change our beliefs about the climate, we must si	35	2	1	1	1	1
32	We do not have to respect the environment.	32	-2	-3	-2	-3	-1
18	The climate was not better when I was younger.	18	-2	-1	-3	-1	-1
34	It is possible to change my beliefs when someone else tells	34	-1	-2	-2	0	-2
23	We have the right to know about climate issues that affects	23	2	0	2	3	1
28	It is possible for humans to control the climate through tec	28	0	0	1	-1	0
36	My beliefs can change if I see in reality that things are di	36	2	2	2	0	2
40	The climate influences how people feel emotionally and that	40	1	0	-1	-1	0
31	The climate does not play an important role in our lives.	31	-2	-1	-3	-3	-3
14	Climate change is not caused by technology.	14	0	-2	0	-2	0
3	The climate is unpredictable.	3	0	2	0	0	2
24	Educating people about climate change will anger the ancesto	24	-3	-2	-1	-2	-2
26	We can address climate problems by drafting laws that protec	26	1	0	1	1	3
37	My beliefs about the climate can change when I feel less vul	37	0	0	-2	0	0
4	The climate is not changing.	4	-1	-2	-3	-3	-1
17	People are trying to make money, that's why they are damagin	17	0	0	-1	2	0
10	Climate change is caused by the fighting of the ancestors.	10	-3	-3	-1	-2	-2
29	Using sustainable technology is not good for the climate.	29	-1	0	0	-3	-1
30	It is difficult to care about climate change because of econ	30	-1	1	-1	1	1
21	We must act now to prevent the climate problems of the futur	21	2	1	2	2	0

39	It is not possible to change my beliefs.	39	-1	-1	1	0	-2
12	The climate is affected by the behaviour of people.	12	1	-2	0	1	0
6	Climate change is not a sign that the world is ending.	6	1	1	-1	1	-1
13	Increasing population growth causes climate change.	13	1	1	0	-2	1
2	The climate is not complicated.	2	0	-1	1	0	-2
16	The climate influences the growth of crops and the productio	16	3	2	3	2	0
22	Young people can help older people catch up with new knowled	22	0	3	1	2	3
9	Climate change is not punishment for the sins that people co	9	3	0	0	1	-1
38	I am open to change my beliefs, because I learn new things a	38	1	2	0	0	3
27	We can solve climate problems when we stand together and uni	27	3	1	1	3	0
15	Climate change is related to the burning of fossil fuels and	15	1	0	3	3	1
5	There is something wrong with the climate.	5	0	-1	1	2	2
33	It is difficult to educate people about climate change becau	33	0	-1	0	-2	2
25	It is not the duty of the government to inform people about	25	-1	-1	2	-1	-3
1	The climate is a natural part of the world we just have to a	1	0	3	-1	-1	1
7	Natural disasters happen when nature wants to reshape itself	7	2	1	-2	-1	0
20	The next generation will not be influenced by our current be	20	-2	0	-3	0	2
19	We can solve environmental problems by returning to the ways	19	-1	2	-2	1	-3
11	Traditional healers cause the climate to change.	11	-3	-3	0	-1	1
8	The climate is determined by God.	8	-2	3	3	0	-1

Annexure 4 Factor 1 Interpretation Sheet

Factor 1

Items Ranked at +3

9	Climate change is not punishment for the sins that people commit.	
16	The climate influences the growth of crops and the production of food.	
27	We can solve climate problems when we stand together and unite.	

Items Ranked Higher in Factor 1 Array than in Other Factor Arrays

2	The climate is not complicated.	0
4	The climate is not changing.	-1
6	Climate change is not a sign that the world is ending.	1
7	Natural disasters happen when nature wants to reshape itself.	2
9	Climate change is not punishment for the sins that people commit.	3
12	The climate is affected by the behaviour of people.	1
13	Increasing population growth causes climate change.	1
14	Climate change is not caused by technology.	0
16	The climate influences the growth of crops and the production of food.	3
21	We must act now to prevent the climate problems of the future.	2
27	We can solve climate problems when we stand together and unite.	3
29	Using sustainable technology is not good for the climate.	-1
31	The climate does not play an important role in our lives.	-1
35	In order to change our beliefs about the climate, we must sit down and discuss the matter.	2
36	My beliefs can change if I see in reality that things are different from what I believe.	2
37	My beliefs about the climate can change when I feel less vulnerable.	0
40	The climate influences how people feel emotionally and that may cause changes in their beliefs.	1

Items Ranked Lower in Factor 1 Array than in Other Factor Arrays

3	The climate is unpredictable.	0
8	The climate is determined by God.	-2
10	Climate change is caused by the fighting of the ancestors.	-3
11	Traditional healers cause the climate to change.	-3
22	Young people can help older people catch up with new knowledge about the climate.	0
24	Educating people about climate change will anger the ancestors and cause bad luck.	-3
26	We can address climate problems by drafting laws that protect the environment.	0

30 It is difficult to care about climate change because of economic pressures. -1

Items Ranked at -3

10 Climate change is caused by the fighting of the ancestors.

11 Traditional healers cause the climate to change.

24 Educating people about climate change will anger the ancestors and cause bad luck.

Additional Items

9 Climate change is not punishment for the sins that people commit.

(No neutral, definitive statement @ 3)

11 Traditional healers cause the climate to change.

(Very contested)

Annexure 5 Factor 2 Interpretation Sheet

Factor 2

Items Ranked at +3

1 The climate is a natural part of the world we just have to accept and live with.

8 The climate is determined by God.

22 Young people can help older people catch up with new knowledge about the climate.

Items Ranked Higher in Factor 2 Array than in Other Factor Arrays

1 The climate is a natural part of the world we just have to accept and live with. 3

3 The climate is unpredictable. 2

6 Climate change is not a sign that the world is ending. 1

8 The climate is determined by God. 3

13 Increasing population growth causes climate change. 1

18 The climate was not better when I was younger. -1

19 We can solve environmental problems by returning to the ways of the past. 2

21 We must act now to prevent the climate problems of the future. 2

22 Young people can help older people catch up with new knowledge about the climate. 3

30 It is difficult to care about climate change because of economic pressures. 1

36 My beliefs can change if I see in reality that things are different from what I believe. 2

37 My beliefs about the climate can change when I feel less vulnerable. 0

Items Ranked Lower in Factor 2 Array than in Other Factor Arrays

5 There is something wrong with the climate. -1

10 Climate change is caused by the fighting of the ancestors. -3

11 Traditional healers cause the climate to change. -3

12 The climate is affected by the behaviour of people. -2

14 Climate change is not caused by technology. -2

15 Climate change is related to the burning of fossil fuels and pollution. 0

23 We have the right to know about climate issues that affect us directly and indirectly. 0

32 We do not have to respect the environment. -3

34 It is possible to change my beliefs when someone else tells me to. -2

35 In order to change our beliefs about the climate, we must sit down and discuss the matter. 1

Items Ranked at -3

10 Climate change is caused by the fighting of the ancestors.

11 Traditional healers cause the climate to change.

32 We do not have to respect the environment.

Additional Items

8 The climate is determined by God.

(Very contested)

11 Traditional healers cause the climate to change.

(Very contested)

12 The climate is affected by the behaviour of people.

(Definitive statement @ -2)

32 We do not have to respect the environment.

(Consensus, no neutral)

Annexure 6 Factor 3 Interpretation Sheet

Factor 3

Items Ranked at +3

8 The climate is determined by God.

15 Climate change is related to the burning of fossil fuels and pollution.

16 The climate influences the growth of crops and the production of food.

Items Ranked Higher in Factor 3 Array than in Other Factor Arrays

8 The climate is determined by God. 3

10 Climate change is caused by the fighting of the ancestors. -1

14 Climate change is not caused by technology. 0

15 Climate change is related to the burning of fossil fuels and pollution. 3

16 The climate influences the growth of crops and the production of food. 3

24 Educating people about climate change will anger the ancestors and cause bad luck. -1

25 It is not the duty of the government to inform people about climate change. 2

28 It is possible for humans to control the climate through technology. 1

36 My beliefs can change if I see in reality that things are different from what I believe. 2

39 It is not possible to change my beliefs. 1

Items Ranked Lower in Factor 3 Array than in Other Factor Arrays

1 The climate is a natural part of the world we just have to accept and live with. -1

3 The climate is unpredictable. 0

4 The climate is not changing. -3

6 Climate change is not a sign that the world is ending. -1

7 Natural disasters happen when nature wants to reshape itself. -2

17 People are trying to make money, that's why they are damaging the environment. -1

18 The climate was not better when I was younger. -3

20 The next generation will not be influenced by our current behaviour towards nature. -3

30 It is difficult to care about climate change because of economic pressures. -1

31 The climate does not play an important role in our lives. -3

34 It is possible to change my beliefs when someone else tells me to. -2

35 In order to change our beliefs about the climate, we must sit down and discuss the matter. 1

37 My beliefs about the climate can change when I feel less vulnerable. -2

38 I am open to change my beliefs, because I learn new things all the time. 0

40 The climate influences how people feel emotionally and that may cause changes in their beliefs. -1

Items Ranked at -3

4 The climate is not changing.

18 The climate was not better when I was younger.

20 The next generation will not be influenced by our current behaviour towards nature.

31 The climate does not play an important role in our lives.

Additional Items

8 The climate is determined by God.

(Very contested)

18 The climate was not better when I was younger.

(Consensus, no neutral)

20 The next generation will not be influenced by our current behaviour towards nature.

(Very contested)

25 It is not the duty of the government to inform people about climate change.

(Definitive statement @ 2)

31 The climate does not play an important role in our lives.

(No neutral)

Annexure 7 Factor 4 Interpretation Sheet

Factor 4

Items Ranked at +3

15 Climate change is related to the burning of fossil fuels and pollution.

23 We have the right to know about climate issues that affect us directly and indirectly.

27 We can solve climate problems when we stand together and unite.

Items Ranked Higher in Factor 4 Array than in Other Factor Arrays

2 We do not have to respect the environment. 0

5 There is something wrong with the climate. 2

6 Climate change is not a sign that the world is ending. 1

12 The climate is affected by the behaviour of people. 1

15 Climate change is related to the burning of fossil fuels and pollution. 3

17 People are trying to make money, that's why they are damaging the environment. 2

18 The climate was not better when I was younger. -1

21 We must act now to prevent the climate problems of the future. 2

23 We have the right to know about climate issues that affect us directly and indirectly. 3

27 We can solve climate problems when we stand together and unite. 3

30 It is difficult to care about climate change because of economic pressures. 1

34 It is possible to change my beliefs when someone else tells me to. 0

37 My beliefs about the climate can change when I feel less vulnerable. 0

Items Ranked Lower in Factor 4 Array than in Other Factor Arrays

1 The climate is a natural part of the world we just have to accept and live with. -1

3 The climate is unpredictable. 0

4 The climate is not changing. -3

13 Increasing population growth causes climate change. -2

14 Climate change is not caused by technology. -2

28 It is possible for humans to control the climate through technology. -1

29 Using sustainable technology is not good for the climate. -3

31 The climate does not play an important role in our lives. -3

32 We do not have to respect the environment. -3

33 It is difficult to educate people about climate change because of their beliefs. -2

35 In order to change our beliefs about the climate, we must sit down and discuss the matter. 1

36 My beliefs can change if I see in reality that things are different from what I believe. 0

38 I am open to change my beliefs, because I learn new things all the time. 0

40 The climate influences how people feel emotionally and that may cause changes in their beliefs. -1

Items Ranked at -3

4 The climate is not changing.

29 Using sustainable technology is not good for the climate.

31 The climate does not play an important role in our lives.

32 We do not have to respect the environment.

Additional Items

29 Using sustainable technology is not good for the climate.

(Definitive statements @ -1, -2 and -3)

23 We have the right to know about climate issues that affect us directly and indirectly.

(Consensus)

31 Using sustainable technology is not good for the climate.

(Consensus)

32 We do not have to respect the environment.

(Consensus, no neutral)

Annexure 8 Factor 5 Interpretation Sheet

Factor 5

Items Ranked at +3

22 Young people can help older people catch up with new knowledge about the climate.

26 We can address climate problems by drafting laws that protect the environment.

38 I am open to change my beliefs, because I learn new things all the time.

Items Ranked Higher in Factor 5 Array than in Other Factor Arrays

3 The climate is unpredictable. 2

4 The climate is not changing. -1

5 There is something wrong with the climate. 2

11 Traditional healers cause the climate to change. 1

13 Increasing population growth causes climate change. 1

14 Climate change is not caused by technology. 0

18 The climate was not better when I was younger. -1

20 The next generation will not be influenced by our current behaviour towards nature. 2

22 Young people can help older people catch up with new knowledge about the climate. 3

26 We can address climate problems by drafting laws that protect the environment. 3

29 Using sustainable technology is not good for the climate. -1

30 It is difficult to care about climate change because of economic pressures. 1

32 We do not have to respect the environment. -1

33 It is difficult to educate people about climate change because of their beliefs. 2

36 My beliefs can change if I see in reality that things are different from what I believe. 2

37 My beliefs about the climate can change when I feel less vulnerable. 0

38 I am open to change my beliefs, because I learn new things all the time. 3

Items Ranked Lower in Factor 5 Array than in Other Factor Arrays

2 The climate is not complicated. -2

6 Climate change is not a sign that the world is ending. -1

9 Climate change is not a sign that the world is ending. -1

16 The climate influences the growth of crops and the production of food. 0

19 We can solve environmental problems by returning to the ways of the past. -3

21 We must act now to prevent the climate problems of the future. 0

25 It is not the duty of the government to inform people about climate change. -3

27 We can solve climate problems when we stand together and unite. 0

31 The climate does not play an important role in our lives. -3

34 It is possible to change my beliefs when someone else tells me to. -2

35 In order to change our beliefs about the climate, we must sit down and discuss the matter. 1

39 It is not possible to change my beliefs. -2

Items Ranked at -3

19 We can solve environmental problems by returning to the ways of the past.

25 It is not the duty of the government to inform people about climate change.

31 The climate does not play an important role in our lives.

Additional Items

19 We can solve environmental problems by returning to the ways of the past.

(Very contested)

25 It is not the duty of the government to inform people about climate change.

(No neutral, definitive statement @ -3)

31 The climate does not play an important role in our lives.

(No neutral)

33 It is difficult to educate people about climate change because of their beliefs.

(Definitive statement @ 2)

Annexure 9 Co-author permission letter – J.V. Dokken

CO-AUTHOR PERMISSION FOR ARTICLE: "Challenges to belief systems in the context of climate change adaptation".

To Whom It May Concern:

As co-author of the presented article, I hereby give permission that the article may be included as part of the dissertation that will be submitted in partial fulfilment of the requirements for the degree *Magister Artium* in Development and Management at the North-West University and declare that the student contributed sufficiently to the research and the writing process of the presented article.

Signed at Eidsvoll

on the 03th day of July 2016.

Signature: Jon Vegard Dokken

Full Name: Jon Vegard Dokken

Title: Master of Philosophy in Human Geography

Affiliation: University of Oslo

Annexure 10 Co-author permission letter – D. van Niekerk

CO-AUTHOR PERMISSION FOR ARTICLE: "Challenges to belief systems in the context of climate change adaptation".

To Whom It May Concern:

As co-author of the presented article, I hereby give permission that the article may be included as part of the dissertation that will be submitted in partial fulfilment of the requirements for the degree *Magister Artium* in Development and Management at the North-West University and declare that the student contributed sufficiently to the research and the writing process of the presented article.

Signed at _____Potchefstroom_____, on

the 4th day of April 2016.

Signature: 

Full Name: Dewald van Niekerk

Title: Prof.

Affiliation: NWU – African Centre for Disaster Studies

Annexure 11 Co-author permission letter – R.A. Loubser

CO-AUTHOR PERMISSION FOR ARTICLE: "Challenges to belief systems in the context of climate change adaptation".

To Whom It May Concern:

As co-author of the presented article, I hereby give permission that the article may be included as part of the dissertation that will be submitted in partial fulfilment of the requirements for the degree *Magister Artium* in Development and Management at the North-West University and declare that the student contributed sufficiently to the research and the writing process of the presented article.

Signed at Potchefstroom,

on the 30 day of May 2016.

Signature: _____

Full Name: R A Loubser

Title: Dr.

Affiliation: North-West University

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