THE CONFLUENCE OF RHETORIC AND SCIENCE: A RHETORICAL ENQUIRY OF CLIMATE CHANGE PUBLICATIONS IN NAMIBIA

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GERSON IHEMBA SINDANO

200113550

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MAIN SUPERVISOR: PROF. JAIROS KANGIRA (UNIVERSITY OF NAMIBIA)

CO-SUPERVISOR: PROF. REWAI MAKAMANI (NAMIBIA UNIVERSITY OF SCIENCE AND TECHNOLOGY)

ABSTRACT

The thesis explored the dynamics of the rhetoric of the language of science on climate change publications. The arguments presented in this study were drawn from a theoretical framework that saw rhetorical arguments, texts and general discourse as instruments of communication of science publications on climate change in Namibia. Thus, Rhetorical Structure Theory (RST) was used in this study. The theoretical framework of the study was extended to incorporate the Aristotelian rhetorical theory. The study aimed at making a consequential input to an ongoing debate about climate change in Namibia and the world over; the use of rhetorical devices in the construction of knowledge about climate change; analysis and exploration of rhetorical elements employed by science researchers.

The research was inspired by the study of rhetoric. As such the study looked at the progression of persuasive methodical arguments and facts, as a result providing clear understanding of how scientific publications influence government policy on climate change. The study adopted a qualitative approach. By employing the qualitative approach the emphasis was to discover and understand the epistemological dynamics of rhetoric of science. Rhetorical interpretations of science publications seemed complex, and as such required a research design that enabled such complexity to be analysed and explored. Against this background, this study used the qualitative methodology of desktop research. As a desktop study, the researcher analysed existing climate change sources or publications. The study found that different rhetorical moves and strategies were used by the authors of the analysed documents to try and influence policy makers and the public.

The study revealed the frequent use of scare tactics by the authors to try and persuade the public regarding climate change. Moreover, the study exposed the presence of language forms that

seemed to rely on perpetual persuasive techniques in order to persuade the current and future generations. Extraordinarily, the analysed publications made known how writers use visual images in a dramatic fashion to appeal to their peers, followers, and mostly the general public. The study developed a new language filter model of science interpretations because the existing models seem to be effective only in dealing with large information; they, however, lack the epistemological and ontological interconnections between science and public interest.

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DEDICATION

This thesis is dedicated to my late parents, Klementine Kakoya Sindano and Paulus Sindano (May their souls rest in peace). Simultaneously, I dedicate this study to one of my best friends, and the first female PhD holder in both Kavango East and West regions of Namibia, the late Dr. Felistas Kunyima Mberema.

DECLARATION

I, Gerson Ihemba Sindano, hereby declare that this study is a true reflection of my own research, and that neither this work, nor any part thereof, has been submitted for a degree in any other institution of higher education.

Gerson Ihemba Sindano; ----------……. Date: _____

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ACRONYMS AND ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
CCVAAN	Climate Change Vulnerability and Adaptation Assessment Namibia
CFCs	Chlorofluorocarbons
CH_4	Methane
$C0_2$	Carbon dioxide
DNA	Deoxyribonucleic acid
EIA	Environmental Impact Assessment
GDP	Gross National Product
GTZ	German Technical Cooperation
HIV	Human Immunodeficiency Virus
IPCC	Intergovernmental Panel on Climate Change
NCCP	National Climate Change Policy
NDC	Nationally Determined Contribution
NEMA	National Environmental Management Act
NPC	National Planning Commission
N_2O	Nitrous Oxide
RST	Rhetorical Structure Theory

SADC REEP	Southern African Development Community, Regional Environmental Educational Program
UNFCCC	United Nations Framework Convention on Climate Change
UN	United Nations

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CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 Introduction and background

The rhetoric of science seems to be grounded in the assumptions that rhetoric mediates the shape and the systematic influence of science. Gross (1990) argues that understanding science requires a legitimate subject of rhetoric. This is because rhetorical conjecture provides an illuminating model and a set of methodical techniques for the elucidation of the complex texts generated by particular cases of scientific communication or publications.

Thus, the rhetorical analysis of science texts and discourse brings attention to the persuasive magnitude of scientific findings. Accordingly, the present study explored and examined rhetorical devices used in selected academic science publications in Namibia on the subject of climate change, to provide a better understanding of science discourse. The investigation was based on the theoretical framework that sees rhetorical argument, structure, and discourse as important features of science publications on climate change.

Equally, the study of rhetoric has traditionally and particularly been concerned with humanities and social sciences. The findings and knowledge produced by rhetorical studies have been, it seems, arranged as a system of perception rather than authentic science knowledge.

Gross (1993) contends that underneath the facade of objectivity resides a ferocious struggle to gain followers for a particular viewpoint and claim precedence for a breakthrough. Science findings and science knowledge are believed to have been founded as a result of rigorous testing and experimenting, and as such they are equated to a strong rational conviction and do not depend on persuasion (Behrendt, 2001). Because of the traditional belief that science does not use persuasive techniques, there seems to be a dearth of critical information on the rhetoric

of science publications on climate change in Namibia. The role of rhetorical presence in scientific findings and scientific knowledge production has, to a certain degree, been ignored.

In the current study, attempt was made to examine the rhetorical devices used in science publications on climate change in Namibia. The study offers insights and perspective concerning science communication in relation to other forms of communication. Persuasive techniques and strategies employed by the authors in published climate change papers were meticulously examined, including the pictures used in those publications. Chapter 1 sets the scene for this dissertation, covering wide range issues pertaining to the rhetoric of climate change publications in Namibia. Due to the unexpected improvement in science and technology in recent years, it is fair to argue that science publications and the use of language in those publications seem to have changed gradually.

1.2 Statement of the problem

According to Burke (2015) climate change is perhaps one of most challenging scientific and political issues of our time. However, despite the threat of a changing climate, scientific findings and communication of those findings are still being questioned by sceptics of climate change. Levine and Kline (2017) observed that a significant number of Americans, for example, do not consider climate change as an important problem facing their country; they are simply not engaged in wide-scale advocacy efforts to address climate change challenge.

In Namibia, Dupisani (2017) observed that the water supply to the city of Windhoek in 2017 was cut by 20%, and that equally the decision by the Namibian President Hage Geingob to declare a drought relief state of emergency, on the 24th of June 2016, are all associated with climate change. Even though uncertainty as to whether any direct links can be drawn between

present climate happenings, recent trends in climate variables, such as temperature and precipitation, and predictions of Namibian climate change, a consensus has been realised that something should be done about climate change in Namibia and elsewhere (Nhemachena & Hassan, 2007).

Following climate change warnings by scientists, in the study of climate adaptations in Southern Africa, Nhemachena and Hassan (2007) found that at least 45% of the respondents (farmers) had anticipated a reduced precipitation in the future. However, 40% of the respondents, according to the study, did not adopt any environmental adaptation strategies to mitigate climate change conditions because they did not believe the warning, since the rainfall recording for the following year increased, defying scientific warning of a reduction in rainfall for that year (Nhemachena and Hassan, 2007).

The farmers therefore regarded the warning as an exaggeration. Again, despite compelling scientific findings and evidence about climate change, why is there still so much scepticism (40%)? Can the climate change scepticism be attributed to the scientific forms of messaging? Thus, the present study systematically examined and explored rhetorical devices used in science publications as a way to show how scientists use language to persuade readers, fellow scientists and policy makers. The publications ranged from the year 2004 to 2016.

1.3 Objectives of the study

The main objectives of the study were to:

1.4.1 Analyse scientific persuasion and how language forms are used in the selected academic science publications;

1.4.2 Interpret and judge the rhetorical effect of visuals used in the selected science publications; and

1.4.3 Develop a model for the language of science interpretation for environmental policy makers and the general populace for easy understanding of scientific discourse.

1.4 Significance of the study

Findings emanating from this study add information to the existing body of knowledge. Equally, the findings from this study also provide a better understanding for scholars and the general populace regarding climate change discourse. The findings also present information on the rhetorical effects of language in science publications, and this may be useful in enhancing the effective use of visuals by climate change researchers. In addition, the research may be helpful to those who wish to study and pursue further research in this area.

The fact that a model of the language of science interpretation is developed is in itself a welcome move to those who intend to deconstruct the language of science and need to have a better understanding on the reality of clime change in Namibia. In the end, the research findings can be helpful to policy makers to have knowledge and a better understanding on climate change discourse and be able to make meaningful policies that respond to the environmental needs of the country.

1.5 Limitations of the study

Limitations are intended to recognise potential weaknesses of the study. Research strategies and procedures have got their limitations. The qualitative nature of this study meant that the numerous limitations that sprang from this study needed to be taken into consideration and interpreted. The fact that a limited number of climate change publications were used meant that

the likelihood of overgeneralisation was to occur. As such, generalising the findings to global audience may be challenging as writers living in different areas of the world might have different experiences regarding climate change and the way it should be presented in writing to different audiences.

Nevertheless, generalisation can still be made from the findings to help us understand the rhetoric of climate change beyond the borders of Namibia. Of course, qualitative approach does not aim to be statistically representative of the findings, but it provides context to the sample. Notwithstanding the limitations of the study, the study provided a wider understanding on how scientists communicate their findings into the public discourse.

The study was limited to a critical examination of the selected scholarly science publications on climate change in Namibia. Engaging the authors of the selected publications would have been ideal, but due to logistical constraints, this was not possible.

1.6 Delimitation of the study

Delimitations are intended to reduce and narrow the scope of the study. For example, the interpretational latitude may centre on various specific variables. There is a plethora of literatures on the rhetoric of science, but the fact that this research study used a sample of 20 science publications delimits the study only to those selected publications. The differences in the science dynamics in different subjects could mean that some science publications may not entail the rhetorical features extracted from the analysed texts.

1.7 Conclusion

In this chapter introduction and background, statement of the problem, objectives, significance, limitation and delimitations of the study are discussed.

CHAPTER 2: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

Following a review of a plethora of literatures, this chapter presents the opinions, contributions and findings of various industry experts, scholars and researchers about the rhetoric of the language of science on climate change in Namibia. Correspondingly, the chapter covers a wide range of discussions about rhetorical enquiry of climate change. The context of the literature review provides an opportunity for the identification of gaps in the reviewed literatures and creates a link between the preceding studies and the study at hand.

The initial section of the chapter deals with scientific persuasion and language forms. The discussion brought to the fore the essential rhetorical moves and elements that exist in the rhetoric of science. These moves are within the rhetorical structure which underpins the study. Furthermore, the segment underscores the theoretical framework and the discussion surrounding the rhetoric of science from a comprehensive point of view.

The second section of the chapter tackles the rhetorical effect of visuals used in science. This part looks at the scholarly contributions and discussions in the form of visuals. The examination of the effects of visuals in science by previous studies is explained. In the final section of the literature review, previous language models and science interpretations are presented and discussed.

2.2 Rhetoric of science

The idea that rhetoric exists in science studies, to many, is virtually non-existent and unheard of, let alone scientific findings on climate change. Some may ask: why bother study rhetoric in

science publications, when it is general knowledge that science rests on evidence, and as such it is disconnected from persuasion? In addition, for a long-time science has been characterised by a firm anti-rhetorical tradition. Gross (1993) contends that underneath the facade of objectivity resides a ferocious struggle to gain followers for a particular viewpoint and claims of precedence for a breakthrough.

Science findings and science knowledge are believed to have been founded as a result of "rigorous testing and experimentation, and as such it is equated to a strong rational conviction and does not depend on persuasion" (Behrendt, 2001, p. 189). Because of a traditional belief that science does not use persuasive techniques, there is a dearth of critical information on the rhetoric of science publications on climate change in Namibia. As a result, an independent source of evidence to secure social scientific claims on climate change and the ground for the facts of science in the public interest has been largely ignored.

In order to understand the rhetorical analysis of science publications on climate change in Namibia, it is imperative to define and explain what rhetoric of science is. There is a plethora of definitions and explanations provided concerning rhetoric, but for purpose of this study some of the definitions are used. Welldon (1886) cites that Aristotle defines rhetoric as the faculty of discovering in any particular case all of the available means of persuasion.

Gross (1993) observes that Aristotle had seen that rhetoric was an activity that was central to the efficient functioning of the Greek city state. For Aristotle, Welldon (1886) and Kennedy (1991) argue, it was more of an oral culture and male culture to see the available means of persuasion in each case and effectively utilise those means with the desire of reinforcing

conviction and deed. In other words, rhetoric is an attempt to coordinate and influence human choices on specific matters that require immediate attention.

For the purpose of the present study, an explanation of rhetoric of science by Gross (1993) is used. Gross (1993, p.3) defines rhetoric as "the process of persuasion in the lab and in the field, and in the study." On the contrary, some scientists such as Max Perutz (as cited in Frye, 1996, p.1) views rhetoric of science rather differently from other scholars. Perutz is reported to have said "rhetoric of science is humbug" (as cited in Frye, 1996, p.1) and that individuals who do not understand the underlying science are the ones who attempt to critically examine scientific writings.

However, Gross (1993) presents contradictory views by presenting the example of Thomas Kuhn's analysis of how scientific discourse occurs as follows:

> The brute facts themselves mean nothing; only statements have meaning, and of the truth of those statements we must be persuaded. These processes, by which problems are chosen and results interpreted, are essentially rhetorical: only through persuasion are importance and meaning established (Gross, 1993, p.4)

Therefore, the above quotation firmly proffers that rhetoric is inevitable and ubiquitous in scientific discourses.

Rhetorical analysis of science publications on climate change in Namibia can provide a model for public understandings of the language of science, textual characteristics, visuals and context. Gross (1990) argues that understanding science requires a legitimate subject to rhetoric. This is because rhetorical conjecture provides an illuminating model and a set of

methodical techniques for the elucidation of the complex texts generated by a particular case of scientific communication or publications.

It should further be understood that the rhetoric of science is philosophical for the task at hand in that the authenticity of what climate scientists write about is irrelevant to analysing how they win over their peers that a particular analysis is acceptable or unacceptable. Gross' (1993) investigation of the DNA discovery, Charles Darwin's formulation of his theory of evolution, and Isaac Newton's effort to have his Optics accepted by the scientific community demonstrate how science writing, further than the bare appearance of measures and 'truthful' results, is mutually a biased and juridical process. The political observation is over which hypothesis should be followed and over what substantiation should be weighed within the framework. The fact that scientists concur with regards to the examination of scientific 'reality' makes the nature of those realities debatable.

As an academic field of study, Gale (2005) sees rhetoric of science as a study of how scientists and non-scientists the world over use arguments to advance claims about science. As it is stated before, the idea that rhetoric exists in science may seem perverse to some scholars, and to some it may seem obvious. Most scientists perhaps view rhetoric as something that probably connotes something less truthful, particularly in politics. Tying rhetoric to science seems like a curse which Gale (2005) refers to as staining the purity of certain knowledge and accurate measurement with the mark of ideological bias and political manoeuvring. Of course, to scholars of rhetoric, the term rhetoric of science is not necessarily seen as having connotations. Rather, rhetoric of science is viewed from its ancient tradition; it denotes the meticulous examination of how texts are designed to seek the attention of the audience or public.

In the world of academia, rhetoric does not mean mere falsehoods or empty words over substance. Ceccarelli (2017) observes that despite drawing from old tradition, rhetoric of science is still seen as a relatively young field of study. However, despite being a young field, Ceccarelli (2017) believes that rhetoric plays a significant role in understanding climate change. For example, rhetoricians have introduced the concept of litotes as a way for climate scientists to respond effectively to imprecise but poignant imagery. Ceccarelli (2017) views litotes as a figure of speech which functions as an understatement by stating the negation of its opposite and notable is that litotes rely on the texts.

To all intents and purposes, when these texts come from the realm of science, the means of persuasion used entail factors as appeals to disciplinary assumption and values, and revelation to methodological rigour, and the chosen discourse that suggests the neutral observation of nature. In any case, the opposition from scientists who view rhetoric as telling 'untruths', the notion that communication between scientists and the general public might have persuasive dimensions seems to be rarely refuted. Weimer (1977) observed that the first hint about rhetorical inquiry being applied to scientific discourse began appearing in the journals in the 1970s. Actually, Overington (1977) argues that research about examining persuasive nature of scientific texts equally began in the 1970s.

Consequently, Harris (1991) recorded that the development of this field resulted in the birth of two books on rhetoric of science: *A Rhetoric of Science* (1989) by Lawrence J. Prelli and Alan Gross' *The Rhetoric of Science* (1990). After reviewing various literatures, the findings reveal that during the initials stage of rhetoric of science, most studies in the new field focused on the internal rhetoric of scientists rather than specifically on climate change. Needless to say, internal rhetoric of scientists focused on the discourse that scientists use when communicating

their findings to other scientists; this is either within their own discipline or across disciplines (Gale, 2005).

In the initial stage of rhetoric of science development most scholars, of course, focused on internal rhetoric because they thought that internal discourse of scientists was resistant to rhetorical scrutiny. Conversely, despite the limitation in the scope of the study, rhetoric of science began to expand, with scholars such as Bazerman (1988), Gross (1990), miller (1992) Fisher (1994) examining various scientific articles to explain their persuasive designs via rhetorical theories *vis-à-vis* ethos, irony, *kairos*, stasis and narrative.

A notable observation is how research was devoted to the development of the rhetoric of science to illuminate writing practices in the science genre. Standing out is the manuscript written by Bazerman (1988) in which scientific articles were contrasted with other forms of discourse. The findings of Bazerman (1988) revealed how scientists used, transformed and invented equipment and tricks of symbolic trade to influence claims so that they are judged truthfully by other scientists.

Various studies have demonstrated how scholars of rhetoric of science have done a wonderful job of revealing how the style in which a scientific claim is communicated has an influence on how scientists view that claim. Fahnestock (1999) carried out a study on rhetorical figures in science and the findings revealed that language does much of the thinking for everyone, including in sciences, and rather than being an unfortunate tainting, its influence had been seen as prolific, assisting every thinker to come up with concepts and theories that could be tested.

Scholarly, scientists view themselves as perhaps responsible for that growth of knowledge, and this knowledge is the central activity of scientists. Scholars of rhetoric have focused on the way scientists use the tools of language and arguments to advance knowledge claims. An interesting internal rhetoric of science which has received less attention is the way in which scientists convince and persuade one another pertaining to the area of research that holds future promise.

This reluctance prompted Myers (1990) to devote a whole chapter explaining the rhetoric of grant proposal, a kind of scientific writing that should persuade reviewers that a research proposal deserves funding because it has potential interest to the scientists and the professional ethos of the writers. Myers' (1990) effort was later on complimented by Ceccarelli (2001), who examined the motivational texts of science to reveal that scientists who tend to use strategic ambiguity of language are likely able to induce fellow scientists from various disciplines to overcome barriers that are divergent from their fields. The studies by both Myers (1990) and Ceccarelli (2001) point to the direction that the internal rhetoric of science tends to be descriptive and broadly explanatory in its makeup.

However, a further analysis of the two studies' findings reveal that rhetoric of science entails implicit prescriptive ethos, providing different resources of a language and argument which scientists seem to use to shape and mould science in an ethical way. Fahnestock (1986) demonstrated, after contrasting scientific journal articles which were written for popularisation purposes, that the rhetorical inquiry that focuses on popularisation, which is another genre of rhetoric of science – tends to do away or remove hedges.

It can be seen from the above findings that the absence of hedges and other rhetorical devices may be distorted by the public or audience about the importance of scientific knowledge claim, which can easily be precarious if the subject entails threatening social implications. Public audiences tend to develop an image of science as the unquestioned observation of nature and does not have any interferences from scientists regardless of the methods and theories these scientists employed.

Rhetoric of science is a relatively young field and as such, there is a gap in this specific discourse. Myers (1990), Fahnestock (1986) and Ceccarelli (2001) demonstrate how scientists use rhetoric in their writing, but these literatures seem to lack the model or explanation that explains and connects the existing knowledge of science and the unknown or undiscovered knowledge. Findings by various authors such as Bazerman (1988), Preli (1989) and Ornatowski (2007) lack an insightful understanding of a rhetorical representation of the 'unknown knowledge.' To all intents and purposes, an examination of all the literatures used in this study reveals a lack of understanding on how the undiscovered knowledge in science can be represented by a model that has a potential to demystify the notion of pure science in relation to the connection between climate change perception and the public understanding of climate change.

It seems the above situation could be attributed to the rhetoricians for either being apprehensive or hesitant to explain more about the rhetoric of predictions in science which climate change seems to be characterised by. Most studies focused on the physical nature of science but there seems to be a dearth of information on the study of the language of science on weather predictions, which are issues which scientists on climate change are concerned with.

Woolgar (1979) carried out a study on the rhetoric of science in which the process of scientific statements gained assent, and intimately become accepted as facts by the wider scientific community. The findings of the study revealed how raw materials in the laboratory can hurriedly be modified into symbolic currency through the usual activities of labelling, coding and classifying. Furthermore, the results of the study revealed how scientists subject those raw materials to devices, inclusive of scales and spectrometers, which eventually produce still more focused symbolic representation of the materials in the form of graphs, tables and charts.

At each stage of the labelling, Woolgar (1979) found that the previous activities were rapidly forgotten because what mattered to the scientists was to forward the final symbolic representation to the scientific paper for inclusion. These findings prompted historians of science to begin a thorough examination of the formation of modern science and the way modern science had been done in local belief and practices. These historians questioned the exclusive authority of scientific writing which had been representing itself for a long time as non-rhetorical.

Other studies on the rhetoric of science were carried out in the collection of essays by Seizer (1993). The essays reveal some of the methodologies or approaches used, such as narratives, cultural studies, intersexuality gender studies, classical rhetoric and linguistic pragmatic. The findings in all the essays presented pointed to the fact that science indeed cannot escape rhetoric (Seizer, 1993). However, despite all the evidence about the rhetoric of science, some scholars such as Ornatowski (2007) concluded that there is still less argument on the extent to which science is viewed as rhetorical.

Science scholars may bristle at the suggestion of rhetoric of science and may see it as an implicit invasion on the status of science, particularly its epistemological claim. For some scientists such as Max Perutz (as cited in Frye, 1996) the idea of science of rhetoric could be interpreted as an attack on their integrity. What these scientists should perhaps understand is that science involves a language, and as such, it inescapably entails rhetoric.

Ornatowski (2007) notes that whatever makes a functional use of words and phrases is likely to be involved in the technical problems associated with words, including rhetorical issues. Ornatowski (2007) likewise argues that the rhetorical outlook of science anchors at the bottom on the premises that science is nature, but science only represents it, and of course any representation entails strategies of representation.

Gould (1981) contends that in science data speak for themselves, but Keller (1985), Blackstone (2004) and Rickert (2013) seemed not to buy into the idea of scientific data speaking for itself when the scholars argued that despite scientists insisting on the idea of data speaking for itself, the truth is that data does not really 'speak' (Keller, 1985). Blackstone (2004), Keller (1985) and Rickert (2013) argue that people speak for the data, and when they do they inevitably face challenges such as what to say (invention); who should listen (audience); what is the aim of presenting the data (argumentation); ways in which data should be prepared (stylistic), and the manner of presentation and articulation (delivery). Therefore, rhetoric of science entails issues of how and what scientists decide to say. Similarly, it entails issues of scientists' way of communicating, and how they communicate.

Discourse seems to be embedded in the process of creating and arriving at scientific knowledge. Reeves (2005) explains that the term discourse, apart from the common understanding that

discourse refers to the structure of rules for language use that evolves in the community through conscious choice and cultural forces, also refers to the patterns of a language that can be identified as bound to a particular community and context. This view is supported by Latour (1987) who argues that the formulation of scientific knowledge involves scientists arguing and negotiating their written texts with reviewers, editors and even fellow scientists in the laboratory.

Based on this explanation by Latour (1987), it can be argued that scientific discourse therefore refers to the general language of science and the patterns of rule-governed language used among scientists (Reeves, 2005). All language is governed by rules; that is when one speaks or writes, one must follow rules guiding word order and idioms as well as specialised rules for communicating in a specialised community. In specialised communities such as science, rules and conventions evolve over time, in response to new pressures and needs. From these arguments it can be seen that discourse does not only express the emerging knowledge but also moulds the emerging knowledge through specialised rules.

Various scholars such as Malone (1998) and Bitzer (1968) have also postulated that scientific texts may carry a complex connection between knowledge and practical reality. To substantiate this observation, Keller (1985) once again noted that many scholars of science have singled out the structure of scientific papers, arguing that the actual experience of carrying out science activities is not always reflected in the final paper. This observation seems to hold water because final science publications rarely reflect incidents, failures and negotiations. Of course, science research and publications require that scientists interpret, articulate, compose, discuss and review their publications.

Ornatowski (2007) agrees with the above submission, arguing that ideas and language are inextricably linked and intertwined. Ornatowski (2007) further explains that ideas do not exist in some neutral space, but they emerge in response to circumstances, and they are adjusted. On this ground, it can be argued that rhetoric of science attempts to identify the presence of the underlying assumptions in a scientific text. Arguably, rhetorical approaches to science start with the connection between practice, discourse, knowledge and attempts to arrive at a coherent record of science as a particular area of discourse.

It should further be noted that despite some initial cynical approaches by rhetoricians to undermine science on the basis that it pretends to be objective, neutral and privileged, rhetoric of science has since become a section of a bigger philosophical effort to rethink the nature of human knowledge in light of wider debates.

A study carried out by Preli (1989) looked at five dimensions of scientific discourse. One of the dimensions that seem to stand out is that of symbolic inducement wherein it is argued that scientists tend to induce others to share an orientation for assessing and sensing of situated phenomena and the connections among them. These scientists seem to be well aware that research and writing processes entail decision making, adjudication, negotiation and selection. They use all these characteristics to motivate any choice they make in a laboratory or in the field. To ensure that their findings are acceptable, a claim is shown as consistent, systematic, standardised and seems measurable. Ornatowski (2007) contextualises this observation by saying that scientific discourse tends to exhibit an increased persuasive orientation and prefers contextualisation that Prelli (1989) refers to as the period for symbolic inducement.

Another scientific rhetorical dimension of scientific discourse unearthed by Prelli (1989) is the situatedness dimension. Under this dimension, rhetorical moves such as exigencies – appropriate event that calls for response – inclusive of context of audience expectations and conditions, is demonstrated by scientific discourse. Prelli (1989) reveals that scientific discourse is situated in the rhetorical sense, arguing that scientists work, speak and write in various places that makeup rhetorical situations, with embedded expectations, constrains and opportunities.

In the same study, Prelli's (1989) findings revealed a third dimension of scientific discourse: the transactional dimension. The study by Prelli (1989) argues that the third dimension orientates towards gaining acceptance for one's ideas and findings, securing interest in one's work and associating one's activity in what is seen as a prestige field and connections. Meanwhile the fourth dimension of scientific discourse looks at reasonableness of the activity. Herein, scientific claims are dully judged based on the basis of formal logic not according to reasonableness that holds for other kinds of discourse, but the judgment is in accordance with the criteria of reasonableness that is particular to science. Criteria may include relevance of data, precision of measurements, result consistency and warrantedness of conclusions.

By the same token, the fourth dimension entails problem solving skills through experimentation – replication, corroboration, and observational competence, and predictive power.

- Evaluative – involves accuracy, internal consistency, scope simplicity and elegance.
- Exemplary – involves examples, analogies and metaphors.
- Ethical – involves universality, scepticism, and commonality.

The above criteria may alter overtime, and it may even be foregrounded or challenged as part of the argument. It is this knowledge which is essential to professional and rhetorical competence of the scientists (Prelli, 1989).

The fifth and perhaps, the most prominent dimension of scientific discourse is the invented dimension. The invented dimension has nothing to do with information being cooked up or made up, but the term merely refers to how scientists do not necessarily ramble on about their findings and theories but rather how they engage in coherent argumentation and presentational theatrical performance. The performance entails, inter alia, recognising appropriate purpose for the argument, pinpointing the exact position of departure – the stasis whereby scientists are situating themselves within existing body of knowledge, and sticking to orthodox criteria for reasonableness and usefulness (Prelli, 1989).

Looking at these five dimensions, one is compelled to argue that in scientific texts, any form of accountability which Bazerman (1988) noted should entail successful adjudication among different contexts; these being the object under discussion (types of information conveyed), existing body of knowledge and prior literature in a field (research problem, location and methodology), and audience, which relates to the knowledge and attitudes assumed in the anticipated audience, including the structure of the argument in view of the anticipated audience. Bazerman (1988) concluded that science, as traditionally put, is rational, but its rationality can only be realised through linguistic, rhetorical and social options, all with epistemological repercussions.

Hossain and Marinova (2011) carried out a study on the rhetoric about climate change in Bangladesh. The study revealed that the rhetoric about climate change in the country of study

was diverse. The study first pointed out the existence of the scientific evidence by the Intergovernmental Panel on Climate Change (IPCC), wherein the issue of rising sea level and sinking of coastal areas were reported; but other scholars refuted the presented evidence with alternative views. The study similarly revealed how most people from Bangladesh viewed the unilateral withdrawal of India from the water summit as contributing to an increase in desertification in the western part of the country (Hossain and Marinova, 2011).

Daringly, the study further accused the Bangladeshi authority of being morally bankrupt for not standing up to address the water-sharing problem with India. Fascinatingly, the study also revealed how religious and spiritual people perceive climate change. The findings indicate that religious people view climate change as a result of human transgressions on nature's limits. The study finally concluded that regardless of the diverse rhetoric, inhabitants in Bangladesh should continue to technologically dominate nature (Hossain & Marinova, 2011).

2.3 Language of science

Daughton (2016) explains that rhetoric resembles science in that both the scientist and the rhetor yearn to be taken seriously. In the current study for example, the scientists argue in order to persuade the readers to believe that climate change is a serious concern, and that measures should be put in place as soon as possible to mitigate the threats posed by climate change. Additionally, scientists want their warnings about climate change to be heeded by the intended audiences, the readers, the public and policy makers. Just like the rhetor, the scientists are expected to marshal evidence such as statistics and models.

Modern scientific texts, according to Ilynska, Ivannova and Senko (2016), are characterised by the application of traditional rhetorical strategies that are used to structure the content.

Richards, Platt and Webber (1985, p.159) define language of science as "language used for particular and restricted types of communication, containing lexical, grammar and other linguistics features which are different from ordinary language." Helder (2011) argues that language of science is made up of informative texts, and the text's dominant form of appeal is logos as the sender needs to persuade the receiver that the text presents a credible picture of the subject matter.

Contemporary "scientific texts fulfil not only informative and persuasive, but equally expressive function in an attempt to invite attention to the information presented (Helder, 2011, P.56). Swales (1990) carried out a study on the language of science, and the findings of the study revealed that form, purpose and functions are some elements that constitute science texts. Swales (1990) used a methodology which categorised the language of science according to register, genre, text and discourse type. Language of science entails complex grammatical structure combined with vast amounts of technical vocabulary (Crystal, 2006); Bhatia (2002) concurs with Crystal but goes a step further and postulates that language of science is not only dynamic but also complicated as scientific discourse entails texts of various kinds, serving often overlapping and at the same time, conflicting communicative purpose.

Bhatia (2002) equally notes that to reach communicative goals, reasonable and considerable changes to the language of science use have been greatly introduced. Because of these considerable changes to the language of science, the language has become more expressive and stylistically, marked to attract the attention of the readers and raise their interest in science and technology. Advancement in science and technology means that the language of science is vastly influenced by the development of popular scientific texts. Words such as cyberspace, cybercrime, android and genetic engineering and many others were not necessarily coined in

the language of science per se but rather in popular scientific texts. And afterwards, these lexical units entered not only the language of everyday use but also entered the language of science.

Crystal (2006)'s study on the language of science revealed that modern language of science is influenced by different factors, inter alia; interdisciplinary character of scientific discourse, the emerging domain of internet linguistics, development of digital rhetoric, and the development of popular science texts resulting in an apparent tendency for hybridisation of genres and shift from formal to more colloquial style (foregrounding). However, some scholars such as Max Perutz (as cited in Frye, 1996) and Gould (1981) seem to try to re-evaluate what was traditionally considered necessary for the language of science. The notion that somehow the language of science is non emotional was refuted by Crystal (2006, p.23) in which it was argued that "it is the myth of science language that it can be characterized solely as emotionless, factual, objective and stable.''

Presently, rhetoric seems to be studied as a comprehensive approach for the production of persuasive arguments and as a collection of coded solutions for affective communication. Ilyanska, Ivanova and Senko (2016) investigated rhetorical strategies typically of other genres, which were frequently used in special texts. Integrating genre analysis and pragmatic analysis, the paper studied how rhetorical strategies contribute to new meaning creation in the process of translation from English into Latvian, when lexical units acquire new connotations and trigger various associations in the context of the target text. One of the objectives of the conducted analysis was to demonstrate the interrelation of different genres in scientific and popular scientific texts.

Bizzel and Herzberg (2001) view language of science in relation to knowledge, which is an essential element of the professional and rhetorical competency of a scientist. Bizzel and Herzberg (2001) demonstrated in their findings that language of science gives a sense of identity to scientists. They revealed how scientists communicate and present knowledge, what symbol system scientists use to structure, express and share their knowledge.

The findings of the study equally revealed that scientists' texts are characterised by specific contexts, variety of purposes and also governed by professional conventions. However, Bizzel and Hertzberg (2001) study was limited in scope. Their study did not include rhetorical techniques most commonly used to bind information together, for example, time order, space order, order of significance, comparison, contrast and illustration.

Bizzel and Hertzberg's (2001) study was not comprehensive, because earlier Trimble (1985) carried out a study that discovered new approaches to analysing the language of science. Trimble (1985) revealed that analysing science goes beyond the purpose and scientific professional governance, instead rhetorical functions in terms of classification, definition, and visual verbal relations should be looked at. Similarly, the findings revealed that another element to look at is rhetorical strategies.

Under rhetorical strategies, it was suggested that stylistic devices such as metaphor, metonymy, irony and other devices should be examined. To understand these stylistic devices, Clark and Zyngier (2003) provide a plausible argument regarding stylistics: they note that the main aim of stylistics is to focus on a language of the text and the relationship between language and possible meanings and interpretations generated by it.

Stylistics is seen as what drives persuasion in science texts. The modern scientific text is always stylistically coloured. To substantiate this argument, Pera (1994) postulates that contemporary scientific rhetoric entails persuasive moves of reasoning and argumentation that aim at altering the belief system of the public in scientific debates. However, despite this assertion, Ilynska *et al*. (2016) warn that the interpretation of any information encoded in science texts also blurred lines between genres and complicated information structures.

The scholars equally warn that the application of rhetorical strategies such as culturally bound allusions, metaphors and metonymies facilitate communication of the intended information and its resultant decoding by the intended readers in a situation where they share similar background.

Despite differences in scholarly approaches to the rhetoric of science, there seems to be some kind of an agreement among the various scholars. The element of universal appeal in all rhetoric does seem to be the nerve-centre of agreement. Burke (1969) agrees that rhetoric entails 'universal appeal' through a form; noting that once one grasps the trend of the form, one is likely to be invited into participation regardless of the subject matter. Burke (1969) found that in terms of a form, you would find that someone is swinging along with the succession of antitheses, despite not agreeing with the proposition that has been presented in that form. For that reason, the reader is likely to be drawn to the form, and not in your power as a partisan, but because of some universal appeal in it.

Burke (1969) demonstrates how swinging along with the form provides a rhythm which can easily get everyone swinging along with proposition. Rhetoric of science can equally be linked to a form, so is climate change rhetoric. Burke's (1969) postulation is very much like that of

Plato's as they both argue that being directed in a series of movements by the form will likely get everyone moving with the "matter" as well.

If one applies this postulation to rhetoric of science on climate change publications, one is likely to find the arguments put forward by the authors or scientists of those publications which are similarly likely to sway public opinions through 'form' approach. It should be understood that there is a good reason why rhetorical theory and criticism is brought to science; this could be because scholars have recognised that there is certainly something significant about studying the rhetoric of science discourse. When scholars bring rhetorical approaches to climate change publications or simply science, they bring them to the most potent and ubiquitous discourse of the age.

In understanding the rhetoric of science, Gross (1993) notes two distinct roles that rhetoric plays: it is seen as both a theory capable of analysing public perceptions and an activity that is able of creating it. Regardless of the truths behind these observations, the reality seems to be that unless we analyse, we cannot fathom the intention and interest. Rhetoric, therefore, is seen as a way of revealing scientific sufficiency and public deficiency.

As a result, the deficiency part depicts communication as a one-way flow from science to its public. In this manner science practitioners do not try to persuade because they assume that the public is already trusting and persuaded by the value of science. The unfortunate part about this notion is that science practitioners imply that the general public or audience is passive. Of course, the genre of this approach is epideictic as communication is based on cognitive ability – knowledge alone is transferred, ethical and political considerations are ruled out as unnecessary. Conversely, sufficiency or the contextual approach depicts communication in

science as a two-way flow between science and the public. Overall, Gross (1993) contends that rhetoric provides the space for remonstration, and one that reconstitutes the facts of science in the public interest.

In the world that desperately needs to get involved in more sustainable practices, surely climate change activists and environmentalists should ask themselves how best to convince the public to partake in practices that are environmentally beneficial or even environmentally less detrimental. It is a major dilemma for scientists to persuade the public and this problem is rooted in the question: how do scientists get the public to care for climate change?

Hughes (2017) observes that traditionally almost all climate change rhetoric has centred on the public's sense of morality, justice and ethics. While Hughes (2017) believes that the arguments are fair and hold water, the scholar suggests that scientists incorporate a human-centred approach which can appeal to a person's sense of selfishness and to the right to exist in a prolific world. Hughes' (2017) arguments are rooted in most scholars' belief that all humans are innately selfish. This argument is centred on the understanding that the rhetoric of climate change does little to appeal to the public's sense of selfishness that is fundamental to the spirit of humanity. By using phrases such as 'save the climate' and 'save the earth,' rhetoric appeals only to a sense of goodwill and guilt. Such phrases, despite being rooted in truth and the desire for action, display humans as the ones who should do the saving of other living creatures, rather than a species also at risk.

It is common knowledge that every publication of a text has a goal; the goal to make a submission in support of an opinion or of the new information given, providing backgrounds and reasons and at times discussing seemingly incompatible views about the world. It is almost

difficult for anyone to achieve this goal by just writing down a collection of separate statements. Obviously, readers and viewers would certainly like to read a text. Reitter (2010) observes that the central element of a text is that one part of the text builds on another one. Reitter (2010) further claims that a text can only be understood if small chunks of text are coherent.

Reitter (2010) equally observes that when using rhetorical structure theory to explain linguistic phenomena, there can be challenges when it comes to analysing rhetorical structure because a deep semantic analysis with sufficient coverage is almost infeasible. In the study by Ritter (2010), the study concentrated on the integration of different surface cues. Those rhetorical indications were found on different linguistic levels (punctuation, lexical choice and disclosure marker). The study revealed that features of the cues which are commonly assumed to be correlated to rhetorical relations, couldn't significantly contribute to the detection of rhetorical relations.

Despite the overwhelming evidence about the threats posed by climate change, in some countries like the United States of America, there are seemingly still people who question the findings of the climate change scientists (Leveine & Kline, 2017). Leveine and Kline (2017) observe that a quarter of Americans do not consider climate change as an important problem facing the country; they are simply not engaged in wide-scale advocacy efforts to address the climate change challenge. When confronted with such reality, it becomes increasingly difficult for scientists not to be tempted to use persuasive moves to convince the public about the danger of climate change.

Levine and Kline's (2017) study revealed that some people called for common arguments backed by intuition and social science research, and that rhetoric must highlight how climate

change would personally affect the American public's lives. Their study further revealed how some want scientists to explain the impact that climate change might have on personal health and make it hard for public to get the food they need. Through this study, the two scholars argue that food security reminds the public that significant personal goals of staying healthy will be hard to achieve.

However, Levine and Kline's (2017) study does not further explain the issue of philosophical connections between what is perceived as knowledge or truth and the consumers of that knowledge. An application of multiple qualitative techniques would probably have yielded more explanations regarding the philosophical understanding of climate as we know it. Despite this lack of philosophical connections, credit should still be given to Levine and Kleine (2017) for unearthing essential findings about the rhetoric in the language of science on climate change.

For example, the two scholars compared information of people who had seen rhetoric in climate change publications, highlighting how climate change could impact their personal health where 17 percent less likely to endorse the petition and join the organisation than those who received the food security language where 15percent less likely to join the petition against climate change. Those who read the language about health and well-being of children in the publications were 9 percent less likely to join the petition.

Reeves (2005) observes that the general public tends to assume that scientists report absolute facts as opposed to interpreting or even developing ideas. This observation is not strange in the world of academics; it seems that many people assume that the language of science is simple because it is descriptive, thus less important than practical experience. This is perhaps why

science subjects confine language to reading the text and memorisation of facts. Oblivious to students is perhaps the fact that no one learns scientific knowledge without human interference with words. Arguably in the absence of a language, the presence of facts is almost impossible.

Reeves (2005) equally submits that the language of science is different from the language of politics and language of advertising. This is so because the objectives of meticulous description of nature are important. It seems that scientists try hard to find the suitable and objective language to describe the appearance, functions and phenomena. Certainly, the goal of scientific language, it seems, is to be as free as possible from connotations that create cultural biases and emotional attachments. Despite concerted efforts by scientists to be careful and to avoid emotional attachments, the fact that they use a language can easily result in attitudes and prejudices. Admittedly, the aim to achieve objectivity and denotative scientific language is, in most cases, difficult to achieve.

Regardless of how meticulous scientists can be in describing the observable elements of phenomena, cultural meanings and cultural bias are likely to subvert the aim of objectivity. This we have learned from social sciences that human beings are fallible and so does the language they employ. Because of these challenges, it becomes increasingly difficult for scientists to rule out bias even from the conceptual stage of their investigation. The production of scientific knowledge, therefore, rests on the notion that knowledge becomes accepted by the public as a reasonable interpretation of what transpires in nature.

However, despite these compelling submissions on the language of science, Bulhof (1992) recorded that in the 16th and 17th century, some scholars tried in vain to imply that one must not study science, and let alone nature, by reading about it; meaning the rejection of knowledge

acquired by reading texts. Admittedly, this effort by scientists was intended to remove language from the observation of nature. But being educated in a culture dominated by metaphysical tradition, it became increasingly difficult for those scientists to detach language from what they thought as pure science.

Moreover, Bulhof (1992) further recorded that the 17th century effort to delegitimise language in science interpretation failed spectacularly, particularly when those scientists had tried to argue that because language is made up of words, those words signify only what goes on in the speaker's mind and that nature does not operate on that premise. What these scholars seem to have failed to understand is that nature can only be represented through discourse. This is likely to be true because the fact that scientists speak about nature represents the importance of language in science interpretations.

According to Bulhof (1992) these scientists of the 17th century did not end there in their quest to delegitimise language from science interpretation; they still argued that in science mute nature and speaking investigator are separated. They even gave an example by demonstrating the relationship between the wishes of the absentee speaker and a spokesperson. They suggested that in politics 'where rhetoric belongs,' when a speaker is accidentally absent from political the forum, the spokesperson replaces the speaker because they are both linked. They felt that human made words or language cannot express nature, and that nature is not expressive.

Science, for these scientists, was mathematically structured and could not be associated with rhetoric. Language was seen as not a source of truth but less of a medium in which reality could be revealed. After these scientists had achieved what they saw as separation of language and

nature, they confined language to mere arbitrary signs, and language was only good for transferring plain issues, not for finding or advocating the truth in science (Bulhof, 1992). The conclusion was drawn that reality and language, human beings and nature had nothing to do with each other.

However, from the 18th century to the 20th century, Bulhof (1992) contended that things began to change when language began to gain ground, despite the claim to the contrary that the prestige of science was high, and much higher than that of a language.

Following the above discussion, one is made to think that many scientists strive to make their writing unambiguous, this to them would perhaps no longer be interpreted as fulfilling the function of persuasion. Debatably, scientists seem to do their best to try and be as unequivocal as possible; meaning that unequivocal scientific language tends to create a sense of illusion that the public is in touch with literal reality. By avoiding literary fills, scientists are likely to think that it would provide a reassuring presence of reality independent from the influence of a human being. Surely by desiring to avoid literary and emotional writing, the scientists tend to self-assure themselves by thinking that scientific knowledge is independent of a language. But it seems highly unlikely.

To substantiate this argument, let us look at the example provided by Bulhof (1992) wherein scientific texts are characterised by depersonalisation. The provided scientific texts are characterised by depersonalisation. Equally so, the provided scientific texts frequently use 'we' and the passive voice by explaining sequences of events. By using the above stylistic devices, the scientists seem to present themselves as autonomous performers of regulated research, and the scientists feel detached from their findings or their results.

To contextualise the above information in a philosophical fashion, one is tempted to argue that what we know of the world today is that it exists as an evolving set of human understandings. The world seems to entail a considerable number of conflicting interpretations of reality. We know for a fact that bad conflicting reality creates problems for the people who duly had vested interests in some interpretations over the other. Thus, as argued by Wander (2009, p.226), "each society evolves a body of rules by which one version of reality may be legitimated and the other competing versions desecrated.''

There was a moment in time when religion viewed reality and secured the principle rules for its validation through God on earth and via interpretation of the holy bible. So, any views that were seen as opposing the bible were viewed as an abomination or disrespecting to the living God. Equally, science today has its own reality. Any opposing views that do not conform to standardisation, compartmentalisation and systematicity are viewed as unscientific.

Moreover, scientists present their arguments through a language, and interestingly arguments in a language encapsulate rhetoric. Rightly so, from scientific experiments and mathematical calculations, science scholars write and present their cases rhetorically. Nelson, Megill and McCloskey (1987, p. 3) once remarked that "modern scholars usually deny their rhetoric. Wearing masks of scientific methodology first doomed in the 17th century, they have forgotten, about the rhetorical faces underneath.'' However, despite this known fact, some scientists still continue to respect the existence of rhetoric in their findings. Their continuous denial is mainly, it seems, to dampen curiosity about how exactly things happen in the lab. But the reality is that the mask of "methodology'' is wearing thin, and numerous scholars such as Woolgar (1979),

Gross (1993, Nelson (1995) are beginning to question how science interpretation avoids subjectivity.

Nelson *et al.* (1995) note that rhetoric maintains that arguments is more unified than is commonly understood, and they further argue that rhetoric is far more unified than the fragmentation of academic courses might empty. Thus, rhetoric connects discussions of scientific methodology to concrete investigations in different situations and specifically to the language that the investigation conducts. In this sense, rhetoric encourages scientific methodology to become what Nelson *et al*. (p.5) would call "comparative, situating itself in actual researches and exploring their mutual duplications for better inquiry." Rhetoric makes the audience or the readers aware of the art of sciences clearer. Scott (2008) observes that overwhelming scientific evidence exists that global change is occurring, and that human actions are doing much in the increase of greenhouse gases.

Moreover, ethos or a trustworthy character is another significant concept that rhetoricians share with scientists. Ceccarelli (2017) contends that scientists can reach out to sceptical listeners with appeals that signal their vulnerability rather than the scientists' supremacy. While observing climate change, scientists speaking to sceptical audiences, required to exhibit complete trust in order to receive it in return (Ceccarelli, 2017).

Climate change is one of the most challenging scientific and political issues of our time. Bulkeley and Betsill (2005) argue that loaning disappearance of the island Tuvalu as seas rise, the fast collapse of the Ice shelf in Antarctica, and equally the decision of the reinsurance from Munich conference to increase premiums and threats to Europe's water supplies as a consequence of glacier retreats in the Alps are surely just some of the pertinent issues which

are associated with climate change. Even though uncertainty as to whether any direct links can be drawn between present climate happenings, recent trends in climate variables such as temperature and precipitation, and predictions of global climate change, an agreement has been reached that something should be done about climate change around the globe.

Bulkeley and Betsill (2005) define climate change as an increase in mean annual surface temperature of the earth's atmosphere due to extreme increases in atmospheric concentrations of greenhouse gases such as carbon dioxide (CO_2), Methane (CH_4), Chlorofluorocarbons (CFCs) and Nitrous oxide (N_2O). On the other hand, Wilhelm (2012, p. 2) defines climate as "long-term average weather conditions for a region." Both definitions relate average weather conditions over a long period of time. The Intergovernmental Panel on Climate Change (IPCC) report suggests that the concentration of these gases has increased dramatically ever since the 1750s, and this is due to human activities such as combustion of fossil fuels (Houghton, 2002).

However, despite the efforts to protect the globe from climate change, sceptics argue that there is insufficient evidence to demonstrate that climate changes outside the natural variability have actually taken place, or will even take place, in the first place. Houghton, (1996, p.5) argues that "the balance of evidence suggests that there is a discernible human influence on the global climate.'' Moreover, Watson (1999) argues that it is no longer a question of whether the earth's climate will change, but rather when, where and by how much. Grubb (1999) on the other hand suggests that some people hold the belief that changes will perhaps be gradual and within societal control.

Given the mammoth task of solving global climate change, solutions to solving problems require international concerted efforts and negotiation between nation states. It seems that for

a long period of time now there has been a need to take unanimous action by different countries to reduce the emissions of greenhouse gases. The efforts to reduce emissions have been mainly popular in urban centres such as Windhoek, for Namibia. Urban cities, it is suggested, are important areas through which to address climate change for various reasons (Willbanks & Kates 1999).

Findings by the latter authors reveal that urban centres represent areas of high energy consumptions and production of waste. Similarly, urban centres have been for considerable time, seemingly, been engaging with issues of environmentally sustainable development and attempting to translate international rhetoric into local practice. In short local authorities seem to demonstrate a degree of influence over the emission of greenhouse gases such that this has an impact on the national government to achieve global agreed targets.

Namibia is one of the driest countries in Africa with mean rainfall ranging between 25mm and 700mm (Ministry of Environment and Tourism, MET, 2008). It is predicted with high degree of certainty that Namibia will become hotter in 2046 – 2065 (MET, 2008). Moreover, there seems to be compelling evidence pointing to the direction of changes in climate extremes and rainfall seasonality in Namibia as observed since the 1960s (MET, 2008). However, despite unpredictability in the pattern of Namibia's climate, researchers continue to argue that Namibia is headed for a change in climate; they do this by trying to convince policy makers through scientific publications.

The presentations of these publications are in most cases quantitative; but language is used to present these findings. As such linguistics teaches us that language is constructed on the foundation of arbitrary symbols. That is, texts used in these publications are collections of

words and pictures that have no inherent meaning or connection to the objective world of things or objects. The fact that language is used in the science publications on climate change, and given that language constructions are unsteady, interpretations of these scientific findings are also unstable and uncertain; as a result, the presentation of the findings would most likely not be objective.

Additionally, since the meanings of words in those findings are derived from a social context, a reality of the presentation is entirely subjective and persuasive. Scholars of rhetoric of science such as Gross (1990), Gross (1993), Pepper (1948), and Ivanova, Ilynska and Senko (2016) all agree that science is characterised by the assumption that the audience is already trusting, and that science does not need to persuade its audience.

The macro and micro conceptions of climate, science (mathematics) and language are important because they are indications of human convictions that systematically influence instructional conduct. Discussions by different scholars and experts on rhetoric of science have revealed that climate change researchers tend to rely on mathematical frameworks to authenticate their findings.

However, even Mathematics that is considered a pure science, as a discipline, has dealt for several centuries with the issue of what is the commutative nature of mathematics (Handal, 2009). Moreover, Handal (2009) argues that the philosophical foundation of mathematics as a brand of science is influenced by the perspective adopted, and since mathematics has had such an essential role in the advancement of societies, defining its nature, role and methodology has at least become a fundamental, ideologically and cultural issue. Therefore, separating mathematics from rhetoric becomes increasingly difficult.

However, despite the efforts by rhetoricians to demonstrate the availability of rhetorical devices in science discourse, this did not deter the mathematics fanatics from attempting to develop a methodological foundation to try and vindicate the discipline as free of error, and as such something that does not rely on persuasion. Some of these mathematics extremists went as far as claiming that mathematics is "green of all science" (Mura, 1995, p.390). Lakatos (1986, p.31) similarly concluded that mathematics is "the most perfect of all science."

As if the declarations from these scholars that mathematics is pure and hardly influenced by bad belief system was not enough, others such as King and Watanabe (1996, p.17) post that mathematics is a "science in its own right". In fact, various scholars note that mathematics is detached from persuasion because it is infallible and does not rely on human influence in its communication of the findings. Despite all these attempts by the mathematics extremists, later on even their fellow mathematicians began to question the infallibility of mathematics, and they met resistance from the new alternative conception that began to evolve in which mathematics was viewed as a fallible discipline.

The rhetoric of science and mathematics determine the way educators communicate science and mathematics to learners in schools (Southwell, 1999). For arguments sake, if science and mathematics were just entities out there uncomplainingly waiting to be discovered then it is as good as letting the schools and universities present the course outlines as just a gathering of information or facts. This means that the absence of rhetoric in these entities would seem as if just conveying unquestioned facts that learners have to accept without any need for logical reasoning. Conversely, if the notion of rhetoric of science and mathematics is embraced then

learners and students alike, would be in a position of constructing their own scientific and mathematical knowledge regardless of the approaches used in learning.

Moreover, mathematics relies on logic, and logic is one of the rhetorical strategies under logo. Simply put, logic is essentially a form of Platonist realism wherein mathematics is viewed as a set of abstracts that is found outside human creation. Logicians argue that all mathematical concepts can be rescaled down to abstract properties that can be derived through logical elements. It was not long before logisticians were criticised for their inability to encapsulate intuition and conjecture which some scholars see as generators of rhetorical moves.

It can be argued from the above explanations that science and mathematics are brought about via symbol and experimental manipulation, prescribed by a set of rules. It is this manipulation which constitutes rhetoric by manipulating figures and chemicals; the ultimate goal of such a researcher is to persuade the audience or public about his or her findings.

Equally, it can be contended that the manipulation of science and mathematics enables these entities to be conceived as rhetorical. Manipulation seems to come with intuition and imagination. Similarly, science and mathematics seem to be characterised by intuition and imagination, and for someone to come up with an experiment, a cure for HIV/AIDS for example, one has to imagine how the manipulation of chemicals would be conducted. In the same vein, to develop a mathematical formula, one has to imagine how the numbers should be manipulated before such formula is attempted. It is clear that from imagination comes the need to persuade others through a language.

2.4 Climate change rhetoric

The issue of climate change often raises the possibility of whether people the world over could come to some form of agreement about the true meaning of climate change and actions that should be taken to address it (Malone, 2004). At face value, climate change does not seem to be worthy of rhetorical analysis and examination. From physical characteristics, climate change seems to be concerned with the scientific and physical elements only. Also, it seems that few scholars are concerned about the rhetoric embedded in the climate change publications. Much of climate change interpretation and analysis have been about the scientific dynamics that underpin global climate change rather than rhetoric.

As a result, the issue of global climate change, as can be seen from the rhetorical point of view, does not get enough attention. The present study claims that to get an independent understanding about global climate change, rhetorical examination should be deployed to ascertain the accuracy of each climate change publication. It should further be understood that any climate change publication on Namibia has the potential to cause unrest. This is because climate change issues are intertwined with societal issues. Beck, Anthony and Scott (1994) are equally in agreement with this observation as they argue that climate change is something that one could not see or touch and that it might not make someone sick but might make life on the planet uninhabitable for human beings.

Goldberg (2017) observes that environmentalists tend to overstate the challenges of climate change by using wide-ranging frantic rhetoric, thinking that if the previous doomsday prediction did not work, the following prediction should. To substantiate this claim, Goldberg (2017) cited Stephan Hawking's statement as an example. Hawking, a renowned scientist, was reported to have said that Donald Trump's withdrawal from the Paris climate accord had been

monumental; claiming that Trump's action had the potential to push the planet over the brink, to become like Venus, with a temperature of 250 degrees (Celsius) and raining sulfuric acid.

Subsequently, Goldberg (2017) contended that the atmosphere takes up carbon dioxide which has been higher than that in the past years without boiling the oceans or raining acid from the sky. Furthermore, Goldberg (2017) quoted Rachel Becker, a science scholar, who had noted that the use of scare tactics by scientists could easily backfire when people deploy their psychological defences against the threatening information.

Research attention on global climate change in recent years has begun to focus on the rhetorical process entailed in the framing of climate change as social problem that requires independent solutions. As such, the present study has incorporated several observations into the conclusions, as a way of looking for middle ground on global climate change, particularly climate change in Namibia. Scientists may have brought the climate change issue to the attention of the public in Namibia, but they possibly cannot explain the social dynamic connections between the public and the science of climate change. This phenomenon seems to have been going on for a long time before attention was given to the rhetorical dimensions of climate change.

The bone of contention here, it seems, are several elements that must be addressed separately in terms of social dynamic interaction. The contestation of the reality of climate change seems to have been constructed by climate scientists nearly on the periphery sensory experience of the general public and yet little is understood by them. Therefore, the time and space of the climate change challenges are difficult for the public to comprehend resulting in the lack of urgency to take action against the challenges.

The prominent view to climate change science is the notion that science is descriptive. Indisputably, a descriptive approach gets its eye from the physical sciences. Malone (2004) notes that the scientists who use a descriptive approach prefer to weigh, measure and count, and at the same time prefer the language of mass and equations. Moreover, from the discussion above one is tempted to think that scientists perhaps see themselves as impartial and objective observers of a reality out there which is similar to a pilot who hovers above the surface. Hence, scientists tend to see themselves as global players who are concerned with scientific calculations to mitigate climate challenges.

Under the descriptive approach, Malone (2004) contends that scientists prefer to concern themselves with research that tends to be based on data, graphs, charts and meticulously constructed reports that end with findings and discussions. By so doing, these scientists feel that they are detaching themselves from rhetoric and that they disinterestedly seek truth to inform policy makers of the truths they have discovered. As a result, these policy makers then consider their choices for efficient governance in light of these truths.

When dealing with climate change science, most scientists seem to view themselves as the providers of knowledge; they supply knowledge to the policy makers and the policy makers are expected to implement those supplied facts. However, in all these scientific efforts, much relevant research activities have been conducted using an interpretive approach. Rayner and Malone (1998) observe that the interpretive approach tends to focus on the meaning of activities and language, the structure of perceptions, the nature of experience, recognition of interest and the development of a framework. Rayner and Malone (1998) further argue that in climate change research, interpretive approaches have dealt with the framing of the problem,

social cultural issues, stakeholder involvement, the nature and production of knowledge, and so on.

The present study is explicitly rhetorical, focusing on the rhetoric of climate change publications. The rhetorical moves used, and rhetorical strategies employed reveal a lot about the dimensions of the rhetorical scope. Despite several studies by Jasanoff and Wynne (1998), Brown (2004) and Moser (2010) being done in the area of rhetoric of climate change, there seems to be a dearth of information to help elucidate and augment the comprehension of how the reality of climate change is interpreted in the public discourse. Exploring and examining the nature of scientific knowledge about climate change is essential to this study, but indubitably insufficient to understanding how arguments gain persuasive moves and operate within the environmental policy framework and public discourse.

The essential tenet of this study is that all knowledge, inclusive of scientific knowledge, is rhetorically constructed. Malone (2004) remarks that scientists do not discover the laws of nature that exist independently of people, somewhere out there, arguing that instead scientists construct knowledge through arranged scientific methods and processes. Arguably, scientists are expected to debate on the methods and procedures used in the research, and mutually accept or reject suggested hypotheses and theories based on the examination of the results. Moreover, the present study employs some elements of constructivists' perspective to the study of rhetoric of climate change by exploring and examining how scientific knowledge of climate change is systematically developed as a rhetorical agreement about the nature and dangers of Namibian environmental changes.

Latour (1987) carried out a study on scientific knowledge construction. The study looked at what scientists really do, describing how the "black boxes'' of science knowledge are constructed. Complimenting the study was the work of Gross (1990) who demonstrated how the so-called discoveries emerge in scientific discourse. Brown (2004) argues that scientific analysis or science rests and is dependent on narrative language to gain legitimacy. As a result, knowledge is easily constructed through a language. Apart from narrative language, scientific knowledge about climate change is based upon highly sophisticated data manipulation and data collection connections.

Moreover, there was also another study conducted Jasanoff and Wynne (1998) on climate change about comparative analysis of how science consensus is usually formed. It reviewed some of the cases of the stratospheric ozone, the international biological programme and environmental computer-based models for rhetoric parallels to the case of climate change. The findings from the study are compelling as the study revealed that the scientific consensus on climate change is poorly grounded, in many instances clashing instead of articulating with local knowledge. Interestingly, the scientific efforts to measure changes in the atmosphere by describing, quantifying physical processes and presenting the climate change accurately to predict dynamics – they tend to result in enormous uncertainties.

Contextually, the present study focused on how scientists build knowledge, communicate, and influence their broader society. Thus, the study placed the scientific arguments and claims on similar footing with economic, political and global view arguments. Respectively, the present study has analysed climate change discourses, and explicitly focused on the rhetoric of climate. The rhetorical perspective is the angle that the present study has taken throughout, but there are also academic arguments from various scholars that have shaped the stance of the study.

Through the rhetorical perspective, data or information, specifically on climate change predictions can easily be tested to find out about the truth of the claim. For example, when scientists present information about the predictability of the danger associated with the exposure to climate change, they are making a claim about the truth to their statements. This is because these scientists have known that such prediction could easily be contested, therefore, surely, they may frame their statements to be acceptable. Similarly, the scientists who strive for absolute objectivity are likely to assert the morality of the scientific findings and sincerity.

Rhetorical observations therefore treat scientific claims, methods and discoveries as socially constructed. Putting scientific claims to the rhetorical lens provides an opportunity to extract scientific discourse out of its scientific cocoon and makes this discourse available for analysis with other rhetorical discourses.

In addition, scientific arguments and observations can easily be evaluated alongside other arguments, and not necessarily for validity but for the global views and the mortality expressed and their likely effects on the global public. Rhetorical analysis should be seen as a tool that is well designed to examining what is going on in the climate change publications. Of course, rhetoric, the art of persuasive communication, moulds the dynamics of the various arguments and the means these arguments are made. Modern rhetorical theories seem to have the potential to judge any scientific claim and the usefulness of that claim, and their ability to be analytical, while preserving the content of that scientific claim. The objective is to use rhetorical tools for structured analysis, and to be able to draw conclusions about climate change.

The challenge that most scientists face when they make arguments about climate change, it seems, is how to convince the public that there is something requiring their attention. For argument's sake, if climate change scientists discover the reality about the danger of climate change, then the rhetorical situation would entail the exigency which Bitzer (1968) discussed as something arising from outside themselves and quickly confronting the people. In the study carried out by Malone (1998), it was found that scientists tend to rely on exigency because unlike war and sport, where physical evidence is presented, climate change evidence is normally based on artificial constructs. For example, when scientists claim that the cutting down of trees in Kavango East and West have resulted in high concentrations of carbon dioxide, it becomes increasingly difficult for these scientists to provide evidence that non-scientists can agree to.

Often, scientists present the dynamics in the weather patterns in the form of graphs and curves without providing empirically verifiable evidence. Equally, climate change is often projected in the form of graphs, charts and other visualisations of computerised simulations. Because of these visual manipulations, some tend to disagree with the scientific findings while a good number of them maybe convinced. As a result, some people may accept the threat of climate change as exigency and argue for and against the response to take to neutralise the treat.

Given the seeming inability for countries to cooperate on what to do to mitigate climate change, the issue that should be tackled should be about exploring and examining arguments that scientists are making to determine nonbiased truth. Accordingly, a rhetorical analysis of the claims made by scientists would be subjected to rhetorical enquiry to shed some light on the potential for agreement. In case there are rooms for agreement, arguments should present their existence through the explanation of a situation or the claims made. Significantly, rhetorical

analysis has the potential to reveal the claims that scientists make without themselves believing in them – opponents tend to pinpoint them out as hidden motivations and arguments. As such a research which examines a broad range of arguments is likely to capture truthful arguments. If this happens, an opportunity to look closer at the claims may provide insights on how best to build on spaces of agreement and get action.

The present study employed rhetorical analysis as a tool to examine the climate change discourse. Additionally, the study also incorporated change discourse. The study incorporated the understanding that each individual audience who consumes on the scientific claims wrestle with the Aristotelian rhetorical dimensions – ethos, pathos, and logos. Moreover, the study took into consideration that each audience segment reads or listens to the scientific claims and constructs an argument based on worldview. The scientific claims are likely to be embedded with justice implications because of the benefits and consequences associated with the claims to mitigate or exacerbate the climate change institutions of science, and as means for revealing facts about the world have been called into question by rhetoricians all thanks to justice.

In Namibian, as elsewhere throughout Africa, the political response to climate change has unfolded along regional lines that construct the issues in dominantly economic ways. Kurz and Crab (2010) have equally observed the Namibian trend in Australia when they argued that politicians in Australia declared their climate change support or scepticism along the economic interest of their constituencies. This shows the way in which a meticulously managed discourse of support and scepticism can be aligned to geographical location to influence the voting public whose livelihoods and economic interests appear to be threatened by environmental policies meant to mitigate climate change challenges.

Moreover, the issue of climate change seems to play out along party lines. A case in particular is an American scope for explaining how views about the reality of climate change are seriously affected by one's political and ideological views (Dunlap, 2011; Hamilton, 2011). 2011). The two parties, Democrats and Republicans, both self-reported the understanding of climate change, and their reports demonstrated an increase in concern about climate change for Democrats, but a little concern for Republicans (Dunlap, 2011).

Despite much research in the area of science discourse, there is still a lack of understanding in terms of capturing the complexity of science communication. Moreover, the scientific dynamics involved in the discourse of science equally seem to be complex that the traditional way of looking at the conceptual detail of scientific discourse is challenging. Other ways to the traditional model of public scientific discourse is a two-way approach.

According to Davies (2008), the two-way approach and interactive model (Logan, 2001) discourse tend to prioritise the significance of context and all the scientific perspectives to the public, and equally does not place scientific knowledge as static (Logan, 2001). Instead, the interactive approach sees science discourse as collective communication that is participated in by a variety of social actors, including policymakers, scientists and government agencies.

Moreover, the interactive model or approach of communication tends to be more in line with modern policy opinion that anticipates public involvement in scientific matters with political importance. Needless to say, climate change scientists who write to the public are therefore the communicators through which these approaches find expression. To further understand this argument, one has to look at the study carried out in the United Kingdom (UK) in which an investigation was carried on how scientists in the UK engage with the audience. Davies'

(2008) account shows that despite its setbacks, scientists tend to go for a deficit model of public understanding of science – the conception most scientists hold, and the more communication style used.

Another approach that scholars of rhetoric seem to prefer to understand science discourse is the analytic approach (Augustinos & Callaghan, 2013). The analytic approach tends to explore the macro and micro level discursive constructions of climate change debate. The social and ideological context of climate change is, in most cases, given prominence at the macro level of analysis. It is this kind of intertextual analysis which allows for a wider reading of the social reflection of climate change that drains from the writer's own knowledge of the debate, also assessing how this wider context impacts on discursively produced meaning (Augustinos & Callaghan, 2013).

At the micro level of examination, the focus is on identifying the situated discursive strategies employed by climate change scientists to produce meaning. Moreover, the analytic approach aims to demonstrate to the public how climate change scientists marshal the agreed knowledge domains rhetorically through the interactive approach communication styles strategically. The approach pays particular attention to the differences between sceptical scientists and consensus scientists in their communicative styles, construction styles and the public styles, (Augustinos & Callaghan, 2013). Purposefully, the approach demonstrates the ways in which climate change scientists construct identities to undermine and bolster particular versions of climate change.

Augustinos and Callaghan (2013) concluded in their study on the rhetoric of climate change debate by arguing that climate change scientists still rely profoundly on the deficit model of

communication, and sceptical scientists tend to rely deeply on the interactive model of communication. Augustinos and Callaghan (2013) further concluded that theoretically the interactive model of communication is seen as a better model. Logan (2001) argues that the interactive model acknowledges and gives credit to the roles that various stakeholders and members of the society play. Davies (2008) agrees with Logan (2001), arguing that the interactive model of communication conforms to policy anticipations that the audience should participate in negotiating the outcomes of policy on climate change.

Augustinos and Callaghan (2013) also noted that a significant number of scientists in contemporary times are acknowledging the use of common-sense knowledge in their arguments; this is a rhetorical move which is believed to undermine mainstream climate change. Consensus scientists still try to maintain authoritative status of science by comparing good science to bad science. The public is viewed by consensus scientists as ignorant or irrelevant in their scientific discourse.

As a consequence of this ignorance from part of the consensus scientists, relevant and crucial factors are outwardly being excluded in the science-to-public deliberation, and the role played by shared values that are significant to the audience as they transform climate change science knowledge into common sense social representations. It should clearly be stated that climate change rhetoric is encompassed within the ideological, political and economic situations.

Complementarily, Augustinos and Callaghan (2013) argue that consensus scientists fail to capitalise on these discourses in the way the sceptical scientists do. Perhaps this difference is caused by the fact that consensus scientists spend much of their time defending science than the sceptical scientists. Admittedly, Augustinos and Callaghan (2013) agree that climate

change scientists must speak out and defend their work with figures and facts; however, they warn that this should not be at the expense of involving the audiences with the issues and values that are central to the climate change problem.

From a rhetorical point of view, language and other symbolic systems employed during scientific discourses have the power to influence the world. These symbol systems and language have the potential to reflect and present, it should also be stated, the potential to also change our perception of realities. Rhetoric can change the ways in which climate change scientists construct, arrange and make sense of social material in the world. Scientists, including the ordinary public members, should view rhetoric as the art of seeking untainted solutions in a situation wherein solid answers seem impossible.

2.5 The rhetorical effect of visuals in science

Climate change graphs and visuals provide a unique perspective on a discipline of rhetoric, which regards these images as arguments that mould polities in specific discussions over climate change (Waslsh, 2015). Walsh (2015) found that there seems to be habitual ways of visualising climate change work against, and not for, efficient political action, that rhetorical options do and should underpin technical climate graphs at basic levels; but paradoxically non-experts and including some experts, perpetuate the myth that climate visuals are transparent, and untransformed views of nature.

Walsh (2010) carried out a study on visual strategies to integrate ethos on graphs and visuals, and the findings on that specific study revealed that graphs and visuals created on the basis of estimation and prediction tend to have inaccurate data entries. To substantiate the findings, Walsh (2015) presented a graph adopted from a study carried out by Mann, Bradley and Hughes

(1998) as an example. The graph, as can be seen below, shows an increase in temperature in the 20th century compared to the otherwise normal oscillating northern hemisphere average temperature happenings.

At the centre of the argument are the graph's appearance and the statistical methods used to develop it. Soon after the production of the graph, McIntyre and Mckitrick (2003) accused Mann *et al.* (1998) that they had mishandled the data input to the graph, consequently prompting series of congressional hearings. Despite those hearings not carrying out fruitful conclusions, and often resulting into failures, there seems to have been no refraction of the graph. Figure 1 was sealed despite its notoriety.

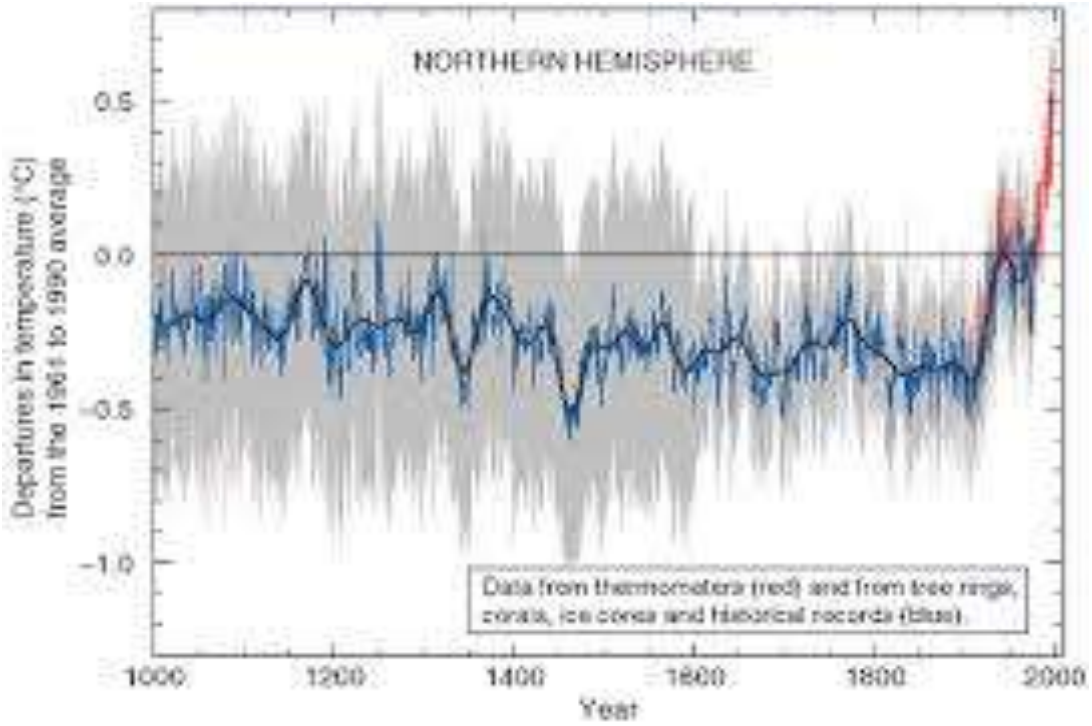

Figure 1. Increase in Temperature in the northern hemisphere in the 20th Century.

Walsh (2010) further contends that based on the above happenings, one would expect that the authorities would defend the findings, or the graph produced by Mann *et.al.*, (1998). On the

contrary, the authority, despite having doubts on the statistical methods behind the graph, later defended it vigorously. It is this kind of perceived hypocrisy that tends to spark debates on climate sceptic and climate change validity.

As can be seen from the above arguments, climate graphs and visuals raise interesting questions for rhetoricians of science – this is because the authenticity of data based on prediction and estimation tend to be perplexing and often results into questionable data. From this observation it can be argued that climate scientists have to deal with their personal ethos and professional ethos to produce graphs and visuals for public use. Furthermore, some of the scientists who produce these graphs and visuals belong to political parties (Walsh, 2010). It is this political involvement that tends to lead to the discrediting of their scientific findings.

Shapin (2008) contends that the nazification of life sciences in Germany, under the Nazi regime is a sign of how visuals and graphs can be manipulated by scientists to suit the government's political agenda. In essence, scientists are normal human beings with their own opinions and biases. As a result, these affect their policy recommendations. It is small wonder why when scientists make environmental policy recommendations on behalf of the government the parties whose politics align with those recommendations laud the trustworthiness of the researchers, but those whose politics are against the establishment tend to accuse the scientists of being biased and corrupt (Goklany, 2008; McKitrick, 2007; Mclean, 2008).

The use of visuals and graphs are seemingly important to climate change scientists. Scientists tend to rely on computer generated models to advance their findings on climate change. In fact, these computer-generated models are seen as technology of prophecy for climate change

scientists (Schneider, 2005). Kendall (2005) argues that the visuals model of climate simulations can add significant meaning to policy situations to be matters of forensic fact.

Most visual images and graphs that accompany written arguments serve certain functions – to appeal to the emotions (pathos) or clarify numerical data in the case of graphs. Certainly, there are of course additional uses for images, for instance cartoons may add a welcome touch of humour, but in the present study the focus is the appeal to emotions through images and graphs. Apart from using visual images and graphs to appeal to the emotions of the audience, images of threat are often used to persuade the audience of the visuals, some visuals and graphs used in science publications on climate change seem to encapsulate emotional appeal, flattery and threat.

Using the above explanations, even in courtrooms in Namibia, prosecutors and lawyers display photos of a bloody corpse and the police use crime graphs to illustrate to the judge how crime has gone up in the society. They do this to appeal to the judge, and as a result punish the convicted criminal severely. Most importantly, lawyers and prosecutors know too well that images matter a lot in the courtroom than arguments only; this is perhaps why sometimes a hard-core criminal that breaks into houses, and usually wears skinny jeans is suddenly seen donning a formal suit in the courtroom. It can be argued that an image (picture) is often used as an argument because an image makes a powerful statement. Graphs often depict vertical lines to the far right, and this is to convey the immense agitation experienced by the figures in rainfall reduction.

Visual images constitute an important part of the rhetorical environment, and to literally ignore them to focus only on written and spoken discourse means that we understand only a miniscule

portion of the symbols that affect us daily (Foss, 1994). Similarly, Audigier (1991) notes that the study of visuals images and symbols from a rhetorical point of view also has grown with the emerging acceptance that such symbols provide access to a range of human experiences that are spatially oriented and multidimensional, and dynamic usually can be conveyed and communicated via visual imagery or through non discursive symbols.

Foss (1994) further contends that throughout rhetoric's long tradition, discursive theories have for a long time enjoyed ideology hegemony, limiting the study of rhetoric to linguistic artefacts, arguing that visual images are less important, as a consequence ignoring the impact of visual imagery in our world. This is not surprising because rhetorical theory seems to have been created almost exclusively from the study of discourse. As a result, rhetoricians seem to largely lack a sophisticated understanding of the conventions through which meaning is created in visual images and the process by which they influence the audience.

Moreover, scientists equally use actual images of children suffering, or they depict a picture of dry land with the sole purpose to communicate with their audience. It can often be in climate change publications where scientists tend to use images of starving people to present their position on the issue of climate change and communicate with their audience. Visual images and graphs are often viewed as symbolic action in the connection they present between image and referent which is arbitrary, in contrast to a sign, where there seems to be a natural relationship between the sign and the object to which it is connected. This is supported by Foss and Graffim (1995) who claim that visual images and graphs entail the conscious choices about the strategies to employ in areas such as colour, form and size. Foss and Graffim (1995) argue that visual images are arranged, changed and moulded by a rhetor not simply for the purpose

of emotional discharge, but for communicating with the audience, even if the initiator is the only audience for the image.

Key to understanding the rhetoric of visual images is that it focuses on a rhetorical response to an artefact rather than an aesthetic one. Finnegan (2008) views aesthetic response as a viewer's direct perceptual encounter with the sensory aspects of the artefact. Finnegan (2008) further argues that in rhetorical response, colours, lines and texture in an artefact provide basis for the audience or viewer to lay to rest the existence of images and emotions. As such, understanding these rhetorical responses to visuals and images is the aim of visual rhetoric as a perspective.

Walsh (2015) submits that while research in the areas of images and graphs on climate change is new and diverse, nevertheless, some common findings emerge that habitual norms of visualising climate change work against and not for, effective political action that rhetorical options do and must underpin technical climate graphics at fundamental levels.

Despite the above arguments, visuals and graphs analyses tend to be ambiguous when you examine the rhetorical moves embedded in these visuals. Often when there are visuals in the arguments, we automatically assume that arguments come through verbal discourse. It should be understood that visuals seem to be inescapably ambiguous as arguments tend to be propositional in content. As a result, visuals' and graphs' rhetorical appeal tends to assert particular qualities that make the visuals to have an immediate impact and concreteness that help to influence acceptance in ways that are available to the oral. To substitute this argument, Zarefsky (2009) notes that the analysis of Hitchcock's film, Vertigo, is a classic example of an approach that began with a focus on characteristics of the visuals.

Through this analysis of a film, four approaches to film rhetoric derived from the characteristics of films were revealed – language, ideology, interpretation and identification. Film identification was the focus of the analysis. The study suggested that Hitchcock employed various visual techniques to focus attention on the psychological consequences of the need for identification. Film identification was the focus of the analysis. The study suggested that Hitchcock employed various visuals techniques to focus attention on the psychological consequences of the need for identification or identity. Considering its visual qualities, it was noted that the film made identification even more inviting than it might have been in a verbal text.

Generally, graphs, charts and tables tend to be more logical in their appeal than say an image or a picture. It seems that graphs and charts tend to quickly catch a reader or an audience's attention than words. By the same token, most visuals are likely to catch the reader's eye and function on an emotional level – even those that are meant to make ethical and logical appeals. It can be seen from the above arguments by various authors that visuals are, in most cases, chosen based on the assumptions that the audience will understand and appreciate them. Certainly, visuals and graphs seem to help the publisher to establish common ground with his or her audience. Often the authors think about the possible emotional reactions to the visual images they present and evoke. Sometimes the authors or publishers choose images on ethical grounds to make an ethical appeal.

Authors and publishers seem to know perfectly that they choose visuals and graphs in their publications to advance their argument rather than just to decorate their pages. They tend to include words that are fluff; they do not just use meaningless images. Similarly, just as they intend to avoid the use of fallacies in their texts, they also seem to carefully avoid using

deceptive images. To exemplify this argument, if you had an argument in which you argued for or against the suggestion that an Angolan bred cow produces more milk, you would definitely require presenting a picture of that cow.

Harding (2013) carried out a study on visual images in which it was argued that much of the impact of the changing planet lies within its rhetoric, particularly the pathos extorted via its visual images. Moreover, Harding's (2013) study concentrated on the types of information conveyed through the reports' visual images and the way they have been modified over a period of time, the changing connections between visual images and text, and the relationship between those modifications. Through the use of social semiotic theory, the study analysed the visual images in the yearly reports, ranging from 1990 up to 2013; this was not only to establish their ability to persuade the target audience, but also to examine the potential relationship between the producer and the viewer. The findings of the study revealed that each of the images had an impact on the audience.

In addition, Syfert (2013) also carried out a study on the rhetoric of images on climate change. Through the examination of eight (8) images taken from the green peace image campaigns, Syfert (2013) was able to demonstrate that images drew attention to climate change issues via their rhetorical capacity to challenge the dominant cultural values that have allowed climate changing human activities to continue. The advocacy group, Greenpeace was determined to present a striking protest around the globe; visual images garnered the attention of the news media and the viewing public. The visual images presented the effects of climate change on the environment and also on human life. To substantiate the above argument, Syfert (2013) gave an example of what had happened in Switzerland in 2007, in which the Greenpeace

activists had posed nude in the mountains to demonstrate the effects of climate change on a melting glacier.

Nelson, Megill, and McCloskey (1987) note that the significance of visuals imagery in moulding public perception is more effective than verbal phrases. Equally so, Deluca (1999) and Perlmutter (2003) duly acknowledge the sophisticated ability of visual imagery to evoke emotion, and this has become a powerful political instrument to ultimately win the hearts and minds of the public.

Modern technologies have made visual images remarkable and convincing. Even Delicath and Deluca (2003) concur with this submission that the proliferation of modern technologies has made visual images efficient and effective. They argue that public discourse takes place in the situation determined by mass communication technology through dramatic visual imagery.

The effective usage of images to persuade the audience is not only limited to climate change, but even in politics visual images are often used as tools with which to convince the audience. Szasz (1994) demonstrated how political discourse seems to heavily rely on visual imagery rather than on words, prompting scholars such as Gunter (1987) to postulate that while both images and words are important in influencing public perceptions, visuals imagery takes priority over phrases. This is the extent to which scholars go to justify the significance of visuals or images over words.

In trying to make environmental issues such as climate change more meaningful to the audience, rhetoric scholars have observed that climate change authors frequently rely on inflammatory language and visual imagery in order to draw attention and persuade the public

perception (Cox 2006; Doyle, 2007). Various scholars may have examined the important roles that visual images have in moulding and shaping public perception of climate change, but there is a dearth of information on the linkage between images and the philosophical interpretation of the unknown knowledge. Simply informing the audience or the public about climate change through visual images may not fully explain the preconceived idea before an image is produced.

Visual images constitute a form of oppositional argument which is uniquely capable of generating social arguments in that they seem to challenge norms of public participation, and equally widen the possibilities for deliberation (Olson & Goodnight, 1994). Olson and Goodnight (1994) further argue that when climate change activists employ visual image campaigns, they tend to challenge the pureness of social discourse and conventions, and they do this by exploiting the means of communication taken for granted, that is, images. As demonstrated above, climate change activists frequently use images to advocate climate change issues, but the analyses of different literatures reveal that these images need to be more dramatic to get the exposure and ultimately inspire an audience who may not be initially engaged with the issues.

The above argument is supported by Scarce (1990) who claims that the more dramatic an image is, the more controversial it is, and as a consequence the more publicity it gets. It should further be understood that climate change visual images of extreme activism tend to use emotional appeal to influence public's perceptions that the climate change problem is real, and the problems can be avoided if the public adopt a more traditional approach. The present study examined visual images and graphs taken from climate publications to establish whether the rhetorical moves suggested by Hashim (2010) were used, but also to decide on the functions and visible hegemonic elements that make images tick.

Most images evoke an ethical appeal in order to frame climate change as a social problem, by revealing that the ordinary people who at times pay a price for development do not benefit from their sacrifices. Of course, scholars know that sometimes using images to appeal to the pathos of the public could easily result in utter rejection by the authority or the public, but those scholars equally know that sometimes rejection signifies a blessing in disguise. Syfert (2013) challenged the fact that rejecting an image may actually strengthen its acceptance. In a study by Syfert (2013), images were examined and called attention to the actions and inactions of corporations and states that contribute to climate change. The study revealed that by making visible the risks and consequences of industrialism, the study brought to the fourth the issue of climate change to the public discourse.

Potter (2011) analysed the presentation given by Al Gore, the former vice president of the United States of America, in March 2009. In the analysis, Potter (2011) revealed how Gore had used graphics and photographic images to make and support rhetorical arguments. More importantly, the analysis showed how Gore used his keynote address to argue through visual analogy and chronology. Gore argued that there should be a price put on carbon dioxide in order to minimise the emission of greenhouse gases into the atmosphere, as a result halting the perilous and rapid development of global warming.

Correspondingly, Potter (2011) displayed some of the visual images used by All Gore in his presentation. For example, satellite pictures of the earth seen from the outer space portrayed a grim reality about climate change, one picture showed the North ice cap intact (1980) and another picture showed the North cap missing (2007), as a prediction of a frightening future.

The interpretation of the picture taken in 1980 showed the earth with ice covering the whole of the North Pole, revealing what the vegetation looked like then.

In the second picture the analysis revealed what happened to the North Pole after 28 years. Potter's (2011) analysis further reveals how an image taken in 2007 clearly shows the substantial amount of ice that had disappeared. The fact that pictures were used by Gore stands as documentation of facts, which seems to create a visual chronology thereby presenting a chronological development which the audience can observe, that is, the ice that was intact and the ice disappearing. The pictures used by Gore during the presentation, which came from climate scientists, tend to appear as irrefutable proof of a specific development. From a rhetorical point of view, this clearly demonstrates Gore's ability to use scientific imagery to persuade his audience.

Potter's (2011) findings reveal the following: the pictures presented by Gore did not really document anything since they were neither photographs nor had any kind of indexical relation with the areas depicted or the disappearing in relation to the areas depicted about the disappearing ice – as far as one could tell. This is so because such pictures appear to be just illustrations of claimed factual relations. Potter (2011) cynically called Gore's images pseudo-documentary images.

However, the interaction between words, pictures and visual graphs created a remarkable argument of urgency, supporting the claim that the ice is truly disappearing. Furthermore, Potter (2011) presented further images of melting ice dripping and collapsing houses, used by Gore during the presentation. Of course, the photographs of an immense ice raft from which water is dripping into the ocean gives an impression that the ice is melting. From these pictures,

Potter (2011) concluded that by presenting a dripping ice, followed by a picture of collapsing houses, Gore intended to strengthen his persuasive moves to appeal to his audience about the danger of climate change.

From Potter's (2011) conclusions, an argument can be made that Gore's intention was use visual images to create imagery of melting ice and collapsing houses in the mind of the audience. This means that if nothing is done to curb climate change, civilisation would vanish from the face of the earth because of the melting ice raft.

What seems interesting to note is the fact that Gore's spoken words are not featured prominently in the analysis, but Potter (2011) did not have to do that because Gore's pictures of the rapidly changing climate made it obvious by presenting pictures with few spoken words, thus Gore had a rhetorical advantage to appeal to the pathos of the audience. In the same way, pictures function as proof for factual situations, and they make the situation more valid and concrete. Of course, pictures have the potential to give the audience the opportunity to be active in the interpretational process, through piecing together the pictures into a coherent narrative.

What is more, the rhetorical advantage of the images in general is that they make it possible for the general populace or audience to see images with their own naked eye. This way, the viewer actively transforms an image into an argumentation – as a result the viewer is likely to construct the rhetoric meant to persuade him or her. Most literatures on visual rhetoric point to the fact that the most important rhetorical task in visual images is creating a sense of urgency. Even Potter (2011) has revealed how Gore talked about climate change continuously using words such as "emergency" and "urgently.''

Another rhetorical advantage of using visual images seems to be sense reality as images are likely to create an impression of reality because the audience can see images and can believe the images as reality. This observation is supported by Perelman and Olbrechts (1969) who argue that the presence of images acts directly on human beings' sensibility. Perelman and Olbrechts (1969) argue that the presence of evidence is of paramount significance for the technique of argumentation.

For example, Gore's use of visual images in his presentation demonstrates how visual presence is connected to such argumentation techniques and the creation of what appears to be reality. Murphy (1994) observes that presenting visual images to the audience in an analogical manner tends to create and form reasoning that functions to establish reality, arguing that any evidence shown must create "real" and the urgency of the situation. In addition, Kjeldsen (2011) points out that images often serve as the function of ground data or backing because they usually emerge as facts, evidence and categorical statements and thus they are seen as reality.

Hughes (2012) carried out a study on the visual rhetoric of climate change documentaries. In the study, the development that had taken place between people and their environments from the start of the 21st century was explored. The study contextualised this exploration with a report of the history of the use of aerial images in environmental documentaries. In those images, awareness of the effects of industrialisation through the use of visuals images about agricultural productivity was done to provide evidence of damaging cultures.

Hughes (2012) further argues that giving an example of an aerial photograph from world war two demonstrates that an environmental issue can be presented by a historical photograph. This

is so because the early photographs are assumed to have their own political context and they are likely to be seen as part of the struggle to prevent environmental distraction.

Continentally, it seems Africa's lack of modern industrialisation and limited carbon footprint have made it the smallest contributor to the ever growing global warming crises, but the continent bears the brunt of the world's rising temperature with devastating effects, including droughts, flooding, waning ecosystems and unreliable crop production (Winsor, 2016). Below is Figure 2 with an image analysed by Winsor (2016) to demonstrate how images are used by climate scientists in Africa to appeal to pathos. The picture shows pupils navigating on a hand-made reed rafts to get to school. The image was accompanied by the message: "the swamp is rife with submerged vegetation, hippos and crocodiles."

Rhetorically, the depiction of the image could be attributed to the desire by the publisher to draw attention to the danger of climate change. Targeting school-going children could be seen as a tactic by the photographer as this may have a strong impact on policy makers to take a swift action to mitigate the environmental negative impacts of climate change. The fact that danger is lurking everywhere in the depicted water could be seen as a source for concern for the authority in the country where the picture was taken.

Figure 2. Photo by Tony Karumba/ AFP/ Getty image (taken in Kenya, March 14, 2014)

Moreover, Winsor (2016) observed how scientists, when commenting on climate change in Africa, use descriptive words, graphic images and phrases to describe climate change. While carrying out the analysis, for example, Winsor (2016) noted some of the phrases that are typically used such as "the floods have contaminated drinking water," "severe drought in sub-Sahara" as opposed to just drought in sub-Sahara, "Food shortages" and "refugee crisis" are some of the phrases used.

The picture in Figure 3, also taken from Windsor (2016), shows a graphic image of a woman with a baby on her back walking on a dry land, walking right behind the donkeys carrying what seems to be empty containers. The image is rich with rhetoric, particularly the rhetoric of climate change. Persuasively, the picture has the potential to persuade the viewers. The image

paints a grim reality about the danger of climate change, particularly in developing countries as depicted in the picture. Displaying such a rhetorically rich image to the public may sway the public's opinion towards climate change and may even compel the public to take action and mitigate the effects of severe climate change.

Figure 3. Photo by Tony Karumba/ AFP/ Getty image (taken in Djibouti, 17 august 2011)

The picture shows what appears to be a single mother, who is probably affected by climate change. The dry Savannah is indicative of the absence of rain in this area. When pictures such as the above are presented in the publications on climate change, they tend to have an emotional impact on the readers of those publications. Multiple containers on the back of a donkey are signs of how desperate this woman is in terms of her desire to get portable water. Depicting

her with a baby on the back while walking behind the three donkeys has the potential to appeal to readers about her plight, but most significantly, the environmental plight she finds herself in.

Observantly, in southern Africa climate change seems to be presented through fear and threats by climate change scientists. Brown, Hammill and McLean (2007) published a paper on the "securitisation'' of climate change in Africa. Therein, the publication reveals how scientists use security threat to make a point about climate change in Southern Africa. Brown, *et al.* (2007) record that scientists make claims about how climate change represents the latest in a series of environmental drivers of human conflict that have been noted in modern times, inter alia, drought, land degradation, desertification, failing water supplies, fisheries depletion, deforestation and ozone destruction. *Brown et al.* (2007) further reveal that scientists had identified worrying evidence of human induced climate similar to none in the developed world.

Brown *et al.* (2007) also argue that security analysts have warned for a while now, that climate change threatens water and food security, coastal population, and the allocation of resources, and that these threats could increase migration, raise unnecessary tensions and trigger conflict. Climate change in southern Africa is seen by many scientists as a security issue lurking on the horizon, and as such it requires an action. Several papers published on climate change in southern Africa paint a gloomy picture of the future awaiting Africa. Brown *et al.* (2007) present that most literatures on climate change in southern Africa are deliberately provocative and present an imagined future where climate change would trigger unrest.

The African continent is presented as the warmest of all the continents. Brown *et al.* (2007) record that scientists view Africa as the continent which is likely to warm faster in this 21st

century. Several scientists have been reported to have claimed that the rainfall patterns would shift as the hydrological cycle becomes intense. Rainfall is said to be on the decreasing slope through most of the region, except in east Africa, where it is projected to be on the increase.

Supporting the above projection, Christensen (2007) cites the conclusions of the IPCC wherein it was reported that all of Africa was going to be warm during the 21st century at rates greater than the global annual mean warming. It seems that governments in Africa are grappling with the issue of climate change and how to tackle those challenges. Certainly, several governments in southern Africa in particular, seem to have insufficient capacities to predict, mitigate, manage and monitor disaster associated with climate change. As a result, scientists seem to take advantage of this inactive response by beating the drums of environmental awareness. Of course, Namibia is no exception to this climate conundrum as the country faces increasing occurrences of flash floods, heavy rain and wind.

The central part of Namibia, Khomas in particular, is most certainly vulnerable to climate change related disasters, because the area has a high-density population without sufficient water reservoirs. Due to rapid urbanisation in the Khomas region, Windhoek to be exact, a considerable number of people have been compelled to live in riverbeds, resulting in loss of livelihoods and aggravating poverty. However, in countries such as South Africa, the issue of rapid urbanisation which is likely to force people to live on unstable hillsides and sinkhole zones, are being addressed through limited measures taken by city authorities (Joubert, 2006).

As a whole, Namibia is a country which is very dry. Due to harsh environmental conditions, supplying the public with portable water seems to have become a challenge for the authorities in Namibia. The water crisis, believed to have been caused by climate change, was exacerbated

by the power supply sector which seems to struggle to meet the ever-increasing demand of the economy according to the United Nations Development Programme (UNDP) (2007). The present study examined several publications, while taking some environmental challenges presented by various authors on Namibia's climate change.

It seems that the harsh environmental conditions being experienced by countries in southern Africa are being exploited by climate change scientists to appeal to the public through fear. Steynor (2017) observes that 111 countries around the world were surveyed regarding climate change perceptions. The survey revealed that Americans and Europeans felt substantially less threatened by climate change than they had been when a survey was conducted four years earlier. In contrast, sub-Saharan Africans and Latin Americans saw themselves as being more at risk.

From an elucidating point of view, rhetoric should be seen as an attempt to illuminate the significance discourse, advocacy, and an orientation of arguments towards the truths at a particular time and space. Correspondingly, rhetoric paves the way for comprehending sophisticated and complex issues as a result of linguistic symbols. Rhetoric should not be seen as empty communication as it is always viewed by most nonrhetorical scholars; rhetoric goes beyond this shallow definition.

Despite Plato's references to rhetoric as a form of trickery, rhetoric in essence is a complex term that encompasses multiple elements of persuasions. Just because language is used in rhetorical arguments, it does not mean that all arguments are meant to deceive the public, or that Namibians have been deceived into believing that climate change is a hoax. Rhetoric, to say the least, goes beyond this. Rhetoric provides a platform to think through and about how

climate change affects all of us, and how it should be dealt with, and how solutions should be sought, and how one should navigate the politics around it.

As it is a common knowledge now, climate entails physical characteristics and social composition, and as such it demands human involvement. Climate change cannot be solved without communication and rhetoric; it requires a multifaceted communicative dynamic. It should equally be argued that rhetoric brings to the fore the knowledge that whatever is done to reduce the effect of climate change entails complex forms of argumentations and deliberations. Understanding national and international issues on climate change requires dialogue, and this dialogue should be guided by complex arguments to reach consensus.

Perusal of various academic sources reveals that rhetorical argumentation of climate change seems to be inherently influenced by ideology and other socio-dynamic factors. Even the arguments put forward by climate sceptics seem to be strongly influenced by ideology. Audaciously, Ceccarelli (2011), notes that climate scepticism is a manufactured controversy to represent a particular interest. Ceccarelli (2011) further argues that, as an example, the Republican Party in the United States prefers to present controversy around climate in order to advance the party's interest. Exxcon mobile is said to be the main sponsor of climate deniers' research. Ceccarelli (2011) similarly observed that Exxon mobile though it has uncovered that climate change was happening; it instead sponsored research that supported the climate change controversy.

It can be seen from the above that the arguments around climate change are rhetorically constructed, thus they can equally be deconstructed. Therefore, this is the area where rhetoric can be helpful in analysing and tracing rhetorical constructions that have pushed this analysis

to what it is. Climate change is increasingly acknowledged as a threat facing human societies in the 21st century.

What should be looked at while trying to understand this phenomenon is the way in which the discourse about climate change resonates in the public discourse. Various researchers dealing with climate change seem to embrace more interaction approaches to science - society relations than ever before (Vincent, 2004). It is almost agreed upon by various scholars that despite being shrouded by uncertainties as to its nature and manifestations, climate change is an authentic phenomenon that is likely to inevitably affect humanity in the foreseeable future.

Moreover, Vincent (2004) observed that growing interest in global environmental change seems to have placed focus on the attention of inter-relationships between nature and human systems. Just like Vincent (2004), traditionally science seems to have concentrated on projections of climate using various models based on previous analogues of climate unpredictability, and subsequently initiated ideas as to how such dynamics might impact on human populations. Nevertheless, it is this kind of top down approach which brings limitations and failures to consider the differential vulnerabilities of human populations to those environmental dangers. As a consequence, evaluating the likely impacts of climate change is thus inextricably connected with an evaluation of the social vulnerability.

In addition, the field of rhetoric on environmental science seems to come out as entailing multiple bottom up studies of the way in which humans mediate environmental change to produce impacts. This area of rhetorical enquiry marks one of a number of emerging research areas of nature-society relations. Despondently, the development of the study seems to have been impeded by a variety of paradigms and conceptual approaches, uncoordinated empirical

studies and, as a result, lacks comparability on the broader scale. It is against this background that the current study therefore fills an academic demand for the examination of climate change publications in Namibia.

Climate change's entrance into the public discourse or domain is an open secret for most scholars. Traditionally, climate change was viewed as a physical phenomenon that was observed, quantified and measured, and was mostly only understood by scientists. But Hulme (2009) observed that nations have been increasingly confronted with the observable realities of climate change and know of the repercussions that scientists claim lurking in the future, and that climate change has turned from being a physical phenomenon to be a social phenomenon.

Hulme (2009) further notes that human beings have become active agents in the moulding and reshaping of physical climates the world over, arguing that cultural, political, social and ethical practices are reinterpreting what climate change is all about. Equally, Hulme (2009) argues that climate change is an idea that travels well beyond the origins in natural sciences, noting that this idea come across new cultures, the world of politics and economics.

As can be seen from the arguments above, climate change has the potential to carry different meanings and it tends to imply different courses of action, depending on the various vantage points one stands. The differences in viewpoints are deeply rooted in philosophical foundations than just mere contrasting of interpretational analyses of the scientific narrative of climate change. In short, climate change is an unravelling phenomenon about the way we perceive and act. Climate change seems to be changing our physical worlds and also altering the social world of things. Therefore, climate change requires rhetorical interpretations to arrive at possible independent solutions in order to deal with it.

Climate change, according to Hulme (2009), interacts with the human psyche and with cultural practices in less material and more imaginative ways. The human psyche, as Hulme (2009) notes, entails the perception through which climate change knowledge is communicated and shaped, and this perception entails how the communicated scientific knowledge is received. Wright and Mann (2013) argue that rhetorical analysis is important for examining and drawing attention to climate change as a socially and politically constructed phenomenon, closely intertwined with the ideological assumptions underpinning collective sense-making processes. This approach seems to become increasingly significant as social studies have noted that the danger behind earlier scientific representations of climate change as a predominantly environmental and natural problem that calls science-drowned evidence-based responses is real. In support, Jasanoff (2010) contends that such representation is likely to lead to the view that climate change is an impersonal, apolitical and universal imaginary protected and projected by science.

Scholarly, rhetorical analysis of climate change provides insightful analyses that highlight how scientific knowledge unavoidably interacts with and is embedded within the social, economic and political constituents of climate change discourses (Koteyko & Atanasova, 2016). The two scholars further argue that rhetoric offers an effective means of understanding how language is used by scientists to communicate and construct ideas, concepts and levels via which the semantic aspects are assigned to the causes and results of climate change. Koteyko and Atanasova (2016) in the same vein revealed that rhetoric identifies of scientific discourses in a wide sense as socially, politically and historically situated constellations of meaning reveals the strategies and examines the visual aspects of the climate change point of view.

At the most fundamental level, rhetoric, according to Burke (2015), helps to reveal different ways of representing climate change, which is crucial in evaluating the means by which this phenomenon can be appreciated from different perspectives. Burke (2015) similarly argues that arguments that emanate from climate change depend on world views which are in turn connected to power relations. Various groups such as environmentalists, including landowners, may perceive climate differently for example as survival; therefore, collective action on climate change is likely to be based on the outcome of the stiff competition between such discourses. Arguably, which ever discourse comes to dominate public understanding will likely influence any environmental related policy (Honneland, 2004).

As a whole, rhetorical analysis of climate change can serve as a sign that texts can be constituted via options not only of what topic to cover, but also linguistic options that relate to the representation of institutional participants. Befittingly, rhetoric helps to uncover authority and whose versions of reality should be involved or foregrounded and this may thus lead to discrimination of other views and voices. From this vantage point, rhetorical analysis techniques, as Koteyko and Atanasova (2016) note, has the potential to reveal a broad range of access to discourse and particularly what positions are afforded to participants (scientists and the public). What should be understood first is that the arguments provided by various authors seem to not explicitly say that scholars who use the qualitative approach to analyse and examine climate change communication should not disregard the broad and ever increasing volumes of text-based data generated by technology that share the attributes of scientific techniques.

2.6 Language (models) of science interpretations

What is a model? Several scholars have attempted to define the term model. For this study, the definition by Heckelman and Dunn (2003, p.76) is chosen, which proffers that "a model is

a representation of a state of affairs or relations." Heckelman and Dunn (2003) believe that such a state of affairs might be economic, mathematical, historical, literary and rhetorical. Additionally, a model could be represented in the form of a model of airplanes, toy soldiers and plastic models of every kind. To discover how these models conceptually and pragmatically function, one needs to examine them. Deducing from Heckelman and Dunn's (2003) definition of a model, it can be argued that a model represents; it predicts the future, sometimes it implies narrativity, it can persuade, reveal and conceal – the issues the study is concerned with.

To illustrate the above argument, a model of an airplane by Heckelman and Dunn (2003) always represents the connections between its components of the whole parts. Through such a model, a prediction could be made to predict how an actual plane would look like. Furthermore, this same model could possess an inherent design component which is likely to remind us of some experiences of a plane, or something else which could help in the interpretation of a model. Equally so, the model also entails strong persuasive aspects the public would believe, on the basis of the model, what an airline is. The public remains persuaded until another model of the same entity is presented.

Models are tentative and in many cases they are provisional. Similar to stories and verbal constructs, models are constructed from a certain point of view. The model of a motor bike may not include any inside engineering techniques needed to drive it. This is where the rhetoric of science comes to mind. In the study, the findings about the models and rhetoric carried out by Heckelman and Dunn (2003) are compelling. They argue that the writing component of science is deeply embedded in the language of modelling. Correspondingly, they argue that science entails brain storming, clustering and outlining as model building activities, nothing

that represents scientists' thinking. When scientists outline, it means that they construct a model.

Several studies focusing on the development of science models interpretations have been similarly carried out in the area of rhetoric of science. It has been observed that most scientific texts exhibit internal coherence structure which can easily be analysed as a tree structure of relations that bind between short segments (Reitter, 2010). Accordingly, through using rhetorical theory structure, a vector model was developed to help analyse a variety of textual properties, including cue phrases, parts of speech, rhetorical context and lexical changing (Vapnik, 1995). In the vector model, classifiers base their decisions on automatic knowledge acquired from sample documents. The model determines general characteristics of the samples that belong to each assigned category or relations. According to Vapnik (1995), the vector model machine analysis delivered superior results in its many applications.

Vapnik (1995) found certain factors that justify the use of the vector model to analyse science texts. The vector model entails the pattern recognition problem, so it is believed that it can deal with multi-class classification. Similarly, it is observed that the vector model has features that are interrelated in terms of qualitative and quantitative features; as such it is designed to solve highly non-linear problems.

The vector model seems to be effective in dealing with large information; it however, lacks the epistemological and ontological interconnections between science and public interest. For example, the vector model classifiers make decisions on rhetorical relations by means of nuclearity (texts span nucleus). The model determines attachment preference for a text span by scoring alternate hypotheses. The model does not make philosophical provisions and

pragmatic interpretations. The model is perhaps suitable for surface interpretations but seems to lack interpretation on the deeper level. Statistical analysis or rhetorical analysis is based on a rule-based chart rather than an ontological and epistemological perspective.

Another model which could help explain the epistemological connections between language and science is the one developed by Aristotle, the rhetorical triangle. This model is based on the three rhetorical appeals: ethos, pathos and logos.

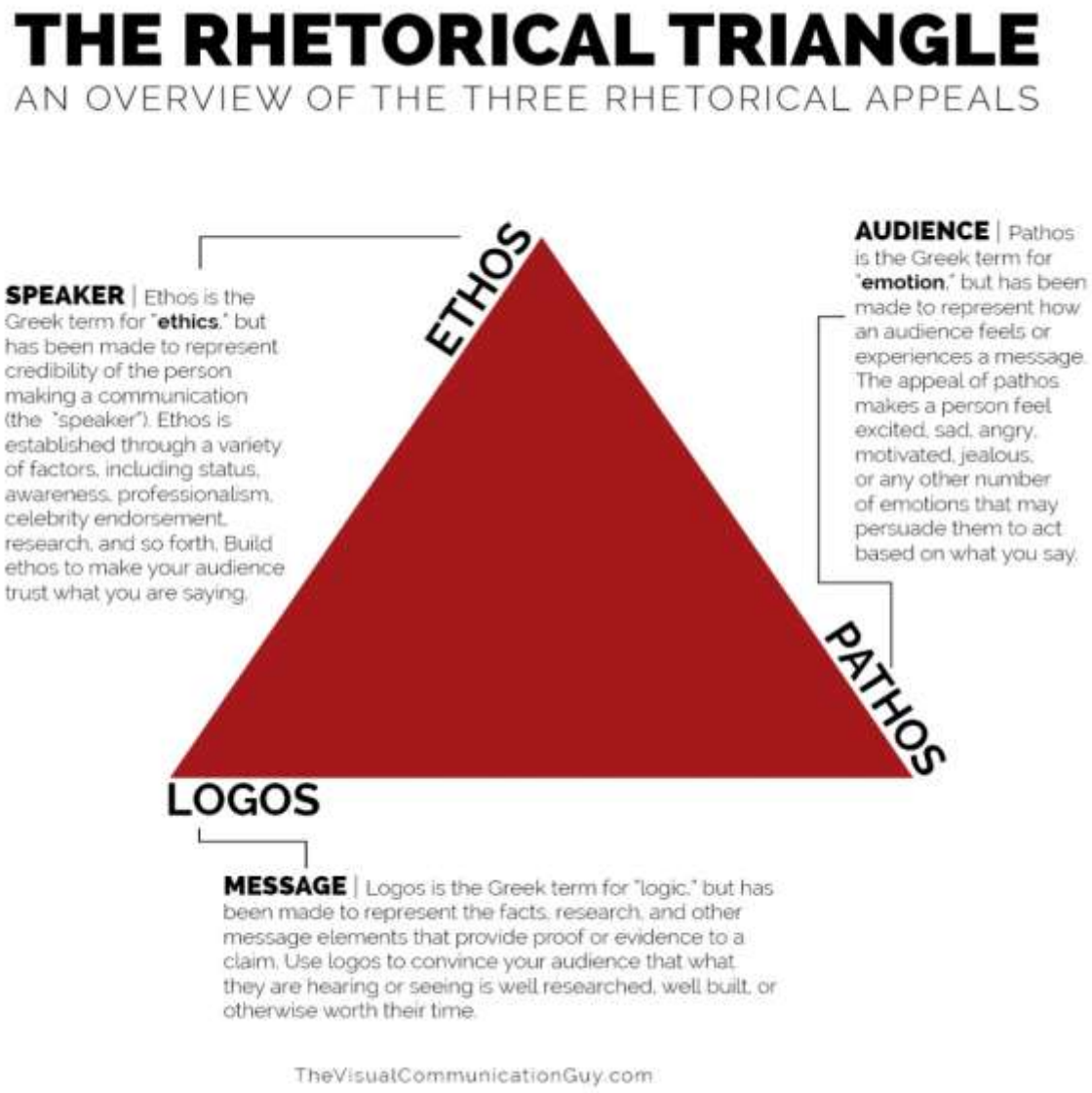

Figure 4. The Rhetorical Triangle (Adopted from thevisualcommunicationguy.com)

As can be seen in Figure 4 above, the rhetorical triangle seems to be effective in explaining social issues. The model seems to lack the aspects of 'the undiscovered reality.' The model is better positioned to explain some aspects of science but not the scientificity of the whole concept of the future knowledge. It is common knowledge that ethos makes wider reference to what makes the situation credible. Scientists create a communication by adopting rhetorical devices that make their communication appear credible. Needless to say, most scientists seem to know that credibility can take over a long period of time to establish. Conversely, scientists also know that ethos can easily be damaged instantly if not jealously protected.

To build ethos, scientists seem to rely on the usage of professional and appropriate language for their intended audience. Scientists seem to design their communication professionally. They seem to use a lot of sources in their citations to create ethos, and they also seem to use appropriate scientific jargon to express awareness among their audience. Most of the scientists seem to follow established conventions and paradigms of science in general. By the same token almost all scientists rely on logical connections between ideas, and they seem to avoid logical fallacies.

The triangle model encapsulates an element of logos. Just like ethos, logos according to the information on the triangle is based on building a logical argument around a situation. Scientists use statistics and other various established facts to build an argument. Scientists seem to do this by making constant reference to the research in support of their claim. Furthermore, they seem to rely on logical connections between concepts by being specific.

Pathos in science entails the use of images to awaken emotions. Unlike in other areas of studies, most scientists seem to avoid using humour, emotionally charged words or place to evoke

enthusiasm when communicating their findings to their audiences. Despite the limited use of emotional language, science seems to find it impossible to detach itself from images that scientists use to argue their case. Rhetoric goes beyond just using emotional language, any form of argumentation intended to persuade the audience, be it emotional or otherwise, is equally regarded as pathos.

Communicating scientific discourse seems a daunting task. To most scholars communicating scientific discourse, let alone climate change, this can be an intimidating endeavour. Some people may wonder how communicating climate change differs from communicating other environmental problems, commercial challenges, risks, policy problems, and behavioural change issues. Moser (2010) even remarked that the insights from other communication experiences cannot simply be applied to climate change and asked if a separate area of scholarly attention for climate change is necessarily needed. Perhaps apart from the institutional makeup and professional challenges, there is probably something in the nature of the climate change problem and also how human beings interact with the climate that makes it more challenging to communicate than other environmental challenges. Yieldingly, Moser (2010) reluctantly agreed that a number of challenging traits truly make climate change a difficult issue to deal with. Clearly, from these remarks it can be argued that climate change perhaps requires a special communication scholarly attention.

Indistinguishably, the causes of some of these traits of climate change can easily be viewed by simply looking at the sky. Literally these traits do not have direct impact on health implications; this way the pollutants causing problems are different from many other air and water pollution problems (Moser, 2010). Equally, Moser (2010) contends that these traits are influenced by the

geographical distance between cause and effect, arguing that emitting greenhouse gases does not lead to a noticeable and visible impact.

The complexity of communicating climate change to the public by scientists was made unproblematic by Halliday (1998) who developed a theory in which an argument was advanced about how and why scientific writing differs from other writings. In that theory, Halliday (1998) explained that scientific discourse exploits the capacity of a language that is used daily without realising it. The theory refers to this argument as grammatical metaphors. Attempting to explain the theory, Halliday (1998) simply and briefly refers to it as the process whereby one thinks theoretically. By theoretically, Halliday (1998) meant the process where one experiences and construes the experience in a language – that is telling someone else about one's experience.

However, what is noteworthy is that the process of the 'experience' may entail processes over an extended period of time in which scientists engage in experimental experiences that they may construe and re-construe in a language. Revees (2005) equally agrees that apart from experimental, sometimes one may observe the process artificially in the texts one writes to communicate one's findings and ideas. These texts may entail grammatical metaphors that convey or mirror the re-construal process in the scientists' thinking, but they (scientists) may also support the arguments the writers are making (Reeves, 2005). When scientific writers change verbs and adjectives into nouns, they tend to create objects out of the process, qualities and attributes (Halliday, 1998).

2.7 Environmental and climatic context of Namibia

Globally, the Millennium Ecosystem Assessment (2005) recorded that a recent study has exposed that over the past 5 decades human activities have changed ecosystems more swiftly and extensively than at any comparable period in history, with more than 60% of the world's ecosystem degraded. Predictably, Namibia's foremost grassy savannah vegetation is likely to fade away and give way to more desert and shrub land with projected increases in bush encroachment (Smit, 2019).

As such, climate change poses a significant challenge to both food security in rural households and to sustainable development in Namibia at large, with a projected decline in GDP in the absence of climate change adaptations and mitigating measures. Worth noting is a study by Southern African Development Community, Regional Environmental Educational Program (SADC REEP, 2011, p. 39) which revealed that "human societies have for centuries obtained materials such as timber, rubber, food and medicinal plants from forests." Forest trees and plants also absorb carbon dioxide, which is lethal to humans, but the trees use it to produce food during photosynthesis. In progression, they discharge oxygen that human beings breathe in and use for respiration. Environmentally, these forest trees and plants keep the soil intact to steer clear of soil erosion, and they also release water vapour through the process of transpiration which contributes to the hydrological cycle that is good for the climate.

However, in order to respond to the climate change threat, the Namibian Ministry of Environment and Tourism has developed the national climate change policy of 2011 which, inter alia, provides the frame for resource mobilisation for the country to embark upon adaptations and mitigation measures. The policy calls for the transfer of technologies, capacity building and the provision of financial resources, while promoting and enhancing synergies

among stakeholders through the inter-sectoral national committee on climate change. Another important document is the nationally determined contribution (NDC) which was approved by cabinet in 2015.

Namibia's NDC is one of the most ambitious of all the countries and it targets to reduce greenhouse gas emissions by 89% by 2030 compared to the business as usual scenario. This will involve increasing the share of renewable electricity production by 2030; reducing energy consumption by about 10% through an energy efficiency programme and implementing a mass transport system in Windhoek as well as other measures to reduce emissions from transport by some 1300gigatonnes. Agriculture, forest and land use sectors are major emitters of greenhouse gases in Namibia.

The Namibian government has pledged to reduce the deforestation rate by 75%, to reforest 20 000 hectares annually from 2018, restore 15 million hectares of grassland by 2030, practice conservation agriculture on 80 000 hectares by 2030 and implement agro-forestry systems on 5000 hectares of land commencing in 2018 (Smit, 2019). Air pollution might not be a priority problem in Namibia for now but the number of air pollution sources which may become more severe as the country industrialises and develops may get significantly high. Alternative approaches and technologies to both avoid and mitigate adverse impacts from these activities should be contemplated by the Namibian government.

The process of burning wastes by towns, settlements and villages results in the emission of a lot of smokes and other chemical substances into the atmosphere. Understandably, Namibia is currently in the process of developing the national waste management regulation in terms of

the environmental management act that will address some of this apprehension, as well as others linked to waste management.

Economically, Smit (2019) observes that Namibia's economy is vastly reliant on climate-change-sensitive sectors such as agriculture, livestock ranching, crop production and fishing. Thus, climate change impacts can be calamitous for the country. Smit (2019) further notes that scientific projections indicate that Namibia will become hotter, with estimated temperature increases of one to 3,5 degree Celsius in summer and one to four degree Celsius in winter by the year 2046. Rainfall in Namibia is projected to become more intense and even more variable, noting that in the previous years, Namibia experienced localised windstorms and flooding, as well as cold and heat waves in different parts of the country. Of course, these destabilising factors can be linked directly to climate unpredictability.

However, the northern part of Namibia is vastly endowed with terrestrial wetlands which are important to climate change mitigation. Wetlands are likely to provide reduced ecosystem vital services such as water rendition, flood attenuation and water purification.

Moreover, wetlands and the general woodland savannah are inextricably linked through the hydrological cycle which is necessary for climate change mitigation. Needless to say, they play a crucial role in the preservation of the climate. Forests or the general woodland savannah can help regulate atmospheric temperatures through a process called evapotranspiration. Also, they enrich the atmosphere by absorbing carbon dioxide (which has the potential to reduce the global warming) and other greenhouse gases, thereby producing oxygen which is used for respiration.

A rhetorical understanding of the role that these bodies play in the hydrological cycle will enable the policy makers to effectively consider these ecosystems when formulating policies and management practices to protect the climate (Sindano, Utete, & Ilukena, 2018). Also, it can equally be argued that climate change has various linkages which can help in explaining the rhetoric of climate change publications in Namibia as shown in Figure 5, 6 and 7 below.

Human linkages

Figure 5. Picture by Utete Christine (2017), Mavanze village, Kavango West.

It the study by Sindano, *et al.* (2018) it was revealed that the terrestrial wetlands, apart from conserving the climate, provide services to the inhabitants as they use the water sources for laundry; they get fish for nutrients, temperature regulation and water for household consumption. Environmentally, terrestrial wetlands rely profoundly on human protection and

humans rely on the wetlands for continued existence. Apart from wetlands absorbing carbon dioxide from humans and humans absorbing oxygen from the wetlands, the relationship between the two is inextricably linked.

Agriculture linkage

Figure 6. Picture by Gerson Sindano (2017), Sharukwe village, Kavango West, Namibia

The terrestrial wetlands are also used as a source of water for agricultural purposes. As illustrated in the picture above local inhabitants have developed subsistence gardens within the surroundings where they grow various crops for consumption and income. It is evident from this observation that the writers of climate change are likely to inject doses of rhetoric in their argumentation about climate change.

Economic linkage

Figure 7. Picture by Utete Christine (2018), Mavanze village, Kavango West, Namibia

The terrestrial wetlands are also used as a source of water supply for infrastructural development such as road construction, as illustrated in picture above. Additionally, it is likely that any climate change writer would consider the economic argument of climate change in his or her writings. Of course, protecting the environment such as terrestrial wetlands come with economic benefits to the locals because the local inhabitants can catch fish and sell them for income, and the companies that draw water from the water sources (wetlands) are mostly required to pay a certain amount of money to the headman as a token of appreciation. As a result, that money will be invested back into the community for various purposes such as helping the poor and developing their areas (Sindano et al. 2018). By the same token, the very

same companies that offer incentives to the communities are equally likely to offer employment opportunities to the local residents.

On the environmental context, Aucamp (2010, p. 1) defines the environment as the "world we live in, work in and play in, and includes all living and non-living things that we encounter on earth." The South African constitution, section 24 of 1996, is one of the few constitutions that prescribe the protection of the environment as a constitutional right. The South African constitution thus provides not only for the natural environment, but also for the human, social and economic aspect of the environment, and introduces the principle of sustainable development.

It defines the environment and sustainable development in the South African National Environmental Management Act (NEMA), Republic of South African (1998) as follows: Environment means the surroundings within which humans exist and are made up of land, water, the atmosphere, plant and animals to mention a few. While sustainable development means the integration of social, economic and environmental factors into planning, implementation and decision making so as to ensure that development serves present and future generations.

Moreover, the Republic of Namibia (2004) in its promulgation of water resources management Act 2004 (Act No. 24 of 2004 of 23 December 2004), viewed the environment as the surroundings within which humans exist and that are made up of the land, water and atmosphere of the earth; micro-organisms, plants and animal life; any part or combination of the aforesaid; the physical, chemical and aesthetic and properties and conditions of the foregoing that influence human health and wellbeing. The same constitution defines

sustainable development as a means of integration of social, economic and environmental factors into planning, implementation and decision making so as to ensure that development serves present and future generations.

The emphasis of most new legislation on the environment was largely on the avoidance of pollution since the adoption of the Environmental Impact Assessment (EIA) in the United States of America (US) in 1969 with no mention of environmental protection and sustainability. The EIA concept was seemingly only introduced in Southern Africa starting with Seychelles in 1994, and Namibia adopted the concept in 2004 (Sindano *et al.* 2018). The environmental management systems in Southern African is based on modern environmental protection and sustainability, hence the focus of this study is based on climate change.

In order for Namibia to look after its own environment, it has acknowledged the importance of making contributions to the global commons by sanctioning the following Global Environment Instruments: Forest Principles signed at Rio in 1992 and convention on Wetlands (Ramsar) in 1995. Nevertheless, it should be celebrated that in 1971 wetlands became the first, and so far, the only type of ecosystem to have their own international convention: convention of wetlands of international importance.

2.8 Theoretical framework

Rhetorical Structure Theory (RST) was used in this study. Mann and Thompson (1989) define Rhetorical Structure Theory as the organisation of words, clauses and texts, and the way they are connected to form a whole functional text: hierarchically organised clauses, relation of concepts and nucleus-satellite relation. RST is systematic; it helps us understand texts as instruments of communication. The interest of this study is to use a theory that can help

understand texts as instruments of communication and analytical tool in the description of text, thereby using it as a generational tool in the construction of knowledge.

Mann and Thompson (1989) while testing the theory used RST to examine particular texts and observed that many phenomena of text structure involved pairs of regions of the text. They further observed that the relations holding between the parts sometimes indicated by conjunctions could hold between text parts of a wide range of sizes, from clauses to groups of paragraphs. Remarkably, RST has the potential to describe texts in a rich and highly constrained way and RST likely predicts much about character effects expected in natural texts.

Moreover, Mann and Thompson (1989) note that there are three basic assumptions that are underlying to RST: texts are not viewed as just strings of clauses, but rather viewed as consisting of hierarchically organised clauses and group clauses that relate to one another in various ways. Secondly, these relations which could be described functionally in terms of the purpose the writer and the writer's assumptions about the reader, reflect the writer's options for organising and presenting the concepts. Lastly, the most type of text relation is a nucleus-satellite relation, in which one part of the text is ancillary to the other. As such, this theory is better placed to explain this study, since the study involves textual interpretations.

Since the study begins with the analysis of scientific persuasion and how language forms are used in the selected academic climate change science publications, RST is best suited to explain the rhetorical discourse emanating from the study. More than that, RST underscores rhetorical devices employed by various authors and these include rhetorical cues: lexical, discourse markers, punctuations, relations attributed, background, comparison, evaluation and explanation. Explicitly, RST provides a framework for investigating the rational proposition

that is unstated but inferred and the propositions that arise from the text structure in the process of interpreting texts (Mann & Thompson, 1986). In view of the fact that the coherence of a text depends in part on these relational propositions, RST seems to be a useful tool in the study of scientific text coherence.

In short, as a descriptive conceptual framework for text analysis, RST has provided a combination of several features that have turned out to be useful in various kinds of discourse studies. RST recognises the hierarchical structures in scientific text. Additionally, it describes the relations between the text parts in functional terms, as a result identifying both the transition point of a relation and the extent of the items related. The theory has been adopted because it provides a thorough and comprehensive analysis rather than selective commentary of the scientific publications.

The theoretical framework of the study has been extended to incorporate Aristotelian rhetorical theory. Of course, in the quest to persuade the listeners and readers, most speakers and writers have to be concerned about the emotional responses of the readers or listeners. Equally, the logical proof and credibility of the writer are taken into consideration when dealing with Aristotelian rhetorical theory (Colleran, 1988).

2.9 Conclusion

Chapter 2 sought to discuss the relevant literature and debates which have informed the present study, and which also guided the formulation of the research objectives of the study pointed out in Chapter 1. The reviewed literature had also guided the thematic analysis of the data as was discussed in the following chapter which focuses on methodology. The preliminary section of the chapter dealt with scientific persuasion and language forms. The discussion brought to

the fore the essential rhetorical moves and strategies that exist in the rhetoric of science. These moves are within the rhetorical structure which underpinned the study. Furthermore, the segment underscored the theoretical framework and the discussion surrounding the rhetoric of science from a comprehensive point of view. The second section of the chapter tackled the rhetorical effect of visuals used in science. This part looks at the scholarly contributions and discussions in the form of visuals. The examination of the effects of visuals in science by previous studies is explained. In the final section of the literature review, previous language models and science interpretations are presented and discussed.

CHAPTER 3: METHODOLOGY

3.1 Introduction

Chapter 3 seeks to describe and explain the research methodology employed in this study. The chapter describes the research design, population, sampling technique, research instruments, procedure, data analysis and research ethics.

3.2 Research design

A research design is a blueprint or a plan which directs how data relating to a given task should be collected and meticulously analysed (Nworgu, 1996). Ali (1996) concurs with Nwogu (1996), claiming that it is that blueprint which determines the nature and scope of the study carried out for a purpose. The researcher employed a qualitative approach. The method has been adopted because it is better suited to provide an in-depth understanding of the rhetorical analysis of scientific publications on climate change in Namibia. Arguably, by employing the qualitative approach, the emphasis is to discover and understand the epistemological dynamics of rhetoric of science.

Rhetorical interpretations of science publications seem to be complex, as such they require a research design that enables such complexity to be analysed and explored to provide a better understanding of how scientists use persuasive arguments to win the hearts and minds of their audiences. Qualitative researchers argue that there are elements of reality which are impossible to quantify (Silverman, 2000). Accordingly, qualitative research entails the subjective understanding of social reality as opposed to number descriptions.

Against this background, this study used the qualitative methodology of desktop research. Desktop research involves collecting data from existing resources which are the selected scientific sources or publications in this case.

As a desk study, the researcher analysed existing climate change sources or publications. The research study was qualitative in nature, since the collected sources were examined from a rhetorical standpoint. Phrases, words and visuals extracted from the sources were listed and subsequently analysed accordingly. The listing of phrases and words necessitated the analysis to be based on rhetorical characteristics. Twenty science scholarly publications on climate change were selected based on their diversity in subject matters: if two authors wrote on the same topic, one was purposefully chosen.

3.3 Population

Ordinarily, the term population refers to all the people in a geographical location. However, according Nworgu (1996), when the term is used in research, it refers to all members or elements, be they human beings, animals, trees, objects etc. of a well-defined group. The study has used existing sources for analysis; therefore, the population in this study was made up of various selected climate change research publications on Namibia.

3.4 Sample

For this study, a purposeful sampling technique was employed in selecting the science publications on climate change. The sample of this study was twenty science articles; journals and reports/publications on climate change in Namibia that were selected for rhetorical analysis, ranging from the year 2004 to 2016. The publications are: Impact of climate change in Namibia by Wilhelm (2012), Climate change vulnerability and adaptation assessment

Namibia (2008), The economic impact of climate change in Namibia by Reid and MacGregor (2007), Expected climate change impacts on land and natural resource use in Namibia: exploring economically efficient responses by Barnes, MacGregor (2012), Knowing farming and climate change adaptation in north-central Namibia by Newsham and Thomas (2011), National policy on climate change for Namibia by Ministry of environment and tourism (MET) (2011), The National Climate Change Policy (NCCP) (2010), Climate governance and development: a case study of Namibia by Zeidler, Kandjunga, David, Turpie and Malema (2012), Impact of climate change on human health in Namibia by Oertzen (2010), Study on the effect of climate change in the Cuvelai Etosha basin and possible adaptation measures by Zeidler, Kaundjinga, and David (2010), Water supply in an arid environment by DuPisani (2016), Climate change: The definition, causes, effects and responses in Namibia by Lubinda, (2015), Community perceptions of climate and variability impacts in Oshana and Ohangwena regions by Kaundjua, Angula and Angombe (2012), The changing climate and human vulnerability in north-central Namibia by Angula (2016), Bush encroachment in Namibia by De Klerk (2004), Climate change and food security in Namibia by Nickanor and Kazembe (2015). Gender and climate change: A case study by Angula (2016), Climate change counts: mapping study by Kotecha (2014), Climate change strategy and action plan by Ministry of Environment and Tourism (2009), and Climate change impacts on Namibia's natural resources and economy MacGregor (2008).

3.5 Research instruments

Research instruments are measurement tools or devices (recording devices, questionnaires or scales) designed to get data on a particular topic of interest from a research (Nworgu, 1996). For the purpose of this present study, a desk research based on document analysis was used and as such requires no instruments.

3.6 Procedure

A total of twenty selected scientific research papers from journals, reports and articles on climate change in Namibia, ranging from the year 2004 to 2016 were collected for rhetorical analysis. Extracted phrases and visuals were presented. The extracted phrases from the science publications on climate change were arranged according to their rhetorical moves and themes, and conclusions were drawn from the analysis.

3.7 Data analysis

The content of the extracted phrases and visuals were text-analysed and examined using rhetorical structure theory. The theory was better placed to explain this study since the study involved textual and visual interpretations. Extracted phrases, words and visuals of each publication were arranged according to their rhetorical moves and themes, and the rhetorical moves were subjected to critical analysis through descriptive coding (words, phrases, sentences and visuals as used by authors) and analytical coding (recognising rhetorical elements assigned by the researcher).

Equally, the extracted words, sentences and visuals were coded manually, and the emerging themes were identified. Cope (2010) views coding as a technique of evaluating and organising data to clearly understand meaning in a text, which helps the researcher to classify categories and patterns. Significantly, coding helps in building up rhetorical interpretation through a string of levels, avoiding the lure of jumping to hasty conclusions. Themes were arranged according to the research objectives.

3.8 Research ethics

The researcher got permission from the University of Namibia to conduct the study. No human subjects were involved in this study. The researcher duly observed and respected the data collected in terms of sources acknowledgement.

3.9 Conclusions

This chapter sought to describe and explain the research methodology employed in the present study. The chapter described the research design, population, sampling technique, research instruments, procedure, data analysis and research ethics.

CHAPTER 4: SCIENTIFIC PERSUASION AND LANGUAGE FORMS

4.1 Introduction

In this chapter the analysis of climate change publications is presented. It sets the scene and provides the contextual overview for the analysis of the publications under study. The Chapter begins with the analysis of scientific persuasion and how language forms are used in the selected academic climate change science publications. It then analyses rhetorical devices employed by various authors and these include rhetorical cues: lexical, discourse markers, punctuations, background, comparison, evaluation and explanation. Finally, the chapter analyses the rhetorical interpretation of visual images and the rhetorical effects of visuals used in the selected climate change science publications.

The first publication by Wilhelm (2012) entitled "Impact of climate change in Namibia" investigated the impact of climate change in Namibia with a particular focus on the socio-economic impact of flooding in the northern regions. The publication further examined the socio-economic conditions of the local people as a result of the 2009 flooding in most of the northern central regions. The findings presented in the publication suggest that the 2009 floods caused massive damage to the northern central regions, particularly to the Oshituna village and it cost the government a substantial amount of money to assist the people to cope with the floods.

4.2 Persuasion and language forms

In the preliminary part of the publication 1, the author seems to have established the credibility of the findings through citations of various renowned authors in the field of climate change. Hashim (2010, p. 379) observes that "establishing credibility is part of persuasive moves." By

citing several authors, Wilhelm (2012) intended to establish credibility since readers would identify the findings with the renowned authors. Through this way, the author solidifies the argument and findings in order to win the hearts and minds of the policy makers and the public.

Scientific persuasion entails the use of language of science. Richards, Platt, and Webber (1985, p.159) define language of science as "language used for particular and restricted types of communication, containing lexical, grammar and other linguistics features which are different from ordinary language." Often, it is argued that language of science is made up of informative texts, and the text's dominant appeal form is logos as the sender needs to persuade the receiver that the texts present a credible picture of subject matter (Helder, 2011). Bhatia (2002) similarly observed that to reach communicative goals, reasonable and considerable changes to the language of science use have been significantly introduced. Because of these considerable changes to the language of science, the language has become more expressive and stylistically marked to attract the attention of the readers and raise their interest in science and technology. As indicated earlier, advancement in science and technology means that the language of science is vastly influenced by the development of popular scientific texts.

4.3 Rhetorical devices

4.3.1 Propositional argument technique

Propositional argument is an argument that puts forth an idea, plan or suggestion. The use of modal auxiliary verbs such as "will" as in "It is a definite fact that our past, present and future as human beings was, is and will be shaped by prevailing climatic conditions" (Wilhelm, 2012, p.1); "An increasing body of evidence are pointing to the disproportionate negative impact climate change will have on the poorest nations, those nations who have contributed least to

the problem" (Wilhelm, 2012, p.1); "the particular challenges posed by climate change will vary by region, and the responses are best formulated at the regional and the local levels (Wilhelm, 2012, p.3); and "could," as in "Where rainfall is predicted to increase, incidences of diseases such as malaria and gastro-intestinal infections could also increase" (Wilhelm, 2012, p.3) are intended to perform vital tasks.

Throughout, the author employed modal auxiliaries in all the structures of the text under analysis; this is perhaps to macro organise the text. As can be seen from this observation, the author seems to have a considerable confidence in the particular propositional argument by using "will," the author assumes the role of writing with absolute certainty that climate change will vary going forward.

The text is stylistically punctuated with discourse markers that are strategically located. From the onset, the author of the climate change publication seems to have presented the written text by using tentative language and discourse markers to look objective. Clark and Zyngier (2003) contend that the central function of stylistics is to illuminate on a language of the text and the relationship between language and possible meanings and the interpretation generated by it. Ordinarily, stylistics is viewed as what drives persuasion in science texts (Pera, 1994). To substantiate this observation, Pera (1994) postulates that contemporary scientific rhetoric contains persuasive moves of reasoning and argumentation, geared at shaping the belief system of the public in scientific deliberations.

Contextually and semantically, Wilhelm (2012) presents scientific arguments by relying on prediction and a futuristic approach to drive the message deep in the hearts and minds of the readers. For example, phrases such as "rain fall is predicted to decrease due to climate change"

(Wilhelm, 2012, p.4) is likely to resonate well in the hearts and minds of the readers since most of them are likely to assume that the scientific pronouncement has been based on the trusting evidence. The author pins hope on the general understanding that the public would assume that the future truly looks hostile for them.

4.3.2 Scare tactics

Scare tactics is when the scientists use shocking and graphic visuals to scare the public. Predominantly, the author presents the findings of the study by relying on scare tactics. The phrase "changes in weather pattern are likely to reduce food production" (Wilhelm, 2012, p.4) could have been used analogically to reinforce changes in human behaviour. The author draws parallels between climate and food as a way to reinforce the human behaviour towards environment.

As can be seen in Table 1 below, the author seems to have used rhetorical moves such as scare tactics, exaggeration and line of argumentation prominently. In the phrase "rainfall is predicted to decrease" (Wilhelm, 2012, p.4), the author creates an impression of good (an increase in rainfall) and bad (a decrease in rainfall). The rhetorical function of the phrase "rain fall is predicted to decrease" is to persuade the policy makers and the public at large to take action against climate change; the phrase has the potential to be interpreted that if action is not taken against climate change, it may lead to hunger and starvation.

Similarly, the rhetorical function of the statement "Changes in weather pattern are likely to reduce food production" (Wilhelm, 2012, p.4), is to appeal to the poor to start demanding that action be taken to deal with climate change. Notably, the word "likely" implies uncertainty, and the writer intends to make the argument look objective. According to the National Planning

Commission (NPC) (2014), a sizeable number of the Namibian population continues to be susceptible to poverty. NPC (2014) further records that about 28.7% of the population is poor, whereas15% are regarded as extremely poor. Rhetorically, with poverty being the highest in rural areas (37%), the statement is intended to appeal to the considerable number of potential electorates, the poor.

Significantly, the rhetorical task in the statement "Majority of the population is directly dependent on subsistence farming" (Wilhelm, 2012, p. 4) is possibly to appeal to politicians and policy makers that climate change has the potential to negatively affect the majority of the population through poor harvests. The information that can be inferred here is that if climate change is not dealt with soundly there would be a decrease in crop production. The statement drives home the argument that the majority of the poor population would be the hardest hit if mitigating solutions to climate change are not found.

Equally the rhetorical function of the statement "climate change will affect the poor most" (Wilhelm, 2012, p.4) is likely to try and persuade environmental policy makers and politicians to implement intervention measures to curb the perceived deteriorating climate. Remarkably, the writer singles out poor people to make a point about the repercussions of unabated climate destruction. Of course, climate change has the potential to affect almost everyone – the writer feels that by making poor people stand in the argument, the message would likely resonate well in the public discourse.

By the same token, the semantic interpretation of the phrase "climate change is expected to lead to decline in water availability" (Wilhelm, 2012, p.4) is likely to evoke emotions of the

readers, policy makers and politicians about the dangers of inadequate water. Water seems to have become a very sensitive issue in Namibia; as a result, the author could have inadvertently appealed to the pathos of the Namibian people by exaggerating the decline of water due to climate change.

4.3.3 Exaggeration

Notably, Wilhelm (2012) has used some phrases that seem to have exaggerated and amplified the arguments and presentation. The phrase "climate change causes major disruptions to the economy of the country" (Wilhelm, 2012, p.18) is likely to appeal to the people's pathos. The author used the word "major" to signify the magnitude of the disruption to the country's economy. By exaggerating the disruption of the Namibian economy without quantifying that disruption, the author seems to have achieved rhetorical pressure tactics in order to influence and persuade the authorities about the dangers of climate change.

Based on the literature reviewed in Chapter 2, Namibia is singled out as one of the most vulnerable countries to climate change due to its arid environment, desertification and recurrent drought. In the phrase "Southern Africa will be hotter" (Wilhelm, 2012, p.18), the writer intends to extend the claim about the increasing temperature by going beyond the Namibian borders to drum up support for the mitigation of climate change. The rhetorical function of "southern Africa will be hotter" is that unless some measures are put in place to reduce climate change, the temperature will be very high, which is bad for humans and crop production. By declaring that southern Africa will be hotter, the writer intends to persuade policy makers and the public at large that drastic measures should be taken to manage climate change to avoid serious climatic repercussions.

4.3.4 Comparative forms

Comparatively, in the sentence "South Africa and Zimbabwe have experienced an increase in child mortality (Wilhelm, 2012, p.20)," it can be seen how the author uses comparative forms to try and persuade the readers of the climate change science publication. The rhetorical function of analogy or the comparative form is to make the comparison outstandingly effective to the readers. This is in line with Chang (2012) who suggested that the comparative form can be developed through parallel similarities as the author can think of, to persuade the readers that because the things are the same in various respects, a conclusion taken from one suggests the same conclusion from the other. Chang (2012) further notes that although comparative forms may function persuasively, they may not necessarily prove anything. As such when using comparative forms, one should carry a parallel comparison based on logical and reasonable association.

Throughout the argument, the author used some lines of argumentation based on the comparative form in order to provide a clear distinction between two variables, that way Chang (2012) may be able to persuade the audience about the need to protect the environment. Even the questionnaire that the author used was designed in such a way that it created the opportunity for the intended purpose, which is seemingly to convince the audience about climate change. The questionnaire entailed structured questions to solicit comparative responses. From the designing of the questionnaire to the presentation of the findings, the author arguably employed rhetorical strategies to persuade the readers. Partially, the publication has encapsulated rhetorical moves as suggested by Hashim (2010).

To use Gross' (1993) argument on rhetoric, it can be argued that facts alone as presented by Wilhelm mean nothing; only statements mean something. As such, the fact that language was

used to present those statements, it becomes increasingly difficult to separate persuasion from the intended objectivity of the publication under study.

In the conclusion part of the publication, the author used phrases such as "climate has the potential to threaten the achievement of national goals" (Wilhelm, 2012, p. 68). Despite the cautious nature of the author's writing style and the fact that the writer drew parallels between climate change and national goals, the intention could be unmistakable: to try and persuade the readers. The writer concluded by carefully posing a soft threat which may resonate well in the public discourse on climate change in Namibia. In the same vein, the writer used another rhetorical scare tactic; "It will hit hardest, those whose livelihoods are intimately tied to local resources bases and therefore climate sensitive" (Wilhelm, 2012, p.69). Finally, another phrase of note in publication one is the use of rhetorical directives such as "therefore it is imperative that support for adaptation is provided immediately" (Wilhelm, 2012, p.69). The word "immediately" is particularly worth noting because it indicates the urgency with which the writer wants the readers to react.

Philosophically, the author seems to have based the study on scientific norms in which knowledge of climate change is seen as being out there, and that the job of a scientist is to reveal that specific knowledge without claiming ownership of it. Knowledge about climate change is perceived by the author to be the absolute truth which has been discovered. Generally, scientists employ research methods and tools; they go out there and discover that perceived truth through what they regard as rigorous methods of verification. After the findings, statements about the discovered truths, in most cases, are likely to be presented in order to persuade the readers. The discovered truth and knowledge would have to be processed through a language; as a result, the message is communicated to the public through newspaper articles.

By doing that, scientists are inadvertently persuading the public. Table 1 shows the rhetorical moves extracted from the text analysed:

4.3.5 Discourse markers technique

Table: 1

Rhetorical moves

Phrase/sentence	**Persuasive move**	**Logos (line of argumentation)**
Rain fall is predicted to decrease (Wilhelm, 2012, p.69). p.4)	Instils a sense of fear	Based on the available data, rainfall is predicted to decrease
Changes in weather pattern are likely to reduce food production (Wilhelm, 2012, p.69). p.4)	To reinforce human behaviour	The weather pattern looks uncertain
Majority of the population is directly dependent on subsistence farming (Wilhelm, 2012, p.69). p. 4)	Has a potential to appeal to policy makers/ politicians	Deforestation reduces the ability for trees to absorb carbon dioxide – as a result this leads to global warming, and in turn contribute to melting of the Ice.

Climate is expected to lead to a decline in water availability (Wilhelm, 2012, p.69). p.4)	Appeals to the pathos/ emotions as water is widely regarded by many as sensitive	As a result of lack of rainfall, decline in water availability will be experienced.
Climate change causes major disruptions to the economy of the country (Wilhelm, 2012, p.69). p.18)	To coerce politicians and policy makers into taking actions	Most rural Namibia depends on agriculture / subsistence farming; as such economy is likely to be disrupted.
Southern Africa will be hotter ((Wilhelm, 2012, p.18)	Intended to change human behaviour	Current high temperature likely to remain steady
South Africa and Zimbabwe have experienced an increase	Intimidates families/ intended to scare/ exaggeration	Due to unchecked climate change, child mortality rate has increased.

in child mortality as a result of climate change (Wilhelm, 2012, p.20).		

Table 2

Discourse markers and their functions

Discourse markers and frequency	**Functions**	**Samples in the publication**
Indeed, Significantly (5 times throughout)	Implied meaning/ attitudinal / dramatic effect	**Indeed**, most respondents indicated these three media as sources of information about the environment... (Wilhelm, 2012, p. 55).
Although, however, despite (39 times throughout)	Contrastive/adversative	**Although,** the change in climate may be due to natural vulnerability... (Wilhelm, 2012, p.2). **Although** these gases occur naturally in very low concentrations, substantial increases due to human

		activities have been detected" (Wilhelm, 2012, p.2).
Because, since, in turn, hence, therefore, ultimately, because of this, for this reason, for this purpose (13 times throughout)	Consequential, resulting	Namibia's rural communities and the poor throughout the country are the most vulnerable to the negative impacts of climate change. This is **because** adaptive capacities amongst these vulnerable groups are considered to be very low (Wilhelm, 2012, p.4). **Since** Namibia is home to several different eco-regions (e.g. tropical, semi-arid, desert), the particular challenges posed by climate change will vary by region (Wilhelm, 2012, p.3). This **in turn** contributes to melting of ice at the poles (Wilhelm, 2012, p.3).

And (850 times throughout the document), furthermore, additionally, moreover, in addition (12 times)	Additives	**and** will be shaped by prevailing climatic conditions (Wilhelm, 2012, p.1).
For example, for instance (3 times throughout)	Illustrate ideas	**For example**, deforestation of tropical rain forests reduce trees that are a carbon 'sink', thus reducing the capacity of trees to absorb carbon dioxide emissions from the atmosphere, which leads to global warming (Wilhelm, 2012, p.3).
Similarly (2times throughout) In general (1 time throughout)	Comparatively	Similarly, production from rural areas contributes to the food economy of people living in urban settings (Wilhelm, 2012, p. 12).
1st, 2nd, 3rd (1 time)	Temporal	**First,** a lower level of development typically

		implies a larger dependence on climate-sensitive sectors, particularly agriculture. **Second**, populations in these countries are typically more vulnerable to climate change because of lower income per capita, limited availability of public services (such as health care), less-developed financial markets, and poor governance. **Third**, the same factors also restrain the adaptive capacity of the economy (Wilhelm, 2012, p. 33).

Table 2 indicates discourse markers of the 1st publication and their usage frequency, as well as the whole discourse markers count. Also, the table displays a sample of the textual functions of the discourse markers. Conspicuously, Table 2 reveals that the most frequently used discourse marker is *and*, appearing more than 850 times throughout the publication, enough to outnumber all the other discourse markers used in the publication.

Other discourse markers such as “although”, “however”, “significantly”, “indeed”, “and”, “furthermore”, “moreover”, “in addition”, “because”, “since”, “in turn”, “hence”, “therefore”, “ultimately”, “because of this”, “for this reason”, “for this purpose”, “for example”, “for instance”, “similarly”, “in general”, “1st”, “2nd,3rd,” seem to have been less frequently used in comparison to the additive “and.” However, what is worth noting is the frequent use of “although” and “however,” totalling 39 coming second only to additive “and.” The textual function of the discourse marker “however,” is to demonstrate contrastive relationships between various discourse stretches.

The third and fourth most frequent use of the discourse markers in the publication are additives “furthermore”, “additionally”, “moreover”, “in addition” and the consequential “because”, “since”, “hence”, “in turn”, “therefore”, “ultimately”, “because of this”, and for “this reason.” Lastly, “similarly”, “in general” and “1st 2nd 3rd” are the least frequently used discourse markers.

To put it into context, from the above observation, it can be seen that discourse markers seem to express dissimilar sort of relationships between sentences and carry out various rhetorical functions, including addition, cause and effect relationships. As such, discourse markers are an integral part of rhetorical analysis. Discourse markers, according to Schiffrin (1987), are language expressions that are inextricably linked with discourse to accomplish significant tasks in written and spoken communication analysis. Discourse markers are part of a wide discourse coherence. Of course, texts that have coherence are likely to carry communicative purpose effectively because the texts tend to have explicit fundamental relations between the situation and the dictions.

Correspondingly, discourse markers are conduits to realising logical communicative objectives of scientifically positioned discourse. Kohlani (2010) critically argued that the functions of discourse markers go across the sentences confines and link the analysis of the text to achieve communicative purpose. In terms of meanings, discourse markers tend to be hollow and, in most cases, they are structurally optional, and often act as rhetorical transitional space and time of persuasion. Conversely, Brinton (1996) contends that discourse markers have a significant pragmatic role in any scientific textual discourse. Thus, discourse markers serve as language elements that bind and guide communication to resonate well in the public discourse, be it in spoken or in written form.

Discourse markers enable semantic relations in a given text. Of course, according to Willemse (2006), semantic relations in different texts are known to have certain functions: they indicate and present text organisation; they show how ideas in the texts relate to each other, and lastly, they indicate cohesion in the text. For the sake of this study, five main types of semantic relations are used to analyse the discourse markers used in the published texts and how these markers contribute to persuasion.

The main semantic relations in any given texts are additive, temporal, causal, adversative and concession (Willemse, 2006). Willemse (2006) views *additive* as words used to add existing information that has been expressed in a clause or sentence. And temporal is viewed as words used to show a time sequence or listing. Additionally, *causal* is seen as a word that indicates the underlying reason or premise of the cause as to why something stated in the phrase or sentence happened. *Adversative*, on the other hand, is viewed by Willemse (2006) as words indicating opposing or contrasting views stated in a clause, sentence and paragraph. Finally, concession is seen as words that show an allowance or compromise.

It is evident from table 2 that the frequent use of the discourse markers *significantly* and *indeed* (5 times throughout) is minimal. This is probably to reduce the author's personal mood towards the proposition in the discourse.

These discourse markers have rhetorical functions; this agrees with the study that Prelli (1989) carried out which looked at the rhetorical functions of discourse markers. Prelli (1989) argued that scientists tend to induce others to share an orientation for assessing and sensing of situated phenomena and the connections among them through the lens of discourse markers. The uses of the words *significantly* and *indeed* seem to show how the author wants to drive the argument and show how semantic connections among these syntactical structures are inextricably linked. Discourse markers have the potential to orientate the readers towards the author's perception.

Wilhelm (2012) is seemingly aware that research and writing processes entail decision making, adjudication, negotiation and selection of words which have the potential to drive an argument home and bind information in the order they should be presented. Similarly, another prominent discourse marker by Wilhelm (I2012) is "*although"* and "*however"* (frequency: 14 times throughout**)** as in for example "although the change in climate may be due to natural vulnerability" (Wilhelm, 2012, p.2). By using the discourse marker "although" in the phrase "although the change in climate may be due to natural vulnerability," the author intends to signify concession.

It appears that the author tries to show a different perspective from the traditional submission of natural vulnerability. By using this phrase, the author intends to introduce ideas that run against what has been said, and with the possibility of persuading that particular reader. It seems that through the use of *although*; the author intends to realise a function of contrastive

linking words, signalling that the provided discourse marker is either a denial or a contrast of suggestion emanating from a preceding discourse.

Moreover, numerous discourse markers are used by the author (Wilhelm, 2012) to semantically and structurally present cause and effect in terms of relationship between one idea and another. The illustrations below demonstrate the author's attempt to establish semantic and structural relationships in the text.

a) "Namibia's rural communities and the poor throughout the country are the most vulnerable to the negative impacts of climate change. This is **because** adaptive capacities amongst these vulnerable groups are considered to be very low" (Wilhelm, 2012, p.4).

b) "**Since** Namibia is home to several different eco-regions (e.g. tropical, semiarid, desert), the particular challenges posed by climate change will vary by region" (Wilhelm, 2012, p.3)

c) "This **in turn** contributes to melting of ice at the poles" (Wilhelm, 2012, p.3)"

Crucially, any author who intends to write critically should know that it is necessary to explicitly explain why something is the way it is. Explanation and reason(s) should be given for any academic claims one makes if one intends to persuade the readers. In sentence (a), the author makes a claim. As can be seen, the claim is preceded by a textual connector "because" to establish the relationship between the initial idea and the idea to follow after "because." This observation is similar to Halliday's (1994) observation in which it was contended that the textual function of a discourse marker is to create coherent texts related to the world and to the readers. Significantly, textual implication is relevant to the context.

Equally so in phrase (b) the author establishes a contrasting relationship, with a discourse marker "since," between the ideas of Namibia being home to several different eco-regions (e.g.

tropical, semi-arid, desert), and the particular challenges the climate change will pose going forward. However, in phrase (c), the author seems to use the discourse marker "in turn" to show the consequence of an initial idea in phrase (b).

In the same publication, the author appears to have textually used the conjunction "and" with high frequency (25 times in the first four pages only, outnumbering all the other discourse markers throughout the publication), as in "and will be shaped by prevailing climatic conditions" (Wilhelm, 2012, p.1) as an example. The discourse marker "and" just like other additive markers, indicates that the statement following constitutes additional information to the previous discourse. At the same time, the discourse marker "and" is often used to show the author's continuation of the discourse. It is clear in this instance that the author's use of *and* is intended to function as additive.

Next, as can be seen in table 2, the discourse marker "for example" is equally used several times by the author. Textually, the linking word "for example" signals an illustration. The author intends to illustrate the argument through a scenario, thereby persuading the reader regarding an argument. As illustrated below, the author seems to have achieved the goal of illustration: "For example, deforestation of tropical rain forests reduces trees that are a carbon 'sink', thus reducing the capacity of trees to absorb carbon dioxide emissions from the atmosphere, which leads to global warming" (Wilhelm, 2012, p.3). Almost in similar fashion, the author further uses language elements of parts of speech to drive the argument home.

In conclusion, the first publication by Wilhelm (2012) entitled "Impact of climate change in Namibia" investigated the impact of climate change in Namibia with a particular focus on the socio-economic impact of flooding in the northern regions of Namibia. The publication further

examined the socio-economic conditions of the local people as a result of the 2009 flooding in most of the northern central regions. The findings presented in the publication suggest that the 2009 floods caused massive damage to the northern central regions, particularly to the Oshituna village and it cost the government a substantial amount of money to assist the people to cope with the floods. Furthermore, Wilhelm (2012)'s publication revealed evidence of the presence of rhetorical devices and strategies in the publications.

The second publication entitled "Climate Change Vulnerability and Adaptation Assessment Namibia, report (CCVAAN)" addresses the vulnerability of the water and agricultural sectors to climate change. It further suggests the adaptation measures to deal with climatic impacts. Accordingly, the publication places vulnerability in the socio-economic contexts of rural areas, more especially in the Zambezi and Karas regions.

Equally, in the introductory part of publication 2, the report seems to establish credibility of the findings through citations of various renowned authors in the field of climate change. In addition, the report cites the legal framework as a way to establish credibility and trust with the readers. Below is an extract from the introduction:

*"*Namibia ratified the United Nations Framework Convention on Climate Change in 1995 and became legally obligated to adopt and implement policies and measures designed to mitigate the effects of climate change and to adapt to such changes" (CCVAAN, 2008, p. 1).

The report opens with Namibia's ratification of the United Nation Framework Convention on Climate Change (UNFCCC). The United Nations' (UN) legal framework on climate change seems to have been foregrounded in the introduction in order to signal to the readers that the report is reliable, and therefore genuine. By citing the legal framework, the report intends to

establish credibility since readers would identify the findings with the renowned UN. Through this way, the report is likely to solidify the arguments and findings in order to win the hearts and minds of the policy makers and the public at large.

Aristotle (1886) defines rhetoric as the faculty of discovering in any scrupulous case all of the available means of persuasion. Against this understanding, it seems that the authors of the report seem to have understood Aristotle's ethos well because the citation of legal framework is likely intended to persuade the readers.

The sentences and phrases used by the various authors in the document appear to carry rhetorical moves suggested by Hashim (2010), and they are likely to be intended to persuade the readers. "Arid environment is extremely high in terms of natural variability" (CCVAAN, 2008, p.7) If the above extraction is anything to go by, then it can be argued that rhetorical devices were used consciously or unconsciously by the authors, with the aim of persuading the readers to agree with the findings.

The use of the word "extremely" indicates the extent of rhetorical intensity employed by the authors in their quest to persuade the public and policy makers. Semantically, one would have expected the scientists to write the phrase as 'Arid environment is high in terms of natural variability' as opposed to arid environment is extremely high in terms of natural variability. From a scientific point of view, intensifying and magnifying adjectives and adverbs are, in most cases, not necessary. However, it should be noted that the above phrase's rhetorical function is to drum up support against climate change. Also, the phrase has the potential to be an influential phrase in terms of scientific discourse.

Respectively, the rhetorical function of the statement "Climate change has implications for one's chance to move out of poverty" (CCVAAN, 2008, p. 7) is intended to appeal to the pathos of the poor majority. The writer argues that if climate change is not solved, the less fortunate people would remain in poverty. Similarly, the statement could be interpreted that climate change brings about poverty, and if it is not mitigated, it has the potential to perpetuate poverty among the poor people. The readers are likely to be persuaded by the statement as they make connections between climate change and poverty. Thus, by drawing parallel lines between the two, the authors instil a sense of fear into the hearts of the poor, and the message has the potential to resonate well in the public discourse.

The authors of the document went a step further to solidify their findings by claiming that "the high level of dependence of rural dwellers on subsistence agriculture makes Namibia vulnerable to climate change" (CCVAAN, 2008, p.36). It is evident from the above assertion that the authors appear determined to make a case that would appeal to the pathos of the largely literate public, and at the same time providing evidence, in some instances, that may be persuasive to the policy makers and politicians.

Moreover, the authors claimed: "As a result of floods, loss of family member, a breadwinner, can be devastating to a household where a man dies and the spouse and children are left behind with the responsibility to continue cultivation and cattle raising, many households fail and gradually fall into poverty" (CCVAAN, 2008, p.38). Ceccarelli (2017) contends that scientists can reach out to sceptical readers with appeals that signal their vulnerability rather than their supremacy. The rhetorical function of the statement above is to appeal to the readers' vulnerability – the writers used the death of a family member and a breadwinner to cement their appeal.

By reminding the readers that a family member or a bread winner could die as a result of climate change, the statement has the potential to persuade the readers, in most cases, the policy makers. Death is used in this argument to reinforce behaviour towards climate change. Gross (1990) was certainly plausible when he said that beneath scientists claim of objectivity resides a fierce struggle to gain followers for a particular viewpoint or to claim precedence for a discovery.

In addition, the writers further claim that an "Increase in population will lead to internal migration" (CCVAAN, 2008, p.38). The rhetorical function of this claim is that if climate change is not dealt with urgently, it has the potential to brew unrest in terms of internal migration. This is so because climate change issues are intertwined with societal issues. Beck, Anthony and Scott (1994) are equally in agreement with this observation as they argue that climate change is something that one cannot see or touch and that it might not make someone sick, but might make life on the planet uninhabitable for human beings, and as a result move from one place to the other.

The statement demonstrates the concerted effort by the writers to persuade the readers that if measures are not taken to thwart climate change certain places within Namibia would be heavily populated, putting pressure on local authorities to provide services to the new arrivals. The writers reason that the only way to avoid internal migration is to mitigate climate change impacts. To all intents and purposes, when this statement comes from the realm of science, the means of persuasion used entail appeals to the logical argument.

The persistent manner of the semantic structure within their lines of argumentation reveals rigour from the perspective of the scientists to make their presentation acceptable to the readers. Remarkably, the study was commissioned by the government, and as such the authors could have decided to use semantically loaded phrases as an opportunity to appeal to the government about the need to protect the environment.

Finally, the authors continued to appeal to the emotion of the poor and the general public by claiming that: "Poverty and lack of income is likely to be experienced by people if measures are not taken immediately" (CCVAAN, 2008, p. 40). The phrase is self-explanatory; the authors seem to rely on emotional appeal by reminding the authority on the potential danger that climate change poses to people's lives. The continuous use of scare tactic is distinctive. As argued before it seems that the harsh environmental conditions being experienced by countries in southern Africa are being exploited by climate change scientists to appeal to the public's fear.

This observation agrees with Steynor's (2017) findings about 111 countries around the world that were surveyed regarding climate change perceptions. The survey revealed that Americans and Europeans felt substantially less threatened by climate change than they had been when a survey was conducted four years earlier. In contrast, sub-Saharan Africans and Latin Americans saw themselves as being more at risk. By reminding the readers about the potential impact that climate has on the income, the rhetorical function that the statement carries is to appeal and persuade readers about the need to fight climate change.

From an elucidating point of view, the rhetorical function of the statement should be seen as an attempt to illuminate on the significance of discourse, advocacy, and an orientation of

arguments towards the truths at a particular time and space. Correspondingly, rhetoric paves the way for comprehending sophisticated and complex issues as a result of linguistic symbols that the statement carries.

Throughout the discussion or analysis, the authors relentlessly relied heavily on scare tactic and exaggeration to make their message heard. Again, just because language is used in rhetorical arguments, it does not mean that all arguments are meant to deceive the public, or that Namibians have been deceived into believing that climate change will automatically result into loss of income. Rhetoric, from an academic point of view, goes beyond this. Rhetoric provides a platform to think through meticulously about how climate change affects all of us, and how it should be dealt with, and how solutions should be sought, and how one should navigate the politics around it.

Table 3 below shows the extracted rhetorical moves analysed above:

Table 3.

Extracted Rhetorical Moves Analysed

Sentences/ phrases	**Persuasive move**	**Logos (line of argumentation) (persuasive move)**
"Arid environment is extremely high in terms of natural variability" (CCVAAN, 2008, p.7)	Appeal to policy makers	Lack of rain fall could have resulted in arid the environment
"Climate change has implication for one's chance to move out of poverty" (CCVAAN, 2008, p.7)	Appeal to the poor/ policymakers	If nothing is done to mitigate climate change, poverty among the masses will continue
"The high level of dependence of rural dwellers on subsistence agriculture makes Namibia vulnerable to	Appeal to the poor has the potential to persuade policy makers and politicians	In part holds logical argument to persuade climate change policies

climate change" (CCVAAN, 2008, p.36)		
"As a result of flood, loss of family member, a breadwinner, can be devastating to a household where a man dies and the spouse and children are left behind with the responsibility to continue cultivation and cattle raising, many households fail and gradually fall into poverty" (CCVAAN, 2008, p.38)	Appeal to the emotions of the people, authority and public	In part, has some logic due to heavy rainfall bread winners are likely to die.
"Increase in population will lead to internal migration (p.38)"	Appeal to politicians – for civil order in the country.	If there is high birth rate in the country, civil unrest is likely to occur.
"Poverty and lack of income is likely to be experienced by people if measures are not taken	Appeal to policy makers/ politicians/ public	In part, has logical argumentation to win hearts and mind of the public

to intervene immediately (p.40)"		

In their attempts to convince policy makers and the public, the authors went as far as presenting demographic evidence as a way to persuade the policy makers about the potential threat to the environment by the booming population, see Table 4 below: Region Population 2001 Population 2031.

Table 4.

*Growth over 30-year period (*Adapted from Republic of Namibia, 2006d)

Regions	**Population 2001**	**Population 2031**	**Growth over 30years**
Zambezi	79,826	105,344	32%
Erongo	107,563	122,290	14%
Hardap	68,246	77,521	14%
Karas	69,321	78,748	14%
Kavango	202,690	472,994	133%
Khomas	250,260	638,993	155%
Kunene	68,735	93,552	36%
Ohangwena	228,383	360,382	58%
Omaheke	68,041	110,771	63%
Omusati	228,841	276,005	21%
Oshana	161,917	213,676	32%
Oshikoto	161,006	239,567	49%
Otjozondjupa	135,385	241,170	78%

Namibia	**1,830,330**	**3,031,463**	**66%**

It is clear from Table 4 that the authors presented the projected figures as 'truth' and as a result the authors expect the environmental policy makers to base their planning on the projections. The figures show the authors' perception of the world. They expect the world's population to grow exponentially, but through deductive reasoning they assume that Namibia's population will grow exponentially too. The absence of the death rate in the equation reveals authors' perception of the world, and the determination that population growth will not be disturbed. The authors know that their presented figures are likely to become increasingly hard for anyone to dispute and as a result these findings are likely to be accepted as the absolute truth.

In the second publication, if the authors had presented figures only without explanation behind those figures, it would have been difficult for the intended message to resonate in the public discourse. Scientific figures alone do not mean anything if they are not accompanied by statements and explanations. The argument below vindicates the observation:

> The brute facts themselves mean nothing; only statements have meaning, and of the truth of those statements we must be persuaded. These processes, by which problems are chosen and results interpreted, are essentially rhetorical: only through persuasion are importance and meaning established. (Gross, 1993, p.4)

In fact, even the planning stage of a research is a form of rhetoric because the design is guided by the desire to fulfil the goal of the research. This is in line with the purpose of this study because an explanation of rhetoric of science by Gross (1993) is used. Of course, Gross (1993) views rhetoric as "the process of persuasion in the lab and in the field, and in the study."

Similarly, in the 3rd publication entitled "The economic impact of climate change in Namibia: how climate change will affect the contribution of Namibia's natural resources to its economy" by Reid and MacGregor (2007), just like in the other two publications, the author appears to have established the credibility of the findings through citations of various renowned authors in the field of climate change. By citing the International Panel on Climate Change (IPCC) Reid and MacGregor (2007) intend to establish credibility since readers would identify the findings with the international entity. Through this way, the authors are likely to solidify the arguments and findings in order to win the hearts and minds of the policy makers and the public.

Subsequently, the authors provide a background context to the publication by placing IPCC at the centre of the argument. The authors, being aware of the fourth assessment report of the IPCC, base their arguments about the economic impact of climate change on the report which purports that the impact of climate change will start being felt within the next twenty years. In the background of the study the authors used the following argument: "Indeed, some impacts of climate change are already being felt" (Reid & MacGregor, 2007, p. 1). The discourse marker "indeed*"* tells the reader about the authors' attitude towards climate change.

Again, the authors' use of the word "more*"* in "The first countries likely to be affected most by climate change are the poor countries that will be struck by more climate change impacts and have less capacity to adapt to them" (Reid & MacGregor, 2007, p. 1),which equally tells the reader about the author's attitude towards the subject matter. The comparative form "more*"* is hard to measure let alone verify.

The authors appear to have used the word "more" to make the climate change impact ambiguous or to simply exaggerate the impact. Ornatowski (2007) saw that whatever makes a functional use of words and phrases is likely to be involved in the technical problems associated with words, including rhetorical issues. The word "more" is likely to influence the reader to assume that the economic impact is truly more.

The authors of the third publication were probably aware that IPCC recognises Africa as a whole and it is seen as the most vulnerable continent to climate change variability. So, placing IPCC at the centre of the report is, in most likelihood, providing the rhetorical ammunition needed to appeal to the poor people on the African continent to act against climate change. Since the publication is intended for Namibia, and Namibia is in Africa, it sounds reasonable that the authors have chosen to base their argument on IPCC.

Textually, the adverb "heavily" as in "many African countries are heavily dependent on climate sensitive sectors" (Reid & MacGregor, 2007, p. 1) has a conspicuous rhetorical function. It seems the authors are explicit in their expressions – using the phrase "heavily dependent" as opposed to just 'dependent' clearly shows the authors' attitude. Conspicuously, the authors attempt to sway opinion through the use of the adverb of manner "heavily", which is perhaps in line with Helder (2001) who argued that the language of science is made up of informative texts, and the text's dominant appeal form is logos as the sender needs to persuade the receiver that the texts presents a credible picture of the subject matter. Equally so, contemporary "scientific texts fulfil not only informative and persuasive, but equally expressive function in an attempt to invite attention to the information presented (Helder, 2001, p.56).

The publication appears to have already declared its position regarding the climate change impact on the economy in Namibia, declaring that: *"*reducing the impacts of climate change on the poor countries requires action now" (Reid & MacGregor, 2007, p. 1). The sense of urgency in the statement appears explicit. The authors seem to be assuming the role of moral authority and high ground, reminding the readers that climate change is a menace that needs to be dealt with head-on.

The authors were aware that fighting climate change requires domestic political will. From the publication's point of view, the Namibian government's reaction towards taking action against climate change has been piecemeal. In the authors' view, precipitation and predictions of temperature changes for vulnerable regions seem to gain very little policy traction when it comes to domestic development policies. Perhaps, a plausible explanation regarding the lack of political action against climate change may be the fact that various climate change processes are complicated, and seriously depend on reaching amicable solutions through consensus.

Politically, policy makers tend to view action against climate change as action against their offices. As such, the authors seem to have been aware of these political challenges and have probably decided to place economic value on the climate change effects as a way to persuade the policy makers. The economic value placed on the environmental effect is likely to bolster the argument for an action against climate change. Through the economic argument, plausible evidence is likely to be provided and thereby persuading the voters that their lifestyle will be better-off if actions are taken to tackle climate change.

Table 5.

Rhetorical cues extracted from the publication above.

Discourse markers and frequency	**Function**	**Samples in the text**
And (693 times throughout the document) In addition, moreover (6 times throughout the publication)	Additive constitutes additional information	... **and** change because of multiple stresses **and** adaptive capacity (Reid & MacGregor, 2007, p. 1)
Indeed, In fact, in general, significantly (4 times)	Constitute mood towards proposition	**Indeed**, some impacts are already being felt (Reid & MacGregor, 2007, p. 1)

However (36 times throughout the publication) Even though, even if, although, but, hence, due to (7 times throughout the publication)	Adversative and contrasting	This, **however**, requires domestic political will (Reid & MacGregor, 2007, p. 1)
Overall, In summary, in total (5 times throughout the publication)	Summarise	**Overall**, predicted losses were greater than gains (Reid & MacGregor, 2007, p.27)
For the purpose of this, thus (2 times throughout)	Consequential / resulting	**For the purpose of this** ... small adjustment presents a good way of modelling the factor income distribution (Reid & MacGregor, 2007, p. 27)
For example, again (3times)	illustration	**For example**, although increased in aridity may reduce livestock stocking rate, it might fail... (Reid & MacGregor, 2007, p. 3)

As can be seen in Table 5 above, the discourse markers used are almost the same discourse markers used elsewhere in the above publications. Expectedly, the discourse marker "and" is

the most frequently used discourse marker in the publication 3. The discourse marker "and" just like other additive markers, indicates that the statement which follows constitutes additional information to the previous information. At the same time, the discourse marker "and" is often used to show the author's continuation of the discourse or illustrates as a sequence marker by showing sequential dependence of the utterances. It is clear in this instance that the author's use of "and" is intended to function as additive.

Equally, all the other discourse markers textually and semantically function as the other discourse markers explained in the above publications.

Notably, the discourse marker "however," just like in the other publications, seems to appear frequently just less than "and." With regard to the other discourse markers, they are sparsely distributed throughout the document.

In terms of the methodology of the publication, Reid and MacGregor (2007) carefully planned and arranged their methodology to suit the end goal of the study. Firstly, the authors' preliminary analysis was to collect existing information concerning climate change effects on the country. To make the study look authentic and convincing, the authors used the literature review of earlier research. Furthermore, the authors relied on the information they got from the meeting about climate change and included that information throughout their analysis. The possible explanation for the inclusion of that information into the analysis could be to make the information more persuasive.

The following extract from the publication summed up the authors' reliance on guessing: "it should be emphasised that because it is impossible to say with certainty what climate change impacts will be, let alone how they will impact Namibian natural resources and the economy,

estimates of how climate change will affect various sectors, and subsequent translation into economic impact can only be based on reasonable guessing" (Reid & MacGregor, 2007, p. 3). Reid and MacGregor (2007) seem to have relied heavily on uncertainty technique or vague technique, by stating in the methodology of the publication that it is impossible to say with certainty what climate change impacts would be and how they would impact Namibian natural resources and the economy.

However, despite the expression of uncertainty of the climate change impacts in the methodology of the publication, the authors relied on literature review and outside discussion to strengthen their arguments about climate change as authentic and a possible reflection of truth. As noted earlier, the above situation could be attributed to the rhetoricians for either being apprehensive or hesitant to explain more about the rhetoric of predictions in science which climate change seems to be characterised with. Of course, most studies focused on the physical nature of science but there appears to be a dearth of information on the study of the language of science on weather prediction, issues which scientists on climate change are concern with.

Moreover, Reid and MacGregor (2007) may have consciously or unconsciously used illustrations and logic to persuade their readers. They reasoned:

> For example, although increased aridity may reduce livestock stocking rates, it might facilitate a shift towards indigenous biodiversity production systems that could ultimately be more productive. In other words, the impact values described here can be seen as worst-case estimates if climate change is not considered in the national development policies. If adaptation measures are taken, these impacts could be reduced" (Reid & MacGregor, 2007, p.3).

Reid and MacGregor (2007) reasoned logically by ending with a conditional clause "if adaptation measures are taken*"* and is preceded by a solution clause "these impacts could be

reduced." The authors illustrated the problem and provided concession before suggesting a solution that may appeal to the readers.

Worth noting is the argument where the authors used the outside happenings (things that happened outside Namibia) to provide lesson to the intended readers, possibly Namibian authority. For example, Reid and MacGregor (2007) demonstrated their observation in the following manner: "a reduction in the international flights due to airline taxes could affect the Namibian economy, which relies on tourism. There are already fears in South Africa that moves by European supermarkets to sell low carbon footprint food products will reduce South African exports of foods like apples" (Reid & MacGregor, 2007, p. 3).

Prediction seems to be the most prominent phenomenon in the publication by Reid and MacGregor (2007). For example, the authors claimed that "precipitation projections are generally less consistent, but most simulations in Southern Africa indicate reduced precipitation in the next 100 years and most models project that by 2050 the interior of Southern Africa will experience significant decreases during the growing season" (Reid & MacGregor, 2007, p.8).

What is worth noting is the use of the adverb "generally" which the authors to avoid quantification as the reader finds it hard to hold the claimer accountable because the word "generally" is vague. Subsequently, the authors used another vague word "most," appearing twice to claim that simulations in Southern Africa indicated reduced rain. But what is "most"? How can the number of simulations be accurately determined to substantiate the above claim? Again, it is another classical example of the authors relying on semantic vagueness to communicate message to the readers.

This is because rhetorical assumption provides an enlightening representation and a set of systematic techniques for the elucidation of the complex texts generated by a particular case of scientific communication or publications. As such, it should be understood that the rhetorical function of the claim above is philosophical for the task at hand because the authenticity of what climate writers write about is irrelevant to analysing how they influence their peers that a particular analysis is acceptable or unacceptable.

Significantly, Reid and MacGregor (2007) textually and semantically navigate from Southern Africa to Namibia. They claimed further "The Southern African monsoon is predicted to weaken during the 2000 – 2049 period, precipitation is expected to decrease, and by the 2090s, a drying over much of the western subtropical region which includes Namibia due to fewer rainy days and less intense rainfall is predicted" (Reid & MacGregor, 2007, p. 8). As seen above, the authors gradually glide semantically from what could have been the message intended for the Southern Africa region to the readers in Namibia. The authors intended to capture the attention of the readers in Namibia; by reminding them about the rain which was predicted to become lower and drier. The logical connection in the publication appears to be that from the uncertainty of climate change impact, the authors appeared determined to make prediction on the basis of presumption.

Subsequently, Reid and MacGregor (2007) claimed further:

> In Namibia, even if rainfall changes little from present levels, the water balance is expected to become drier of an increase in evaporation rates due to temperature increases. ...With rainfall decrease Namibia is likely to face severe water shortages. The country's poor rural population, particularly pastoralists and dry lands populations, will be affected most (Reid & MacGregor, 2007, p. 9).

The authors' use of the adjective "severe" is significant. Reid and MacGregor (2007) could have simply omitted the adjective to avoid being melodramatic with the water shortages. The statement would have read: 'Namibia is likely to face water shortages' as opposed to "severe" water shortages. The choice "poor rural population will be affected most" appealed to pathos of the authority and the readers in general. One would have expected Reid and Macgregor (2007) to have presented the findings without necessarily citing the poor in the explanation of climate change impact.

Table 6.

Rhetorical cues.

Discourse markers and frequency	**Functions**	**Samples in the text**
However **Whilst**	Contrastive Comparative	"More in-depth assessments **however** needed to be carried out" (Reid & MacGregor, 2007, p. 1) "**Whilst** these systems generally pass to the south of

Although, even, so, but, yet (65 times – throughout)	Contrastive	Namibia, when in a northerly position they can bring rain to the southern parts of the country accounting for more than half the annual total" (Reid & MacGregor, 2007, p. 4). "The population of Namibia is expected to grow with 66% between 2001 and 2031 according to the medium scenario of the Population Projections, representing an average annual growth rate of 1.7 % over 30 years. **Although** this is not a very high annual growth rate, the overall increase in population may exacerbate the vulnerability of livelihoods and ecosystems" (Reid & MacGregor, 2007, p. xii)
Furthermore, moreover, additionally, in addition (24)	additive	"**Furthermore**, for many sectors it is the combined effect of changes in rainfall and temperature that impact the

		sector" (Reid & MacGregor, 2007, p. 1)
And (794 times throughout the document)	additive	"...**and** became legally obligated to adopt and implement policies **and** measures designed to mitigate the effects of climate change and to adapt to such changes" (Reid & MacGregor, 2007p. 1)
Therefore The rationale for doing so, because of these, since, as a result, ultimately (38 times)	Consequential resulting	"Given these considerations it was **therefore** decided to undertake the following in addition to the climate modelling" (Reid & MacGregor, 2007, p. 1) "...apart from presenting the climate change impacts and vulnerabilities for Namibia in general. **The rationale for doing so** is that these regions represent two extremes in Namibia" (Reid & MacGregor, 2007, p. 2).

Unfortunately (5 times)	Adversative/ attitudinal/ dramatic effect	"**Unfortunately,** the paucity of meteorological records prohibited crop modelling for locations that are closer to the North-Central regions where cultivation of millet is carried out" (Reid & MacGregor, 2007, p. 2).
First of all (1 time) **Secondly** (1time)	temporal / sequential/ order of importance temporal / sequential/ order of importance	"**First of all**, the pressure on land and water resources is likely to increase in the more densely populated communal areas in the north- central regions and the Kavango and Caprivi regions, if one assumes that land management practices will not change significantly without specific interventions" (Reid & MacGregor, 2007, p. xiii). "**Secondly**, although it is not clearly spelled out in the Population Projections, it is expected that increased population pressure will lead to

		internal migration" (Reid & MacGregor, 2007, p. xiii).

Table 6 above indicates the discourse markers of the third publication and their usage frequency, as well as the whole discourse markers count. The table displays sample of the textual functions of the discourse markers. Noticeably, Table 3 revealed that the most frequently used discourse marker is "and." It appears more than 794 throughout the publication which is enough to outnumber all the other discourse markers used in the publication elsewhere.

Other discourse markers namely "although", "however", "even so", "but", "yet", "unfortunately", "the rationale for doing so", "because of these", "additionally", "as a result", "and", "whilst", "furthermore", "moreover", "in addition", "since", "therefore", "similarly," "1st", 2nd and 3rd, seem to have been less frequently used in comparison to additive "and." Conversely, worth noting is the frequent use of "whilst", "however", "although", "yet", "but" and "so" totalling 65 counts and coming second only to additive "and." The textual functions of these discourse markers are to demonstrate contrastive relationships between various discourse stretches.

The third and fourth most frequent use of the discourse markers in the publication are the consequential markers: "because of these", "therefore", "since", "as a result", and additives "furthermore", "additionally" "moreover", "in addition" and "lastly", "similarly",

"importantly", "approximately", "allegedly", "1st", "2nd" and "3rd" are the least frequently used discourse markers.

Textually and contextually, the discourse markers were strategically planted in the third publication if Rhetorical Structure Theory (RST) is anything to go by. Of course, RST entails the organisation of words, clauses and texts, and the way they are connected to form a whole functional text: hierarchically organised clauses, relation of concepts and the strategic use of discourse markers to eliminate ambiguities. RST is systematic; it helps the reader understand texts as instruments of communication.

The interest of the present study was to use a theory that help understand texts as instrument of communication and analytical tool in the description of text, thereby using it as a generational tool in the construction of knowledge. Mann and Thompson (1989), while testing the theory, used RST to examine particular texts and observed that many phenomena of text structures involved pairs of regions of the texts. Mann and Thompson (1989) observed further that the relations holding between the text parts sometimes indicate by conjunctions and could hold between text parts of a wide range of sizes, from clauses to groups of paragraphs. RST has the potential to describe texts in a rich and highly constrained way and likely predicts much about character effects expected in natural texts.

Moreover, like it was argued in Chapter 2, Mann and Thompson (1989) note that there are three basic assumptions that underlying RST: texts are not viewed as just strings of clauses, but rather viewed as consisting of hierarchically organised clauses and group clauses that relate to one another in various ways. Secondly, the relations which could be described functionally in terms of the purpose the writer and the writer's assumptions about the reader, reflect the writer's

options for organising and presenting the concepts. Lastly, most type of text relation is a nucleus-satellite relation, in which one part of the text is ancillary to the other. As such, this theory is better placed to explain this study, since the study involves textual interpretations.

Since the study began with the analysis of scientific persuasion and how language forms are used in the selected academic climate change science publications, RST was better suited to explain the rhetorical discourse emanated from the present study. More than that, RST underscored rhetorical devices employed by various authors, and these included rhetorical cues: lexical, discourse markers, punctuations, relations attributed, background, comparison, evaluation and explanation. Explicitly, RST provided a framework for investigating rational proposition that was unstated but inferred propositions that arose from the following structure in the process of interpreting texts (Mann and Thompson, 1986). In view of the fact that the coherence of the texts depended in part on the relational propositions, RST was a useful tool in the present study.

In short, as a descriptive conceptual framework for text analysis, RST provided a combination of several features that turned out to be useful in various kinds of discourse studies. Compellingly, RST recognised hierarchic structure in scientific text and it described the relations between the text parts in functional terms, and as a result identifying both the transition point of a relation and the extent of the items related. The theory was adopted because it provided a thorough comprehensive analysis rather than selective commentary of the scientific publications.

The theoretical framework of the study was extended to incorporate Aristotelian rhetorical theory. Equally, logical proof and credibility of the writers were taken into consideration when dealing with Aristotelian rhetorical theory.

As in the 1st publication, discourse makers in the third publication served similar roles: to link phrases and sentences. The discourse markers were significant in semantic and syntactic relations because they helped do away with syntactic and semantic ambiguities.

The illustrations below demonstrate the Reid and MacGregor (2007) attempt to establish semantic and structural relationships in the text.

(a) "More in-depth assessments **however** needed to be carried out" (Reid & MacGregor, 2007, p. 1)

(b) "**Whilst** these systems generally pass to the south of Namibia, when in a northerly position they can bring rain to the southern parts of the country accounting for more than half the annual total" (Reid & MacGregor, 2007, p. 4).

(c) "**Although** this is not a very high annual growth rate, the overall increase in population may exacerbate the vulnerability of livelihoods and ecosystems" (Reid & MacGregor, 2007, p. xii)

(d) "**Furthermore**, for many sectors it is the combined effect of changes in rainfall and temperature that impact the sector" (Reid & MacGregor, 2007, p. 1)

(e) "Given these considerations, it was **therefore** decided to undertake the following in addition to the climate modelling" (Reid & MacGregor, 2007, p. 1)

(f) "... apart from presenting the climate change impacts and vulnerabilities for Namibia in general. **The rationale for doing so** is that these regions represent two extremes in Namibia" (Reid & MacGregor, 2007, p. 2)

(g) "**Unfortunately,** the paucity of meteorological records prohibited crop modelling for locations those are closer to the North-Central regions where cultivation of millet is carried out" (Reid & MacGregor, 2007, p. 2).

(h) "**First of all**, the pressure on land and water resources is likely to increase in the more densely populated communal areas in the north- central regions and the Kavango and Caprivi regions, if one assumes that land management practices will not change significantly without specific interventions" (Reid & MacGregor, 2007, p. xiii).

(i) "**Secondly**, although it is not clearly spelled out in the Population Projections, it is expected that increased population pressure will lead to internal migration" (Reid & MacGregor, 2007, p. xiii).

Significantly, like it is pointed out in the first publication, any author who intends to write critically should know that it is necessary to explicitly explain why something is the way it is. In the sentence (a) the author makes a concession: "More in-depth assessments **however** needed to be carried out" (Reid & MacGregor, 2007, p. 1). The phrase "more in-depth assessments" is preceded by a textual connector "however" to establish affirmative relationship between the initial idea and the idea to follow after "however." Also, "however" signifies contrastive steps in the discourse of science publication and identical in its purpose with "yet" and "but."

Equally, in phrase (b) "**whilst** these systems generally pass to the south of Namibia, when in a northerly position they can bring rain to the southern parts of the country accounting for more than half the annual total" (Reid & MacGregor, 2007, p. 4) the authors establish contrasting relationship with a discourse marker "whilst" between the ideas of the systems generally passing to the south of Namibia while at the same time brings rain to the southern part of the

country. However, in the phrase (c) "**although** this is not a very high annual growth rate, the overall increase in population may exacerbate the vulnerability of livelihoods and ecosystems" (Reid & MacGregor, 2007, p. xii) the authors used the discourse marker "although" to show compromise of an initial idea in the phrase "although this is not a very high annual growth rate"

In the same publication (3) the authors used the conjunction "and" with high frequency (30 times in the first four pages only, outnumbering all the other discourse markers throughout the publication) as in "and became legally obligated to adopt *and* implement policies *and* measures designed to mitigate the effects of climate change and to adapt to such changes" (Reid & MacGregor, 2007, p.1) as an example. "And" is the most frequently used discourse marker in the third publication.

The discourse marker "and" just like other additive markers, indicates that the following statement constitutes additional information to the previous discourse. At the same time, the discourse marker "and" is often used to show the authors' continuation of the discourse or illustrates as a sequence marker by showing sequential dependence of the utterances. In this instance, the authors' use of "and" is intended to function as additive.

Subsequently, as can be seen in table 6 above the discourse markers "furthermore", "moreover", "additionally" and "in addition" are equally used several times by the authors. Textually, the linking words function as additives, but semantically the discourse markers keep the readers know that more information is being added, and as a result the authors are likely to keep the readers engaged.

In the phrase below it can clearly be seen how the authors used "unfortunately" to show attitude towards the topic under discussion. In terms of textual function, the discourse marker "unfortunately" tells us a lot about the writers' attitude towards the topic.

"*Unfortunately*, the paucity of meteorological records prohibited crop modelling for locations that are closer to the North-Central regions where cultivation of millet is carried out" (Reid & MacGregor, 2007, p. 2).

This simply means that the authors were not pleased with the paucity of meteorological records which prohibited crop modelling for locations that are closer to the North-Central regions where cultivation of millet was carried out. Overall, the publication appeared to have achieved its goal of informing and persuading the readers about climate change.

Unlike in the publications above, the authors in the fourth publication (below) introduced their findings by first establishing authority and claiming that the findings are for present use and possibly for posterity. Thus, Barnes and McGregor (2012) are likely to appeal to the wider readership, inclusive of the younger generations. Entitled "Expected climate change impacts on land and natural resources use in Namibia: exploring economically efficient responses" the publication by Barnes and McGregor (2012) entail interesting rhetorical moves.

The publication informs policy about the efficiency of investment on Namibia's land at present and in the future expected climate change. The publication further analyses primary land uses, livestock production and wildlife viewing tourism. In addition, the publication analysed how the anticipated climate change would impact the investment in the near future, 2080. Similarly, the publication suggests that as climate changes, tourism based on wildlife should also adapt.

In the initial stage of the publication Barnes and McGregor (2012) argue that "over a period of 20 years, the annual losses to the Namibian economy could be up to six percent gross national product (GDP) due to the impact climate change will have on the its natural resources" (Barnes & McGregor, 2012, p. 4). By tying the economy to climate change, Barnes and McGregor (2012) argue that the decline in economic growth would affect the poor most with ensuing constraints on employment opportunities and dwindling wages, particularly for the unskilled labourers.

It can equally be argued that the writers are reminding the readers that Namibia should ensure to take measures to mitigate climate change impact. Similarly, by tying the economy to climate change, Barnes and McGregor (2012) perhaps want climate change to be mainstreamed into substantial policies that would bring about the necessary action needed to deal with the perceived deteriorating climate.

Moreover, the Barnes and McGregor (2012) used the concept of tourism as a form of persuasive tool to convince Namibians to mitigate the impact of climate change. The rhetorical function of the following sentence is particularly compelling: "Tourism is a rapidly growing sector in Namibia, and the leisure tourism component of this, which makes up some forty percent, is dominated by nature-based pursuits" (Barnes & McGregor, 2012, p. 7).

Of course, the "nature-based" aspect is attributable to a variety of natural property together with landscape and wildlife which are the most significant. The writers are urging the readers to protect these natural assets by mitigating the impact of climate change. In the same vein, the

writers are appealing to the readers that good tourism can only be maintained if climate change impact is fully minimised.

Significantly, tourism as demonstrated above holds important relative advantages for Namibia because it is not entirely dependent on inadequate and irregular rainfall, but it makes use of the natural beauty inherent in the landscapes. As such protecting the environment is of paramount importance.

Barnes and McGregor (2012) seem to be aware of the dynamic and use that caveat to influence their audience about the need to protect the environment without just focusing on rainfall. Also, the fact that tourism tends to be confined to a small area around areas of high picturesque value and flora and fauna concentrations, the writers' rhetoric appears to resonate well with the readers as the readers can relate to the possible benefit which could be accrued from the protection of the environment.

Textually, the following statement seems particularly significant: "It must be acknowledged that increased concentration of CO_2 may result in a fertilisation effect as predicted by the dynamic global vegetation model (Barnes and McGregor, 2012, p. 18). Worth noting is the use of the word "must" despite the authors sounding cautious; the word must seems very telling. The idea of making the argument that the public should acknowledge an increase in the concentration of carbon dioxide (CO_2) a "must" is to drive the opinion towards the authors' perception of the world.

Not known to most readers is perhaps that the idea being advanced in this submission is likely inseparable with the language employed by Barnes and McGregor (2012), the language of

persuasion. Ornatowski (2007) agrees with the above submission arguing that ideas and language are inextricably linked and intertwined. The scholar further explains that ideas do not exist in some neutral space, but they emerge in response to circumstances. Beneath the wording "must" lies an emotional command although science scholars are likely to dismiss the observation. But, the notion that somehow language of science is non emotional was refuted by Crystal (2006, p.23) who argued that "it is the myth of science language that it can be characterized solely as emotionless, factual, objective and stable.''

Nevertheless, at present rhetoric goes beyond emotion and it is studied as a comprehensive approach for the production of persuasive arguments as a collection of coded solutions for affective communication. Barnes and McGregor (2012, p. 27) contend that "In the case of traditional livestock keeping, the effects of climate change on financial and economic viability will be least." The rhetorical function of this is that in the tourism sector the financial losses is minimal because tourism sector is partially made up by climate prone activities such wildlife viewing, but other tourist activities such as nonbiological attributes and beautiful sceneries hardly get affected by climate change.

The next statement was extracted in the main argument of the fourth publication: "Surface water flows are predicted to decline by up to 15% in the Orange river system to the South and 10% in Western ephemeral rivers" (Barnes & McGregor, 2012, p. 18). Semantically, the authors' use of passive voice "are predicted" does not mean they are not responsible for the prediction. The statement seems to have been strategically crafted to persuade the readers into believing that "these are predicted" is an unquestioned authoritative observation by Barnes and McGregor (2012). Of course, passive voice does not make the doer, or the subject of the sentence disappear. Therefore, the argument put forward by the authors is intended to persuade

the readers that somehow the "predicted" surface water flows is an absolute reality since the predictor is unknown.

Overall, the fourth publication concludes by stating that active intervention on climate change should be focused on expansion of irrigation, based on sound development planning, to ensure the development is environmentally and economically efficient. Again, this seems to be another classical example of how rhetoric can be used to appeal to the public. The two authors conclude by stating the position with regard to climate change and declare that intervention on climate change should be focused on expansion of irrigation. It is likely that the authors assume that the public would be persuaded considering that they speak from the position of authority.

In the fifth publication entitled "Knowing farming and climate change adaptation in North-Central Namibia" Newsham and Thomas (2011) explored the degree to which agro-ecological knowledge held by Aawambo farmers in north-central Namibia constitute adaptive capacity to eliminate climate change impact.

The publication's introduction opens with acknowledgement of various authors in order to establish credibility and connectivity with the readers. Newsham and Thomas (2010) placed historical context at the centre of the publication as a way to establish relationship with what the readers know about the subject matter and the new knowledge being presented. The following statement seems to substantiate the above argument on historical context: "The role of local knowledge and capacities has long been a focus within development studies" (Newsham & Thomas 2010, p. 761).

Moreover, the authors further claimed that the article would add critical mass to the agenda of climate change by extending its empirical coverage. Newsham and Thomas (2010) persuade the readers through an argument that the article explores the extent agro-ecological knowledge held by northern and north central regions can constitute adaptive capacity to climate change impact

Table 7.

Rhetorical cues

Discourse markers and frequency	**Functions**	**Samples in the text**
And (697)	Additive	"... through arid semi-desert **and** semi-arid savanna, to semi-arid **and** sub-humid woodlands in the northeast. Land use is based on natural rangelands **and** takes place commercially on private land, traditionally on

		communal state land, **and** to a lesser extent through leasehold in protected areas" (Newsham & Thomas 2010, p. 4)
However, but, although, due to , thus, despite, nevertheless (49 times)	Contrasting	"**Howeve**r, all land and natural resource uses in these areas were considered" (Newsham & Thomas, 2010, p. 5)
Furthermore, in addition, further, next, again (11 times throughout)	Additive	"**Furthermore**, as climate changes, the existing economic benefits to the Namibian economy associated with pastoralist and wildlife-based tourism should adapt" (Newsham & Thomas, 2010, p. 3)
For this	Resulting	"**For this**, we used detailed spreadsheet enterprise models for livestock" (Newsham & Thomas, 2010, p. 3)

Generally,	Attitude	"**Generally**, traditional small-scale cattle keeping, as practised in the woodland and Savannah biomes, is shown to make efficient use of capital" (Newsham & Thomas, 2010, p. 18)

The conjunction "and" is dominant in this publication. The other discourse markers are equally sparsely distributed and are serving similar functions to the other four publications above. The discourse markers in the fifth publication provide classical example of how these sentence connectors are used by the writers to argue a point. The discourse marker "and" takes centre stage in the tying of words, phrases and sentences to create a meaningful argument. The contrasting discourse markers seem to have equally been used frequently. It shows concessional nature of the language of science when trying to persuade readers.

The Newsham and Thomas (2010) claim in the methodology that "due to the short timeframe available for fieldwork, our findings should be considered as the foundations, not the final result" (Newsham & Thomas 2010, p. 765). From this observation, it can be seen how the authors try to influence the readers to agree to the claim they have made about taking credit of the foundation of the study. Textually, Newsham and Thomas (2010) arranged the methodology semantically with the sole purpose: to drive an argument home. By urging the readers to not treat the findings as final, the authors have already assumed that their findings

are the absolute truth and therefore the public should just choose between foundation and final, and as such should not question the reality and the truth of the findings.

The following submission indicates the interpretive nature of how anxious sometimes scientific scholars seem when they try to explain or avoid altogether the issue of prediction on climate change, while at the same time try to persuade the readers to believe that the findings are the foundation.

> Given how little is known about the future impacts of climate change in north central Namibia, adaptive capacity is not a value amenable to precise calculation. In such circumstances, from a resilience perspective, capacity to predict future climate change accurately and plan accordingly may be less important than flexibility in response to surprise and disturbance (Newsham & Thomas, 2010, p. 675).

The above submission concurs with the general perception that most scientists seem to view themselves as the provider of knowledge; they supply knowledge to the policy makers and the policy makers are expected to implement those supplied facts. Newsham and Thomas 2010 are trying to persuade the readers to avoid holding them (authors) accountable on future prediction should anything not go according to the prediction. As a result, the authors seem to be recommending flexibility in response to the authority than paying attention to the prediction.

The submission above is equally in line with Rayner and Malone (1998) who observed that interpretive approach tends to focus on the meaning of activities and language, the structure of perceptions, nature of experience, recognition of interest and development of framework. Rayner and Malone (1998) further argued that in climate change research interpretive approaches have to deal with the framing of the problem, social cultural issues, stakeholder involvement, the nature and production of knowledge, and so on.

Since the present study is explicitly rhetorical and focuses on the rhetoric of climate change publications, the rhetorical moves and strategies employed by the authors revealed a lot about the dimensions of the rhetorical scope this publication entail.

Overall, the publication concluded with "we have demonstrated how agro-ecological knowledge has imbued farming with resilience to climate variability in north central Namibia, whilst noting that it is no panacea" (Rayner and Malone, 1998, p. 768). The word "demonstrated" implies scientific design meant to achieve the intended goal through a calculated display. The whole paper was rhetorically well crafted and embedded with rhetorical moves intended to persuade the readers.

The sixth publication by the Ministry of Environment and Tourism (MET) (2011) entitled "national policy on climate change" focused on constitutional obligations of the government of the republic of Namibia, particularly the welfare of its citizens and the protection of the environment for current and future generation. Similarly, the publication sought to outline a coherent, transparent and inclusive framework on climate risk management as per Namibia's national development agenda and in recognition of environmental constraints and vulnerability. In the foreword statement of the publication, the ministry sounded an alarm to the readers about the danger of climate change before the findings were even presented to the readers.

The statement opened with the claim that Namibia is recognised as one of the most vulnerable countries to the impacts of climate change. The Ministry of Environment and Tourism (2011) established its position regarding climate change and claimed that the predicted increase in temperature and evaporation as well as increased variability would exacerbate the existing

challenges that Namibia is faces as one of the driest countries in the world. By establishing its position in the foregrounded statement, the ministry assumes that the readers identify with the position taken about the danger of climate change.

Moreover, the ministry further used climate sensitive sectors such as agriculture, fishing and livestock to drive a point home. Drawing agriculture and the livestock into the argument is particularly significant since these are the sectors most Namibians rely on. The rhetorical functions of climate sensitive sectors are based on the understanding that individual livelihoods and the capacity for environment to support human needs will be relentlessly affected by the effects of climate change on natural resources and the general functioning of the ecosystems.

Equally, of particular vulnerability are the underprivileged due to the profound dependence on natural resources for livelihoods and the low capacity to adapt to the effects of climate change. As a consequence, the ministry attempts to drive an argument home in which the Namibian government is urged to adopt climate change strategies that reduce vulnerability and improve adaptive capacity although at the same time working towards lasting economic goals cannot be overemphasized.

The ministry similarly observed that unchecked climate change has the potential to wreak havoc and result in catastrophic consequences on the most vulnerable in the society. The pessimistic view of the future has the rhetorical effect on the readers as they identify themselves with the most vulnerable. In general, the statement is intended to influence the readers before they even come in contact with the findings in the whole publication.

In the introduction part of the publication, a general statement "Global climate change is one of the greatest challenges the world is grappling with in the 21st century" (MET, 2011, p. 1) seems to have been used deliberately as a truthful argument to substantiate the claim about the danger of climate change. In an attempt to win the hearts and minds of the readers, the ministry provided a background context to the observation about climate change possibly with the intention to establish credibility. Another source of credibility is the citation of IPCC report in which it is claimed that during the 20th century the global temperature had increased to about 0.75 degree Celsius. While still relying on IPCC to make an argument, the ministry has placed the organisation at the centre of what constitute reality and truthfulness.

The fact that IPCC is an international organisation, the ministry used its favourable hierarchical global position of the organisation to influence the readers about the danger of climate change. For example, the publication argues that the IPCC predicted that by 2100 the near surface average temperature of the earth over the world would increase by 1.4 to 5.8 degree Celsius from 1990 level. By placing IPCC at the centre, the writers of the publications hope to drive their message through this positioning because the readers are likely to believe and trust IPCC as an international body as opposed to the local researchers asserting that claim.

Still, the publication cited IPCC report as a weapon to appeal to the emotion of the readers. The publication argues that according to IPCC report of 2007 the global warming is of a considerable concern to society as it will have profound impacts on human lives and this will be through changes in food production, water supply, health and land availability. With land and water supply being somewhat thorny issues in Namibia, the publication hinted the issue of land and water supply as a way to let the Namibian readers pay attention.

The publication claims that "with respect to water resources Namibia is predicted to suffer complete water scarcity by 2020" (MET, 2011, p. 4). The rhetoric embedded in the statement points to the fact that, notwithstanding the uncertainty of the impact of climate change on many sectors, there is an urgent need to act now to avert serious water shortages in the near future. MET (2011) intends to influence the readers that the development of the policy would assist the government of the republic of Namibia to macro and micro manage climate change responses in a way that recognises the water national developmental goals and promotes integration and coordination of water programmes of various sector organisations so that the benefits of the country as a whole are maximised and the negative impact minimised.

In order to avoid water scarcity, the ministry of environment and tourism is expected to implement policy adaptation measures to minimise the vulnerability of the general population to the effects of climate change by improving their adaptive capacity whilst pursuing sustainable development.

To cement the policy argument further, the publication claims "Climate change will negatively impact food security and the natural resources base in Namibia" (MET, 2011, p. 15). The sentence underscores the need to mitigate climate change. What the sentence infers is that the extreme poor and vulnerable particularly women and children will be harshly affected. The policy is based on a hypothetical response to the effect of climate change arguing that to efficiently deal with the issue of food security and the sustainable resource base in Namibia, the government would promote systems in the agricultural sector that are climate resilient.

Again, not only is the issue of water is being magnified, but the use of the word "suffer" is significant. It could have been said 'Namibia is predicted to experience water scarcity' but the

writer chose "suffer" to intimidate the readers into submission. Alternatively, the publication's use of the word "suffer" is perhaps to paint a gloomy future and evoke a strong imagery of suffering in the mind of the readers. This line of argumentation creates a strong imagery and has the potential to influence the reader's point of view vis-à-vis climate change.

In terms of content analysis rhetorical cues shown in Table 8 were extracted from the publication.

Table 8.

Content analysis rhetorical cues.

Discourse markers and frequency	**Functions**	**Samples in the text**
And (701 times)	Additive/ binding	"Namibia's climate is generally hot **and** dry with variable **and** unpredictable rainfall patterns" (MET, 2011, p. 2)

However, while, although, but, despite (24 times)	Contrast	"Precipitation projections have greater uncertainty compared to those of temperature; **however,** the Global Circulation Models (GCMs) indicate that Namibia will become drier with more variability in rainfall" (MET, 2011, p. 6).
Furthermore, further, in addition, thus (20 times)	additive	"**Furthermore**, the document makes provision for resources mobilization, monitoring and evaluation for the implementation of this policy" (MET, 2011, p. iii)
For example (4 times)	Illustration	"**For example,** the 2003/4 drought cost the Namibian Government N$ 275 million in provision of emergency relief" (MET, 2011, p. 6)
Therefore, because, as a result (27)	causal	"Therefore, Namibia is likely to face severe water shortages with the poor rural population likely to be affected the most" (MET, 2011, p. 6)

In spite of all of these challenges and threats, (macro-**markers**) With a decrease in rainfall and increase in temperature expected,	Contrasting	"**In spite of all of these challenges and threats**, there are also opportunities for Namibia to benefit from climate change" (MET, 2011, p. i)

The discourse markers played a significant role of persuasion in the MET's (2011) publication. In other words, the discourse markers tend to indicate or signal to the readers that the writer would break up the publication into segmentation in order to indicate temporal (time frame), signal causal (reason), emphasise an argument or contrast. From the observation above, the discourse markers that have been used in the publication were strategically placed to make the message resonate well with the readers.

The discourse marker "and" is still dominant in the sixth publication followed by the causal discourse markers, with contrasting discourse markers coming into the third position respectively. Significantly, the predominant use of the connector "and" shows the binding effort by the writers to string the message together so that it resonates well in the public discourse. Overall, the publication has been embedded with rhetorical moves and devices enough to persuade the readers.

The seventh publication is entitled "The National Climate Change Policy (NCCP) (2010)" and it is a policy document which was developed for Namibia. The NCCP focused on information about the main expected impact of climate change and those most likely to be vulnerable to

climate change. Equally, the document suggests objectives that the government of the republic of Namibia would aim to achieve through an effective and efficient response to climate change.

Publication seven opens with the declaration of the severity of the climate change and the unreferenced statistical information. The publication declares that "the inherent annual and decadal variability in climate will be severely affected by climate change" (NCCP, 2010, p. 9)," before presenting statistical information as follow: "mean annual rainfall is less than 250 millimetres (mm) with an upper limit of about 600mm per year" (NCCP, 2010, p.9). The semantic function of the word "severely" is particularly significant, and it shows the authors' attitude towards climate change. Equally, it also appears to show the publication's sense of urgency to mitigate the effects of climate change. It is unlikely that the document can vouch for the accuracy of the given statistics – phrases such as "less than 250 mm*"* appears hard to quantify since the authors of the document have avoided being specific.

By using such vague language, the message has the potential to resonate well with the readers since it is relatively complex for the readers to hold the authors accountable for the uncertainty or lack of accuracy thereof. The publication places ambiguity at the heart of its introduction as a way to make it uneasy to refute the claims the publication has presented. In general, the introduction establishes credibility of the publication through what appears to be attitudinal approach – with the intention to appeal to the readers to agree to the sense of urgency to do something about climate change.

In terms of content analysis of the NCCP (2010) most of the rhetorical devices appear to have been embedded in the semantic uncertainty. For example, the following argument gives a clue: "There is considerable uncertainty regarding the accurate detection of future climate change

scenarios, despite the continuous improvements in climate science" (NCCP, 2010, p. 6). The statement is probably meant to ease the rhetorical tension that may arise from this publication's argument about the danger of climate change. Despite this sense of uncertainty, the publication seems determined to persuade the readers that policies should be developed to mitigate the effects of climate change.

The publication uses citation and brings the Namibian economy into the argument to appeal to the policy makers about the threat climate poses.

> In terms of Namibia's economy, Reid *et al.* (2007) suggests that over twenty-year period, annual losses due to climate change impacts on the natural resources base alone could be 1 to 6 % of the Namibian GDP. In monetary terms this translates to annual losses ranging from N$490 million to N$ 1, 4 billion if measures against climate change are not put in place (NCCP, 2010, p. 7).

Again, despite the NCCP's (2010) sense of uncertainty about predicting climate change with great accuracy, the publication seems determined to appeal to the potential readers and policy makers about the impending threat that climate change brings. By placing a condition (In monetary terms this translates to annual losses ranging from N$490 million to N$ 1, 4 billion if measures against climate change are not put in place) in the argument, the authors of the document appear to give a veil threat to the policy makers. The authors seem determined to use the economy as a way to get the attention of the policy makers and possibly to influence change about climate.

Table 9.

Discourse markers extracted from publication 7.

Discourse markers	**Functions**	**Samples from the text**
And (856 times)	Additive/binding /temporal	"The climate is generally hot **and** dry with sparse **and** erratic rainfall (NCCP, 2010, p. 9)
However, but, despite, while, although (82 times)	Adversative/contrasting	"**However**, certain human activities, such as the burning of fossil fuels, may

		also contribute to climatic variability through the release of greenhouse gases" (NCCP, 2010, p. 9)
Furthermore, in addition, additionally, further (33 times)	Additive	"**Furthermore,** the national climate change policy shall make room for climate change" (NCCP, 2010, p. 22)
Hence1, because, since, therefore, as a result, as such (28 times)	Causative	"**Hence** the Namibia climate change policy shall primarily focus on climate change adaptation" (NCCP, 2010, p. 16)
Significantly (10 times)	Personal / attitudinal	"Namibia has **significantly** lowered the vulnerability of its population and sectors to predicted climate change impacts" (NCCP, 2010, p. 17)

The use of the conjunction "and" appears textually consistent and dominant throughout the whole publication as in previous publications. Equally it can be observed that rhetorical cues observed in other publications are almost similar the discourse markers observed in this publication.

Overall, the publication uses the economy and development to drive a persuasive argument home. In conclusion, the publication remarked: "Climate change is a developmental issue that threatens the achievement of national development goals including vision 2030" (NCCP, 2010, p. 35). Remarkably, the publication places vision 2030 into the argument in order to appeal to the younger generations.

However, in publication eight below by Zeidler, Kandjinga, David, Turpie and Malema (2012) entitled "Climate governance and development: case study" the authors placed climate change at the centre of development. The writers, in the introductory part of the publication, claim that in order to deal with climate change effects African countries would be required to develop climate change response strategies, plans and policies. Such campaign articulates the countries' vulnerabilities and impact to climate change and provide the basis on which African countries respond to the impacts. The publication claims that most African countries have taken steps to develop strategies and plans that would respond to the effects of climate change. Additionally, in many African countries climate change planning remains an unconnected doing that is not incorporated with development planning processes.

The publication begins by presenting the overall context of the paper. Explicitly, the publication claims that climate change is increasingly seen as developmental challenge and an impediment to achieving the millennium development goals in Africa, and Namibia in particular. "Africa is particularly vulnerable to the impacts of climate change and is likely to suffer the most because of its geographical location and weak institutional, human and economic capacity to cope with multiple impacts of climate change (Zeidler, Kandjinga, David, Turpie & Malema, 2012, p. 3). It seems from this claim that the publication establishes

credibility through a larger picture, Africa. As a consequence, the Namibian readers would see climate change as not just a Namibian predicament but an African dilemma.

Moreover, the authors of the publication have established the position as far as climate change is concern. By stating that 'Africa is likely to suffer most' indicates the position or the side of the argument the authors hold with regard to issues of climate change. Additionally, the authors seem to be aware of Namibia's reliance on agriculture and use that sensitive sector to appeal to the policy makers and general populace about the negative impacts of climate change on the country's economy.

The need to incorporate climate change adaptations into development planning and decision-making processes has become increasingly apparent with the general recognition of the multiple connections between development and climate change. Significantly, an improved knowledge on how climate change impact may jeopardise the results of many developmental efforts presents a clear case for integration in order to minimise the effects of climate change. Additionally, the writers are concerned that some developmental activities may inadvertently lead to an increase in exposure and vulnerability to climate change and as such it has necessitated an improved understanding of the synergies between development and adaptation and how integration can be exploited to address the root cause of vulnerability.

Analysis of Zeidler *et al.* (2012) and the other seven publications above reveal that there is no bona fide connection at a high level between climate change impact and appropriate development in various countries in Africa, including Namibia. Even though the responsibilities for climate change adaptation often lies with the Ministry of Environment, the writer's sense that it is critical to have the issue recognised as an economy-based concern. If

not, they believe that the ability to effectively address climate change within the broader objectives of poverty reduction will be severely weakened. The rhetorical function of the argument above is that it is important to convince decision makers at various levels that climate change has economic implications that will make the achievement of development objectives more difficult, and that climate change should be included in the milieu of factors to influence decision-making processes.

By presenting evidence of economic impact of climate change (through images below), the publication has the potential to help ensure the allocation of sufficient financial resources for policy measures in support of climate change adaptation, whether such measures entail revising existing development plans or implementing new measures specifically targeted at climate change adaptation. Zeidler *et al.* (2012) argue further that Namibia's vulnerability to climate change can be unloaded from two viewpoints: at first by looking at the economic sectors that are vulnerable to expected impact and secondly by considering the social structures that would find it particularly difficult to react as they already have low resilience to shocks.

The publication submits that numerous of Namibian's sectoral and development policies already address the natural circumstances even though certain policies and cultural barriers may have led to the entrenchment of inappropriate production and land use systems (Zeidler *et al.* 2012). To cement the argument further, Zeidler *et al.* (2012) predicted: "Global climate change is expected to pose significant new threats in Namibia" (Zeidler *et al.* 2012, p. 7). The writers have taken position that climate change is expected to pose threat to Namibia; the effect of such pronouncement is rhetorically profound and significant as the readers are reminded that since the writers are writing from 'a scientific realm' the argument should be believed and trusted as an absolute truth.

What is equally profound about such submission is the use of a word "threat." Zeidler *et al.* (2012) appeal to the readers that the impending impacts of climate change should be viewed as a threat and as a result the threatened should be prepared to face the impending danger and possibly do something about it. The publication particularly targets the most vulnerable and demands that adaptation measures should be put in place to mitigate the effects of climate change. The writers appeal to the readers that adaptation action, innovation and resilience building must be considered as highly important to safeguard vulnerable people and development sectors from future shocks. The appeal is seemingly based on Namibia's vulnerability and adaptation assessment of 2008 which indicated that the country's poor and rural populations are the most vulnerable to climate change because they are extremely reliant on natural resources. The image in Figure 8 below is used as evidence that the poor population is reliant on natural resources such as water. The picture indicates men rowing dugout canoes to transport people across the river and to catch fish for business purposes.

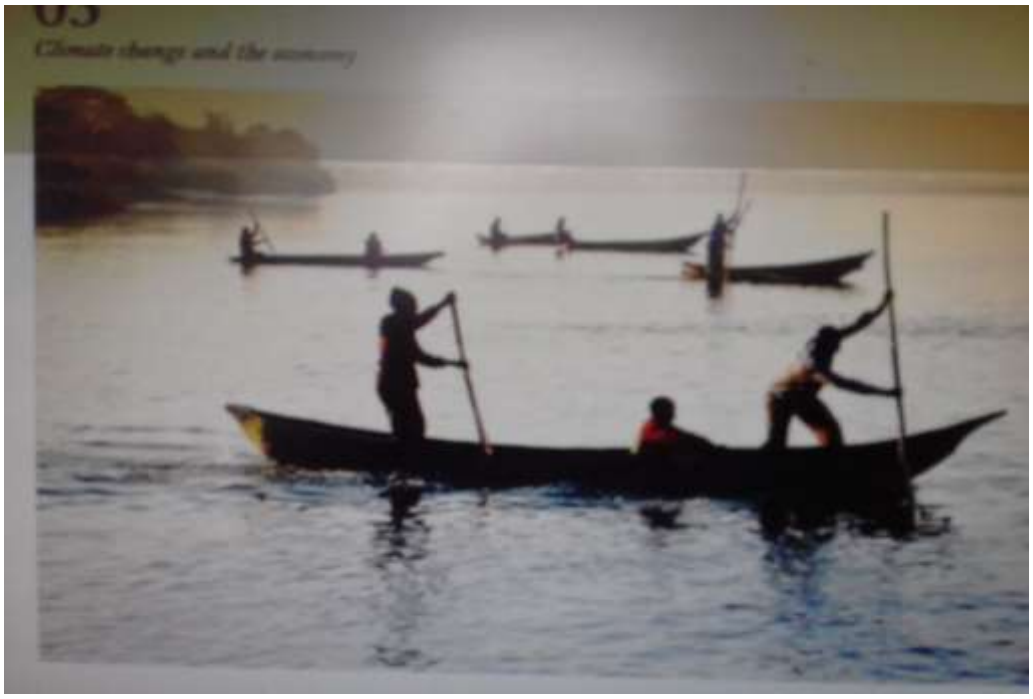

Figure 8. Photo taken by Sanchez, A. AFP/ Getty image (taken in 2008 in Kenya).

Moreover, the publication further appealed that "The direct effects of climate will be felt especially in natural related development and economic sectors such as water resources, agriculture, fisheries, biodiversity, ecosystems and tourism, coastal zone management, health, infrastructure and energy, as well as industry and trade" (Zeidler *et al.* 2012, p. 8). The rhetorical purpose of the claim stems from the understanding that farming and other land-based livelihoods are heavily dependent on the climate. If climate-related mitigation factors are not put in place to combat climate change effects, water resources, agriculture, fisheries, biodiversity, ecosystems and tourism, coastal zone management, health, infrastructure and energy would be placed at risk.

As a way to appeal to a wide audience, Zeidler *et al.* (2012) predict higher temperatures along with more variability in the rainfall, suggesting severe strains on rural livelihoods temperatures along with more variability in the rainfall, imply severe strains on rural livelihoods throughout Namibia, particularly in the north and the south of the country. The rhetorical appeal that can be taken from this argument is that subsistence farmers and people living on dry lands are at risk, especially women, as the impacts of climate change on household food security in the subsistence farming regions could be more severe, leading to chronic hunger and malnutrition.

Moreover, the writers place the inhabitants of low-income rural households at the centre of the argument to drive the message home that the least capacity to cope with adverse of climate change is found within the poor people. The rhetorical effect of such argument seems to be embedded in the idea that effects of climate change can be exacerbated by poverty, lack of income, high unemployment and other social ills. Similarly, the publication places the poor

people at the centre of appeal arguing that "the country's poor and rural populations are the most vulnerable to climate change" (Zeidler *et al.* 2012, p. 8). Placing the poor at the centre is likely to have a significant effect on the readers since many readers can identify themselves with the poor majority.

Figure 9. Photo by Sanchez, A, AFP/ Getty image (taken in 2008 in Kenya).

To strengthen the appeal to the readers, in Figure 9, Zeidler *et al.* (2012) depicts an image of a woman walking in flood water. The woman carries two bags and seems to be struggling to carry the two bags as she walks in reasonable deep water. The publication's depiction of a woman and accompanied by the statement: "The direct impact of climate change will be felt especially in natural resource related development sectors" (Zeidler *et al.* 2012, p. 8) is particularly profound. The readers are likely to sympathise with the woman in the water.

The publication argues further that the country is already heading towards a situation of absolute water scarcity by 2020 even assuming no climate change. Consequently, the rhetorical

aspect of this prediction hints to the idea that any development in Namibia must factor in the reality and cater for solutions to mitigate the impending climatic repercussions. Moreover, the publication contends that "Coastal zone development will be largely limited by water availability, as will be industrial developments such as large-scale mining activities, other high water consumption industries, and even tourism if alternative water sources are not developed" (Zeidler *et al.* 2012, p. 8). The rhetorical point of view of the argument points to the direction that water is an extremely scarce resource in Namibia and even in the absence of climate change the country will likely face absolute water scarcity by 2020.

The purpose of the message cited is to influence the readers and the policy makers that development in terms of industrial activities and large-scale mining activities would be limited. Of course, limitation of development comes with job losses and possible civil unrest if measures are not put in place to curb this scenario from unfolding. Equally, the rhetorical purpose of the argument is to warn the readers that exacerbation of water scarcity by climate change will have a significant impact on the economy. Water shortage can also be expected to bring about increased conflict within and between communities, and between Namibia and its neighbours if the situation is not abated.

The Zeidler *et al.* (2012) have used the coastal and the northern area of Namibia as a rallying point to influence the readers about the danger of climate change. For example, the publication has used the northern Namibia to appeal that:

> Changes in rainfall are likely to bring reductions in flows of Namibia's perennial rivers in the order of 25%, affecting surface water supply from these rivers. These floodplains support important agricultural and fishery activities integral to people`s livelihoods in northern Namibia, as well as providing important ecosystem services such as water quality amelioration and flood protection and being important for tourism. Impacts on wetlands such as the Etosha Pan may have a large effect on tourism (Zeidler *et al.* 2012, p. 9).

This argument shows how the authors of the publication try to influence the readers by arguing that the rivers would go dry and agriculture would be affected because of climate change. The argument is further strengthened by the claim that tourism where most people derive their income would be hampered by climate change. Extraordinarily, this rhetorical battle beneath the objective argument reminds the reader the argument Gross (1993) put forward in which it is recorded that underneath the facade of objectivity resides a ferocious struggle to gain followers for a particular view point and claims precedence for a breakthrough.

Moreover, Zeidler *et al.* (2012) claim that "It has also been estimated that groundwater recharge in south-western Africa may suffer reduction of 30% -60%. This will lead to increased drilling and pumping coasts and reduce potential for borehole, in turn affecting livestock production and supply of water to towns" (Zeidler *et al.* 2012, p.9). With reductions in ground water and rainfall, the rhetorical appeal presented is that increasing demand for water will be accelerated by a greater need for irrigation if climate change is not dealt with head-on. The readers are reminded that shortage in water will become a significant hindrance to growth in certain sectors and consequently life would become unbearable for mainly subsistence farmers.

Correspondingly, *Zeidler et al. (*2012) are warning the readers that reductions in river flow will ultimately lead to a decrease in the floodplain areas and the floodplains support important agricultural and fishery activities integral to people's livelihoods in northern Namibia.

Alternatively, when dealing with climate change, desalination and artificial recharge or underground storage as a potentially viable solution to meeting water demands are options many Namibians pin their hopes on, but it is a costly undertaking. For example, Hartman

(2016) reported in the *Namibian newspaper* that desalination plant which is wholly owned by Areva resources Namibia supplied Namwater with five million cubic meters of water a year due to effect of climate change, but continued that the plant was expensive to maintain. The writers are reminding the readers that climate change will likely speed up the need for these more expensive technologies.

In the north, reduced river flows could also have a significant effect on the output of the Ruacana hydropower plant which suppliers most of Namibia's domestically produced energy and about half of the country's electricity supply (Zeidler *et al.* 2012). This is particularly concerning because Namibia's energy demands are increasing at about 3% a year, and South Africa's capacity to supply the shortfall is diminishing (Zeidler *et al.* 2012). Accordingly, the writers are appealing to the readers that climate change will lead to a reduction in energy supply if measures are not put in place to mitigate the effects. The readers are also reminded about the possible consequences of an unabated climate change.

The overall rhetorical appeal about reduction in water supply and rainfall is that reductions in rainfall will likely have a significant impact on different agricultural and industrial activities especially through the impact on land productivity. The eighth publication estimates that carrying capacity for livestock would be reduced throughout Namibia. In Southern Namibia, the publication has also estimated that this could drop by 15% which would mean that crop farming would cease altogether. While this could be offset to some degree by irrigation, the authors of the publication argue that irrigation potential would also be reduced due to reductions in water availability, land degradation as well as changed growing conditions. Because of their dependence on dry land cropping, agricultural output has been predicted to decrease by 40% -80% as a result of climate change over a fifty-year time horizon.

Contextually, science scholars may spike at the above suggestion and may see it as an implicit invasion on the status of science particularly its epistemological claim, but the above argument demonstrates how scientists battle to persuade their targeted audiences. As argued in Chapter 2, for some scientists the idea of rhetoric of science could be interpreted as an attack on their integrity. What the scientists should understand is that science involves a language, and this language inescapably entails rhetoric. The above arguments are in line with Ornatowski (2007) who noted that whatever makes a functional use of words and phrases is likely to be involved in the technical problems associated with words, including rhetorical issues.

Considering that the above arguments outline climate change projections, the rhetorical argument behind the above submission is that climate change will affect all production sectors. The probable impacts on agricultural production include drier climates, more uneven seasons, frequent and prolong charge of groundwater and seasonally increased run-off from areas expected to receive more rainfall, like northern Namibia, which would cause stress and spread of certain disease such as malaria, while infrastructure damage, for instance through flooding, is to be expected.

Table 10.

Rhetorical cues observed in the science publication 8.

Discourse markers	**Functions**	**Samples from the text**
And (655 times)	Bind/link/ additive	"Traditionally, communities **and** land management systems throughout the country have co-evolved with the climatic **and** natural resources realities, **and** policy shifts since independence in the wildlife management, conservation **and** tourism sectors have promoted more flexible **and** adaptive land uses" (Zeidler *et al.* 2012, p. 8).
However, despite, even though, while, whist, but (54 times)	Contrastive / adversative	"Changes in rainfall are more difficult to model compared to those in temperature, especially in highly variable arid climates such as Namibia. **However,**

		the global circulation model indicate that Namibia will become drier with increased variability in rainfall trends" (Zeidler *et al.* 2012, p. 8).
Further, In addition (5 times)	Additives	"**Further**, concern that some development activities may inadvertently lead to an increase in exposure to climate change" (Zeidler *et al.* 2012, p. 4)
For example (4 times)	Illustration	"**For example**, marginally productive desert margin farms were proclaimed after good rainfall years" (Zeidler *et al.* 2012, p.8)
Traditionally (1 time)	Attitudinal /mood	"Traditionally, communities **and** land management systems throughout the country have co-evolved with the climatic **and** natural resources realities" (Zeidler *et al.* 2012, p. 8)
Therefore, because, hence, since (21 times)	Causative / resulting	"**Therefore,** they are expected to cope and develop adaptation

		strategies" (Zeidler *et al.* 2012, p. 7)

The additive "and" is predominant in the eighth publication. Equally important to take note is the wide frequent use of adversative or contrasting forms throughout the whole publication – trailing second only to the additive "and." The predominant use of all the discourse markers indicates the publication's attempt to influence the readers about the danger of climate change. The contrasting and adversative discourse markers such as "however", "despite", "even though", "while", "whist", "but" indicate the authors' persistent determination to provide alternative arguments to the readers and with the possibility to influence the readers.

The eighth publication places development at the centre of the argument as a way to influence policy makers to take drastic measures to mitigate the effect of climate change. All in all, the publication used persuasive moves to drive the argument home.

4.4 Conclusion

In conclusion, Chapter 4 set the scene for the research discussion and to a certain extent provided an overview of climate change in Namibia and elsewhere. Equally, the chapter highlighted the wider rhetorical devices relevance for the contextual and textual analysis of rhetoric of science. Scientific persuasion and how language forms are used in science writing on climate change were explored. The chapter further underscored rhetorical devices employed by various authors, these included rhetorical cues: lexical, discourse markers, punctuations, relations attributed, background, comparison, evaluation and explanation.

CHAPTER 5: INTERPRETATION OF THE RHETORICAL EFFECT OF VISUALS

5.1 Introduction

This chapter presents interpretation of the rhetorical effect of visuals used in the selected science publications on climate change and the development of various models for language of science interpretation. It sets the scene and provides the visual overview analysis of the publications under this chapter. The chapter begins with the analysis of rhetorical visuals of the selected science publications and it concludes with the analysis of the models developed and discussed by various scholars. It also analyses rhetorical devices that have been embedded within those visuals and models employed by various authors.

5.2 Interpretation of the rhetorical effect of visuals used in the selected science publication

The first section of the chapter examines the rhetorical effect of visuals used in the selected climate change science publications. Walsh (2015) reveals that climate change graphs and visuals tend to provide a unique perspective on a discipline of rhetoric which regards images as arguments that mould polities in specific discussions over climate change. Similarly, Walsh

(2015) observed that there seems to be a habitual ways of visualising climate change work against and not for efficient political action, and should underpin technical climate graphs at basic levels, but paradoxically non-experts and including some experts, perpetuate the myth that climate visuals are transparent, untransformed views of nature.

As stated in Chapter 2, in order to understand the rhetorical analysis of science publications on climate change in Namibia, it is essential to define and explain what rhetoric of science is. There is a plethora of definitions and explanations provided concerning rhetoric but as already indicated for purpose of this study some of the definitions are used. Welldon (1886) cites that Aristotle defined rhetoric as the faculty of discovering in any particular case all of the available means of persuasion. Contextually, Gross (1994) observed that Aristotle had seen that rhetoric was an activity central to the efficient functioning of the Greek city state and arguing that for Aristotle it was more of an oral culture and male culture to see the available means of persuasion in each case while effectively utilising those means with the desire of reinforcing conviction and deed. In other words, rhetoric is an attempt to coordinate and influence human choices on specific matters that require immediate attention.

For the purpose of the present study, an elucidation of rhetoric of science by Gross (1993) is used. "Rhetoric is the process of persuasion be it in the lab and in the field and in the study" (Gross, 1993, p.1). The overarching aim of Chapter 5 is to explore the dynamic context of visuals and models as far as rhetoric of science is concerned.

The ninth Publication by Oertzen (2010) entitled "Impact of climate change on human health in Namibia" presents a brief overview of the anticipated impact that climate change is expected to have on human health in Namibia. The publication warned that the paper analysis was not a

medical study, but rather an assessment based on contemporary literature and statistics about climate change and health related issues. Equally, Oertzen (2010) claims that assessing the effects of climate change on human health requires an understanding of the most likely physical effects and impact that climate change would introduce. Accordingly, as a way to make the presentation authentic and persuasive to the readers, Oertzen (2010) presented a brief overview of health system in Namibia by identifying the major climate effects of significant to Namibia. The presentation was also based on both national and international literature on the possible changes expected due to climate change.

Moreover, to achieve persuasion based on themes the publication focused on climate related health impacts: temperature-related health effects, water-borne diseases and health-related impact of food and water shortages. To further strengthen the appeal, Oertzen (2010) carried out interviews with experts and key decision makers in Namibia on health sector to identify the main concerns likely to impact on health sector as the effects of climate change become more evident.

Significantly, the writer claimed "global climate change is expected to lead to an increase in surface air temperatures, an increase in the intensity of rainfall events, a lengthened dry season, an increase in the general climatic variability, an increase in the evapo-transpiration rates of plants, as well as an increase in wind speeds" (Oertzen, 2010, p. 14). Worth noting in this excerpt is the use of repetition by the writer. Repetition is considered as a form of literary device that repeats phrases or even same words a couple of times to make an argument lucid and unforgettable. Davison (2007) carried a study on repetition and visuals; the intention was to add to theoretical and empirical work on the rhetoric narratives and pictures. The study established that rhetorical arguments based on repetition such as anadiplosis, anaphora,

alliteration and rhyme have a conscious rhetorical emphasis – the lines of argumentation are intended to be clear and memorable to the audience or the readers.

The rhetorical function of "global climate change is expected to lead to an increase in surface air temperatures, an increase in the intensity of rainfall events, a lengthened dry season, an increase in the general climatic variability, an increase in the evapo-transpiration rates of plants, as well as an increase in wind speeds" is to influence the readers that the exterior variables whether independently or cumulatively are expected to impact human health. The writer used anaphora to draw significance to the danger associated with climate change. For example, an increase in temperature, precipitation and severe weather events has been used as a way to influence the readers about the danger of unabated climate change since the readers are likely to be convinced that these effects are expected to lead to changes in physical environment, many of which would have an effect on human health.

Significantly, Oertzen (2010) views climate change in the same way as HIV/AIDS pandemic and malaria are viewed. This is to appeal to the readers that climate change should be feared and viewed as health hazard just like HIV/AIDS, tuberculosis and malaria. The publication argues "climate change is expected to add additional pressures to the social environment that is, in many cases, already burdened by poverty and health challenges such as the HIV/AIDS pandemic, tuberculosis, malaria, malnutrition" (Oertzen, 2010, p. 14). Evoking HIV/AIDS, tuberculosis and malaria has the potential to influence and persuade the readers about the danger of climate change. Placing some of the widely feared diseases such as HIV/AIDS at the centre of an argument has the potential to persuade the reader by appealing to the fear. Additionally, climate change is viewed as an additional pressure to society just like the diseases mentioned.

Apart from the textual excerpts above, the publication displayed some images that are intended to persuade. Most visual images and graphs that accompany written arguments serve certain functions – to appeal to the emotions (pathos) or clarify numerical data in the case of graphs. Indeed, there are additional uses for images – for instance cartoons may add a welcome touch of humour, but in the present study the focus was an appeal to emotions through images and graphs. Apart from using visual images and graphs to appeal to the emotions of the audience, images of threat are often used to persuade the audience of the visuals, some visuals and graphs used in science publications on climate change seem to be embedded with emotional appeal, flattery and threat.

As such there seems to be a strong corpus of research into the use of visuals to persuade readers however the area still remains comparatively ignored. It should be argued that visuals portrayed in science publications on climate change are not merely for designs and decoration, they have rhetorical importance – to persuade the readers.

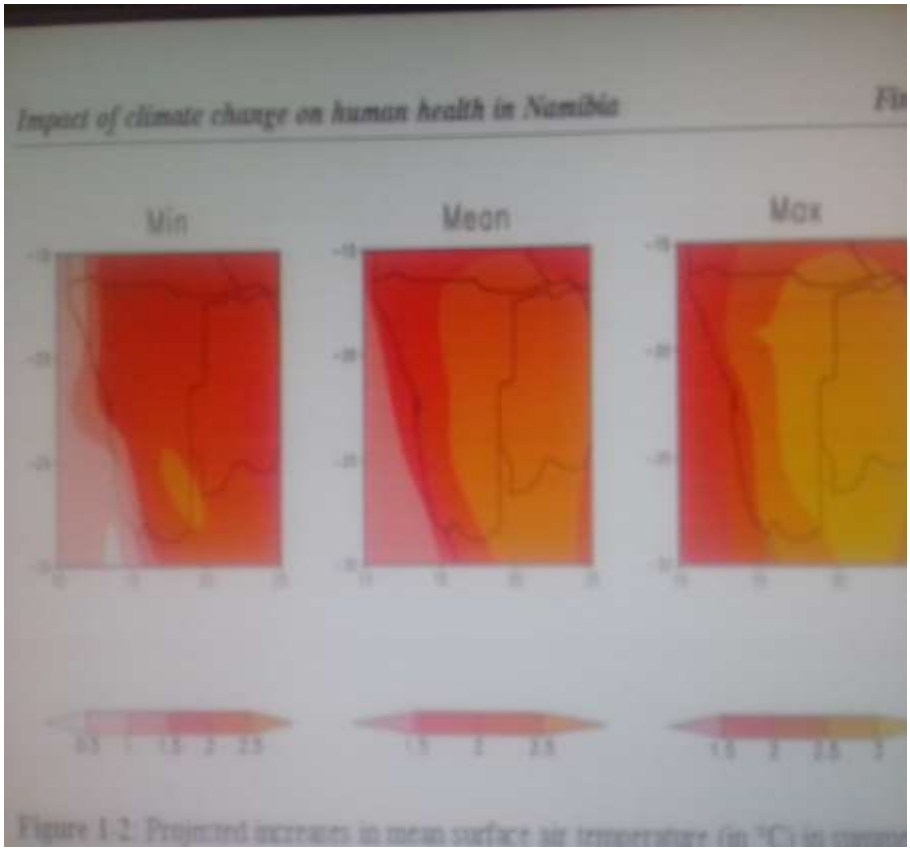

Figure 10. World Climate Research Programme's Coupled Model Intercomparison Project phase 3 multi-model datasets (2008).

The image in Figure 10 [Oertzen, 2010, p. 8] shows a colour-divided map of Namibia and graphs representing rainfall pattern in the country. There are two figures each represented in different colours. Explicitly, the drier coastal area of Namibia is represented in colour red – red

signifies danger. A move to the northern part of the country the colour changes to amber – a sign that the climatic situation is less problematic. The colours could have been chosen by the author to visualise the threat climate change poses to the human health.

Therefore, it can be argued that colours and graphs (pictures) are often used in rhetoric as arguments because images make statements. Graphs often depict vertical lines to the far right as this is to convey immense agitation experienced by the figures in rainfall reduction. Visually, images constitute important part of the rhetorical environment and ignoring them to focus only on written and spoken discourse means little is understood about that effect of climate change (Foss, 1994). Similarly, Audigier (1991) observed that the study of visual images and symbols from a rhetorical point of view also has grown with the emerging acceptance that such symbols provide access to a range of human experiences that are spatially oriented and multidimensional, and dynamic usually can be conveyed and communicated via visual imagery or through non discursive symbols.

As can be seen (Oertzen, 2010, p. 8, 10, 11) different figures represented in colours and graphs are meant to influence the readers. Through graphs and colourful representation, the message about the threat climate change poses to human health appears to have been effectively communicated since most readers find reading graphs easier than reading a complex text. For illustration purposes, figure 1 and 2 [Oertzen, 2010, p.8] indicate the projected increase in mean surface air temperature in summer (Jan to Mar), minimum (left), mean (middle) and maximum (right) projected change, all represented in colours. The readers are likely to interpret easily the communicated message about the danger of climate change than they would have if the message was in text.

The colours appear to appeal to the readers as they would easily associate different colours to the danger climate change poses. With regard to graphs, quantifying numbers on the graph is almost impossible – the readers therefore are likely to find it hard to ascertain the reality and truth behind any given graph. Accordingly, these readers are, as a consequence, likely to assume that the graphs presented are credible and truthful. Overall, the publication's use of graphs and figures was intended to make the interpretation of the message easier for the readers to understand.

In publication 10 by Zeidler, Kandjinga and David (2010) entitled "Study on the effects of climate change in the Cuvelai Etosha basin and possible adaptation measures" the publication describes possible measures to cope with the effects of climate change within the Cuvelai Etosha basin. From the beginning, the document reviews and captures existing facts about climate change in Northern Namibia. Similarly, the publication describes relevant climate change related impact on the Cuvelai basin.

The publication's objective is to describe possible measures to cope with the effects of climate change within the Cuvelai Etosha basin based on projections. However, it is noteworthy to understand that the projection presented in this publication according to the authors Zeidler el al. (2010) represents the best science available. Admittedly, Zeidler *el al.,* (2010) argue further that the projections are produced on a global scale and provide only fairly general information on a basin scale such as for the Cuvulai Etosha basin. Worth pinpointing is the manner in which the admission is made; the writers seem to have casted doubt over what the argument was based on (best science available).

Similarly, Zeidler *el al.,* (2010) concede that the projections are only indicative arguing that the ever-improving models and improved input information are needed to model more robust future projections. The rhetorical function of this kind of admission is that the readers are likely to be persuaded as they may not be able to question the information, since the producer of that information is casting doubt. The writers noted "in the absence of better data and more robust projections, current thinking and decision-making need must be based on the current knowledge" (Zeidler *el al.,* (2010), p. 4). The rhetorical purpose of this statement is to acknowledge high degrees of uncertainty in the information used in order to make it difficult for the readers to decipher the authenticity of the provided information thereby making it harder for the reader whether to rely on the available knowledge or make up one. Significantly, the publication opens with the image of flooded traditional houses [Zeidler, Kandjinga & David (2010) p. 1] as seen in Figure 11.

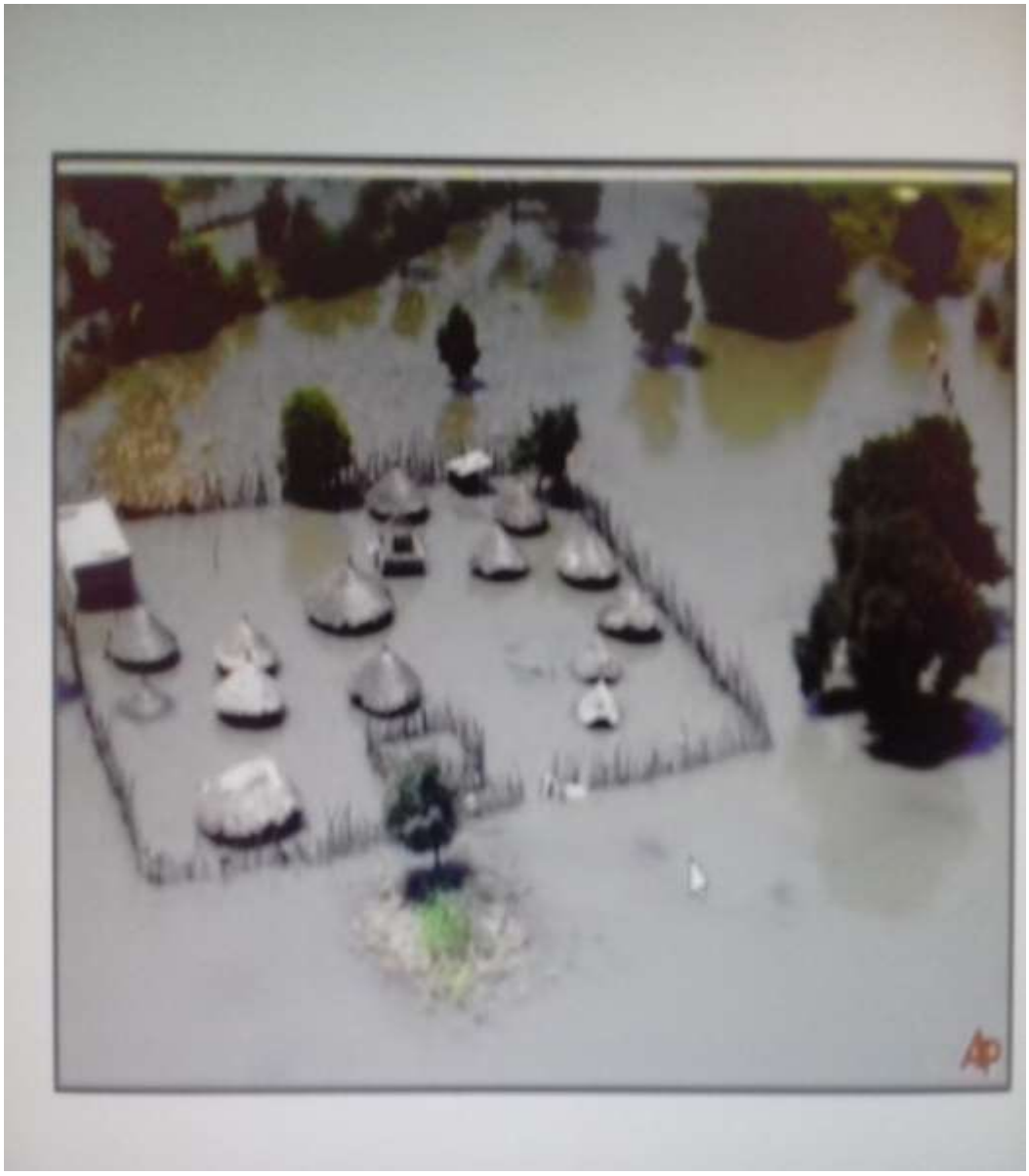

Figure 11. Picture by German Technical Cooperation (GTZ, 2010, p. 1)

The image in Figure 11 indicates a homestead that has been submerged by rainwater. By placing the image on the top of the publication, Zeidler *et al.* (2010) may have intended to draw attention to the danger of climate change. The image may appeal to the most vulnerable people, including the policy makers. Since the publication's objective is to describe possible measures to cope with the effects of climate change within the Cuvelai Etosha basin, the authors are likely to have achieved their objective through the graphic display of a submerged homestead.

Moreover, the above argument seems to be in line with the wide held view that scientists use actual image of children suffering, or they depict a picture of dry land (in this case a flooded homestead) with the sole purpose to communicate with their audience. They do this often in climate change publications where the images of starving people to present point of view regarding the issue of climate change. This observation is in line with the view by Foss and Graffim (1995) who claim that visual images and graphs entail the conscious choices about the strategies to employ in areas such as colour, form and size. They argue that visual images are arranged, changed and moulded by a rhetor not simply for the purpose of emotional discharge, but for communicating with audience, even if the initiator is the only audience for the image.

Key to understanding rhetoric of visual images is to focus on a rhetorical response to an artefact rather than an aesthetic one. Finnegan (2008) views aesthetic response as a viewer's direct perceptual encounter with the sensory aspects of the artefact. Finnegan (2008) further argues that in rhetorical response, colours, lines and texture in an artefact provide basis for the audience or viewer to lie to rest the existence of images and emotions. As such, understanding these rhetorical responses to visuals images is the aim of visual rhetoric as a perspective.

Accordingly, the image of a flooded homestead communicates the message to the readers about the danger of climate change.

Content analysis of the tenth publication revealed how authors reviewed and captured existing supposed facts about climate change in northern Namibia while at the same time using those supposed facts to persuade the readers. The publication further describes climate change related impacts on the Cuvelai basin, by using explicit and graphic depiction of the impact.

The graphic depiction of the flood impact could be interpreted to mean that an unexpected flash flood has the potential to pose direct threat to humans and possibly cause death by drowning. Most importantly, the sudden rise in flood water could pose threat to both humans and animals. The rhetorical significance of the depiction is that measures should be put in place to minimise the destruction caused by flash flood. Zeidler, Kandjinga and David (2010) recorded that Namibia's main causes of deaths in children under the age of five years old are diarrhoea, under-nutrition and malaria. Because of this understanding, the authors of the publication could have used the image to appeal to the authority to do more to mitigate the impact of climate change. Of course, the illnesses and ultimately deaths are related to environmental circumstances and if environmental problems are not dealt with could exacerbate the effects of climate change.

Moreover, to persuade the readers further the writers presented the following argument about the effects of climate change:

> ... increasing hot climates weaken people and especially children. Food may go off more readily, especially if no advanced food storage options are in place, and diarrhoea can be a consequence. Because the climatic conditions are already trying, the effects of the diarrhoea can be detrimental for the already weakened child. During the dry seasons, food supply is limited, and the nutritional status, particularly

> of the rural population, is poor; additionally, the reduced availability of clean water impacts on the health status of the people. Increased frequency and intensity of occurring droughts in the future would exacerbate these problems (Zeidler *el al.*, 2010, p. 13).

Zeidler *et al.* (2010) connect the potential spread of waterborne diseases to flood and argues that flooding could exacerbate the situation if climate change continues without mitigation. The reader is reminded that the possibility of flash flood flooding sanitation facilities such as toilets is real and could be catastrophic, and as a result the scene could become thrilling breeding ground for bacterium.

Arguing further, the writers explain: "During severe flood events, people and homesteads may be cut-off from service centres for a prolonged period of time. People affected by waterborne diseases may not be able to access health care, and those in need of regular medication e.g. Antiretroviral are unable to source their medication (Zeidler *et al.* 2010, p. 13). Significantly, the writers warn that if measures are not put in place to minimise the impact of climate, people would be cut-off from entire major services such as health.

Arguably, by including antiretroviral drugs into the persuasive argument, the writers want to appeal to the most vulnerable in the society. The rhetorical function created by this argument is that the poorest would be cut-off from all the services if climate change is not dealt with accordingly. Climate change does not discriminate, it affects everyone, but the writers chose the poor as a way to persuade the readers by appealing to their emotion as many readers would possibly identify themselves with poor people.

The notion that somehow language of science is non emotional was refuted by Crystal (2006, p. 23) in which it was argued that "it is the myth of science language that it can be characterized

solely as emotionless, factual, objective and stable.'' Presently, rhetoric seems to be studied as a comprehensive approach for the production of persuasive arguments as a collection of coded solutions for affective communication. The argument above demonstrates this observation.

Moreover, for rhetorical purposes making it hard for the readers to authenticate the claim of wetting and dry, the following, Figure 12, is shown in publication 10.

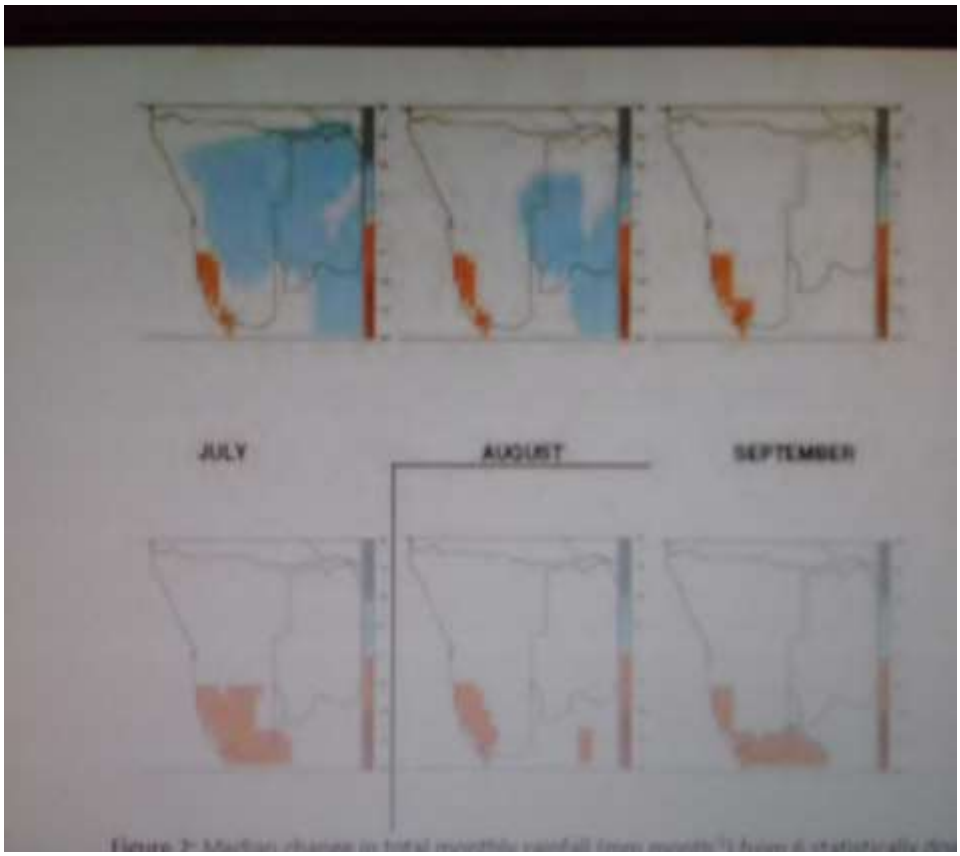

Figure 12. Wet areas and areas with no Change in Climate (Source: Zeidler, Kandjinga and David, 2008).

The areas in blue indicate wet and red indicate areas of potentially no change to climate pattern. Analytically, the information depicted in the figure seems to be ambiguous and it appears hard to authenticate the truthfulness of the shaded area. The shaded area seems to spread across the

Namibian map randomly, making it hard for the readers to authenticate the claim of wetting and dry.

Visuals and graphs analysis tend to be ambiguous when one examines the rhetorical moves embedded in the visuals. Often when there are visual arguments it is automatically assumed that arguments come through verbal discourse. It should be understood that visuals seem to be inescapably ambiguous and arguments tend to be propositional in content. As a result, visuals and graphs rhetoric tend to assert particular qualities that make the visuals to have immediate impact and concreteness that help influence acceptance equivalent to the oral rhetoric. This is perhaps what figure 2 intends to achieve. Overall, the publication concludes with propositional arguments on how best to mitigate the effect of climate change.

The eleventh publication by Dupisani (2010) entitled "Windhoek Namibia: a case study in water supply in an arid environment" described history and supply imperatives, potable reclamation, water demand management and artificial aquifer recharge.

The use of visuals and graphs are outwardly essential to climate change scientists. Scientists tend to rely on computer generated models to advance their findings on climate change. In fact, the computer-generated models are seen as technology of prophecy for climate change scientists (Schneider, 2005). Kendall (2005) argues that visuals model of climate simulations can add significant meaning to policy situations without being matters of forensic fact.

In the eleventh publication it can be observed how Dupisani (2010) arranged the pictures and graphs in a logical manner to possibly achieve influence. The author introduced the presentation [Dupisani, 2010, p. 2] by foregrounding the phrase "Windhoek drinks sewage

water" to draw attention to the presentation. Extraordinarily, the next phrase in the headline is reduced in font size – it is strategically designed to shift focus to "Windhoek drinks sewage water" rather than to "it's purified world first." The observation is in line with Tuan (2010) who argues that the main concern of rhetoric in any given context and situation has been method and the manner and also how to find the most suitable way to exhibit a thought and to change expression to fit different context.

Moreover, to further strengthen appeal to the residents of the city of Windhoek the image in Figure 13 below is presented:

Figure 13. Newspaper Headline *(*Source: Dupisani2010, p. 1)

The above headline in the presentation (image 4) was followed by rhetorical questions: "Why drink water? Why is there no choice?" Eventually the author answered the questions. Worth

noting are the rhetorical questions which seek to solicit response from the readers. By posing those questions, the presentation may have been driven by the desire to influence the audience as to why Windhoek residents are drinking "sewage water." According to Burke (1969, p. 41) rhetoric is "the use of words by human agents to form attitudes or induce actions in other agents."

Persuasively, the author's rhetorical questions were followed by the map of Africa indicating clearly the perennial rivers that exist on the continent. However, on the map of the continent Namibia is seen without many rivers in comparison to the other African countries particularly in the sub-Saharan region. The author's use of a map of Africa was probably to show the audience the potential precarious position Namibia finds herself in terms of climate change. Logically, the audience are likely to be persuaded by the lack of rivers (as demonstrated by the image in Figure 14 below) in the most of Namibia as the reason why perhaps Windhoek residents are drinking sewage water.

Figure 14. Namibia's location of the African Map (Adopted from Dupisani (2010)

To further appeal to the targeted audiences' attention, the image in Figure 15 below points to the massive demand of water the city of Windhoek had to deal with to provide sufficient portable water to the residents of the city.

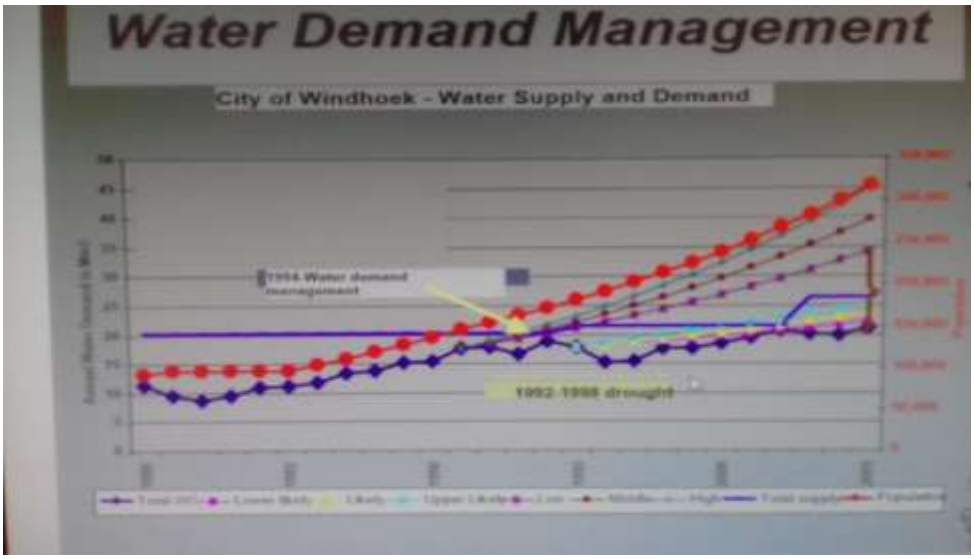

Figure 15. Water demand Management. (Adopted from Dupisani (2010)

In Figure 15, the graph indicates the enormous demand (which comes with rural urban migration) the city of Windhoek had to deal with to provide sufficient portable water to the residents of the city. Generally, graphs, charts and tables tend to be more logical in their appeal than say image or a picture. From a rhetorical point of view, it seems graphs tend to quickly catch a reader or an audience's attention than words. As such, the viewer actively transforms an image into an argumentation – as a result the viewer is likely to construct the rhetoric meant to persuade him or her. Like it is argued before most literature on visual rhetoric point to the fact that the most important rhetorical task in visual images is creating a sense of urgency.

Murphy (1994) explains that presenting visual images to audience in an analogical manner tends to create and form reasoning that functions to establish reality that any evidence shown must create "real" and urgency of the situation. Also, Kjeldsen (2011) points out that images often serve as the function of ground data or backing because they usually emerge as facts, evidence and categorical statements and thus seen as reality. Accordingly, climate change at times, requires rhetorical interpretations through an image that creates reality to arrive at possible independent solutions in order to deal with it.

Climate change, according to Hulme (2009), interacts with the human psyche and with cultural practices in less material and more imaginative ways – such as analogy through images. The human psyche as Hulme (2009) illustrated entails the discernment through which climate change knowledge is communicated and shaped, and this insight entails how the communicated scientific knowledge is received. In support, Jasanoff (2010) admitted that such perception is likely to lead to the view that climate change is an impersonal, apolitical and universal imaginary protected and projected by an image as shown in Figure 16 below;

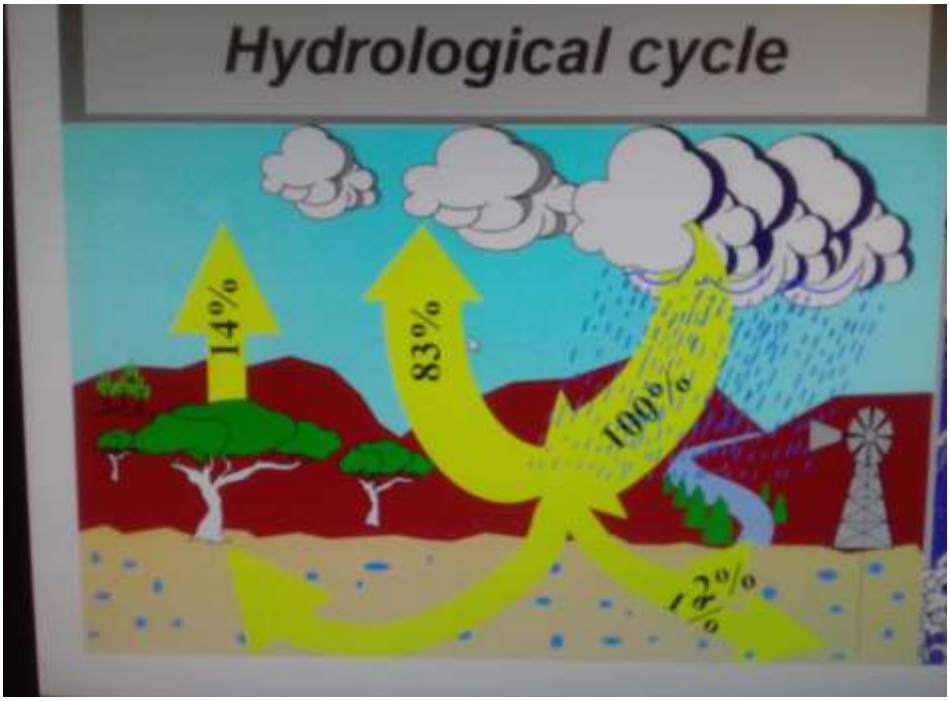

Figure 16. Hydrological Cycle (Adopted from Dupisani, 2010).

Figure 16 indicates the hydrological cycle. The image is self-explanatory – the author draws the attention of the audience to the fact that only 3% of the rainwater is retained in the ground, most of it goes back into the atmosphere. The audience are likely to see for themselves the danger of climate change in places such as Windhoek. In most cases, pictures or visuals are chosen based on the assumptions that the audience will understand and appreciate them. In this context, the hydro-cycle illustration seems to help the presenter establish common ground with his or her audience.

Another rhetorical advantage of using visual images seems to be a sense of realism images are likely to create and an impression of reality because the audience can see images and can believe the images as reality. This argument is supported by Perelman and Olbrechts (1969) who contend that the presence of images acts directly on human beings' sensibility, while at the same time noting that the presence of evidence is of paramount significance for the

technique of argumentation. For example, image in Figure 17 indicates that a dependence on surface water means mitigating the negative effect of climate change.

Image 8

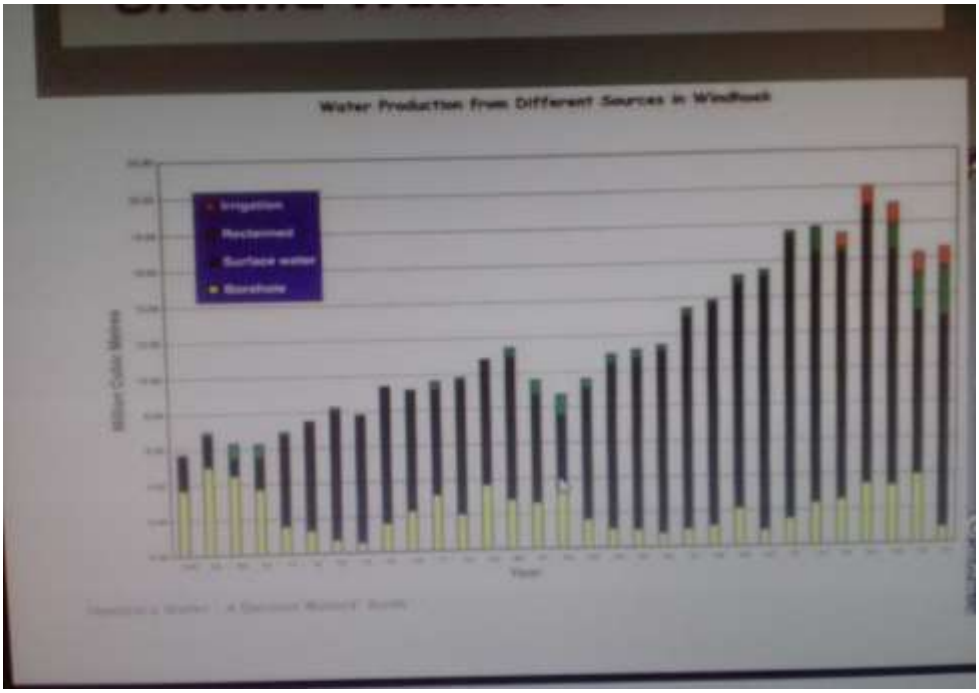

Figure 17. Means of mitigating the negative effect of climate change (Adopted from Dupisani (2010)

Image eight was intended to show the audience water production sources in Windhoek. The graph shows the reduction in borehole water availability and an increased in the use of surface water compared to the past years. The readers can see that a dependence on surface water means mitigating the negative effect of climate change. The rhetorical significance of the graph is to reveal to the readers about the danger of climate change if measures are not put in place to mitigate it.

Contextually, image eight is not presented in isolation; the graph is presented in accordance with the tenets of rhetoric. At the most fundamental level, rhetoric as viewed by Burke (2015) helps reveal different ways of representing climate change, which is critical in evaluating the

means by which this observable fact can be appreciated from different perspectives. Burke (2015) similarly argues that arguments that emanate from climate change depend on world views, which are in turn connected to power relations, which can be through graphs.

Moreover, climate change requires rhetorical visual interpretations to arrive at possible independent solutions in order to deal with it. Through images or visuals interpretation, the readers are likely to virtually interact with climate change. Hulme (2009) agrees that through visuals climate change phenomenon can interact with the human psyche. The human psyche Hulme (2009) argues entails the perception through which climate change knowledge is communicated and shaped, and this perception entails how the communicated scientific knowledge is received, particularly though an image or graph.

In conclusion, the author claimed that Windhoek has no specific plans for climate change and that all the planning decisions are based on availability of water. To avoid Windhoek running out dry, the author concludes by claiming that climate change requires attitude change. Overall the presentation seems to have achieved the desired persuasion through images. Authors and publishers seem to know that they choose visuals and graphs in their publications to advance their argument rather than just to decorate their pages.

The twelfth Publication by Lubinda (2015) entitled "Climate change: the definition, causes, effects and responses in Namibia" demonstrates the seriousness of climate change impact. The publication opens with the claim that climate change is a real and urgent challenge that is already affecting people and the environment worldwide. Lubinda (2015) further claims that significant changes are occurring on earth, including increasing temperatures, rainfall variability and rising sea levels. In its attempt to substantiate the claim, the publication

presented the graph (Figure 18 below) which indicates the link between greenhouse gases and temperature from 1850 – 2009:

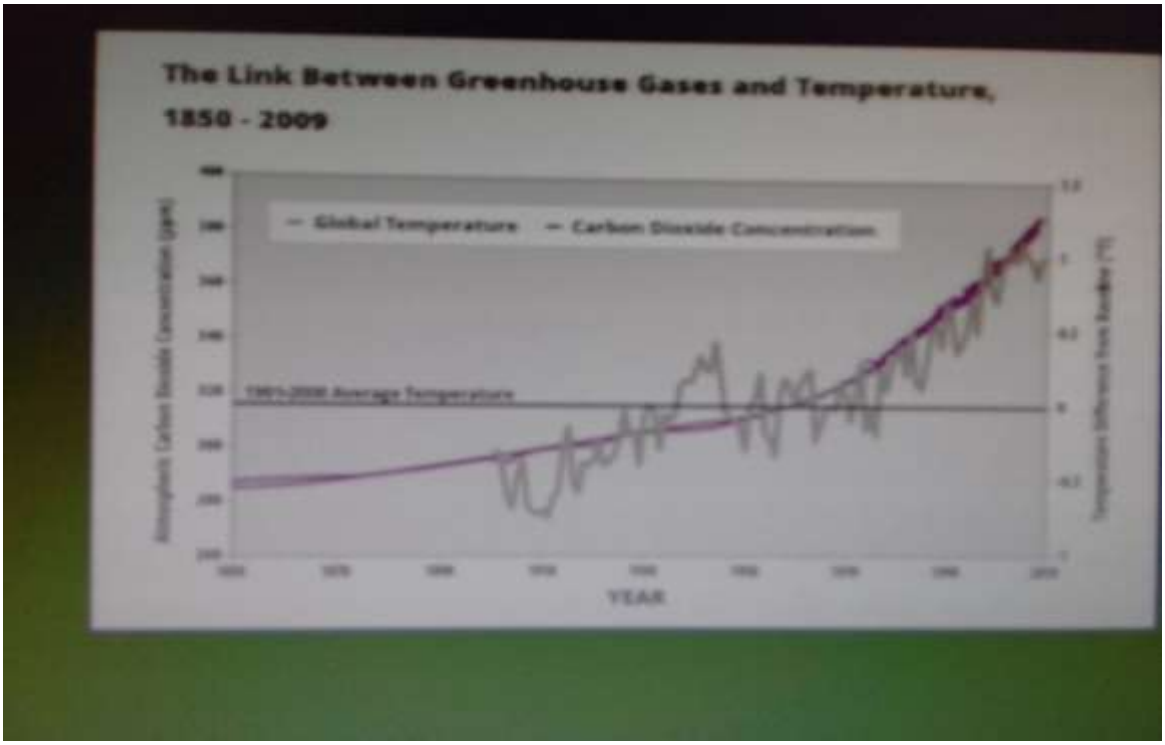

Figure 18. The link between greenhouse gases and temperature from 1850 – 2009 (Source: Carbon Dioxide Information Analysis Centre. 2010. http://cdiac.ornl.gov/and national oceanic and atmospheric administration. 2010. www.noaa.gov)

Figure 18 represents the global temperature. Often, scientists present the dynamics in the climate pattern in the form of graphs and curves without providing empirically verifiable evidence. Equally, climate change is often projected in the form of graphs, charts and other visualisations of computerised simulations. Because of these visual manipulations, some tend to disagree with the scientific findings while a good number of them maybe convinced. As a result, some readers may accept the threat of climate change as exigency and argue for and against the response to take in order to neutralise the treat of climate change.

To further illustrate how natural greenhouse effect and human enhanced greenhouse affect the climate, the publication presented two images below to show the differences in greenhouse effects. As it can be seen below that the part with human enhanced greenhouse effect is thicker and reddish in colour and represents high concentration of carbon dioxide and high temperature. It appears that the author intended to persuade the readers through images and visualisation about the danger of climate change, image 10 reflects that observation. The image in Figure 19 shows an image with two climatic visual interpretations: one natural greenhouse effect and the other human-enhanced greenhouse effect.

Figure 19. Two climatic visual interpretations: greenhouse effect & human-enhanced greenhouse effect. (Source: https:// green Friendswood- lands.files.wordpress. com/2010/03/2.jpg)

Moreover, rhetoric should be viewed as an attempt to shed light on the significance, discourse, advocacy, and a point of reference of arguments towards the truths at a particular time and space – sometimes through images. Correspondingly, rhetoric paves the way for comprehending sophisticated and complex images and graphs. Rhetoric should not be seen as empty communication as it is always viewed by most nonrhetorical scholars, rhetoric goes beyond this shallow view.

In conclusion, the publication claimed that many industrial, agricultural, mining and domestic activities depend on water resources. Because of Namibia's arid condition, the security of water supply of the country is strongly dependent on the fight against negative effects of climate change. Reluctantly, the publication concedes that considerable effort has been devoted to the

fight against climate change, but little is actually done with regard to full protection of the environment. By linking climate to agriculture, mining and other economic activities, the author seems to have intended to persuade the readers that if enough is not done on environmental protection, more jobs would be lost.

The thirteenth Publication by Kaundjua, Angula and Angombe (2012) entitled "Community perceptions of climate change and vulnerability impacts in Oshana and Ohangwena Regions" creates the connections between climate change, social and economic development, health and environmental sustainability. The Kaundjua *et al.* (2012) claim that understanding community perceptions might lead to successful adaptation to climate change.

The publication makes significant claims in its initial stage. The paper claims that the link between climate change, social and economic development, health, and environmental sustainability have somewhat become a dominant and urgent global concern. In what seems to be a pursuit to influence the readers, the publication further argues that understanding community perceptions could easily lead to triumphant adaptation to climate change. Even though the paper analyses community perceptions of climate change in selected regions in Namibia, the paper presents Figure 20 below as evidence to substantiate its claim.

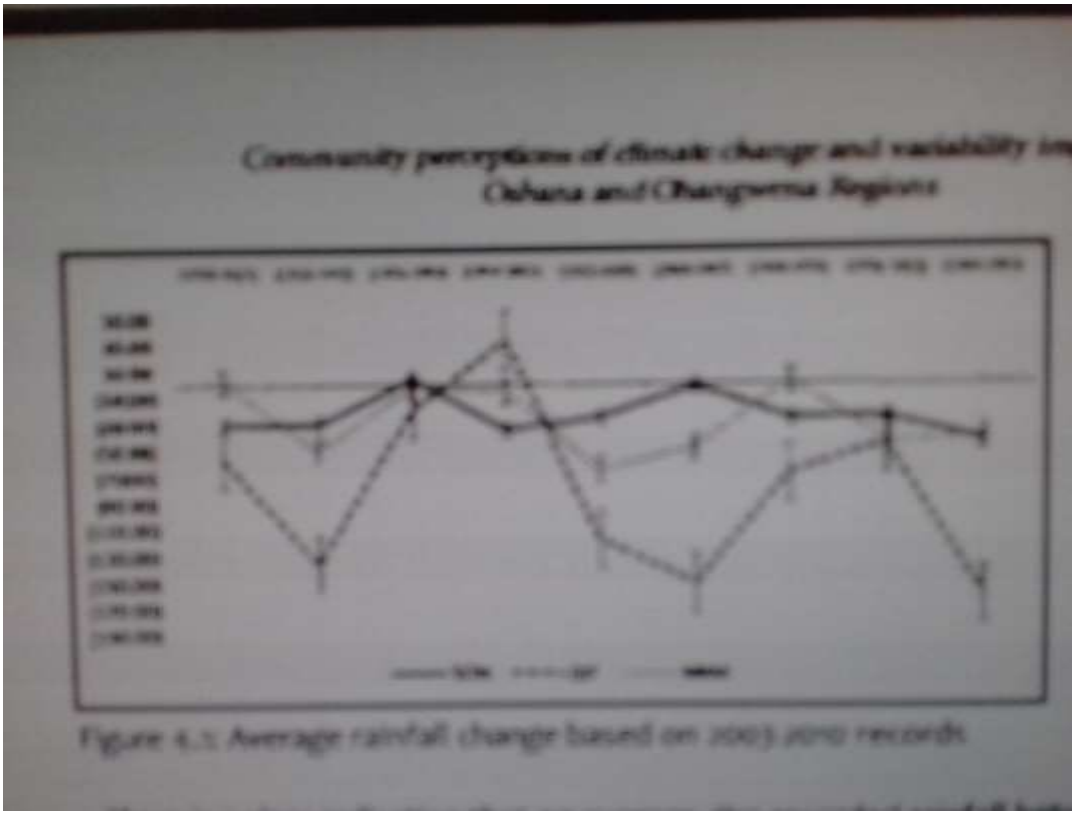

Figure 20. Average recorded rainfall between 2003 and 2010 (Source: journal for humanity and social sciences)

The graph indicates that on average the recorded rainfall between 2003 and 2010 was above an average except in 1944 – 1957 periods where the December to February rainfall exceeded with 30mm. The publication reasoned that the above description is evidence that rainfall in the last eight years was relatively high.

Moreover, the publication revealed that the communities are aware of the changing climate observed in the past three decades, but do not have adaptive capacity to respond appropriately to natural catastrophe events such as recurrent floods. In the attempt to appeal to the pathos of the readers, the publication claims that "Namibia is a semi-arid country characterised by highly variable, fragile and unpredictable climatic conditions" (Kaundjua *et al.* 2012, p. 22)

Logically, the paper tries to connect climate change to economy with the intention to influence the readers further. Kaundjua *et al.* (2012) claim further that Namibia relies on climate dependent sectors for its national economy and that over 70% of the rural population are subsistence farmers. Based on this understanding, the readers are likely to be persuaded by this above reasoning because it appears factual.

The paper concluded by strengthening its argument that the communities are aware of climate change despite the conclusion not being corroborated by the respondents. Most respondents did not provide scientifically defined climate variability, but the study generalised that the communities were aware. The conclusion did not provide evidence as to how the changes in climate have threatened food security apart from just stating livestock and crop production – as if assuming that everyone knows.

The fourteenth Publication by Angula (2016) entitled "The changing climate and human vulnerability in north-central Namibia" examines the factors contributing to subsistence farmers' vulnerability to impact of climate change. The publication further explains different aspects of human vulnerability and existing adaptation strategies to mitigate impact of climate related disasters.

The publication opens with the claim that north central Namibia is susceptible to effect of climate change and variability. Explicitly, the publication argues that combined effects of environmental degradation, social vulnerability to poverty and climate change would most likely compromise subsistence farming in north central Namibia. Also, the publication establishes credibility by making a considerable claim about climate change before presenting the images to strengthen the argument. The graph below, extracted from the publication, shows

the scope of the different types of disasters. Figure 21 intended to illustrate the argument that drought and floods are the most visible disasters of climate change.

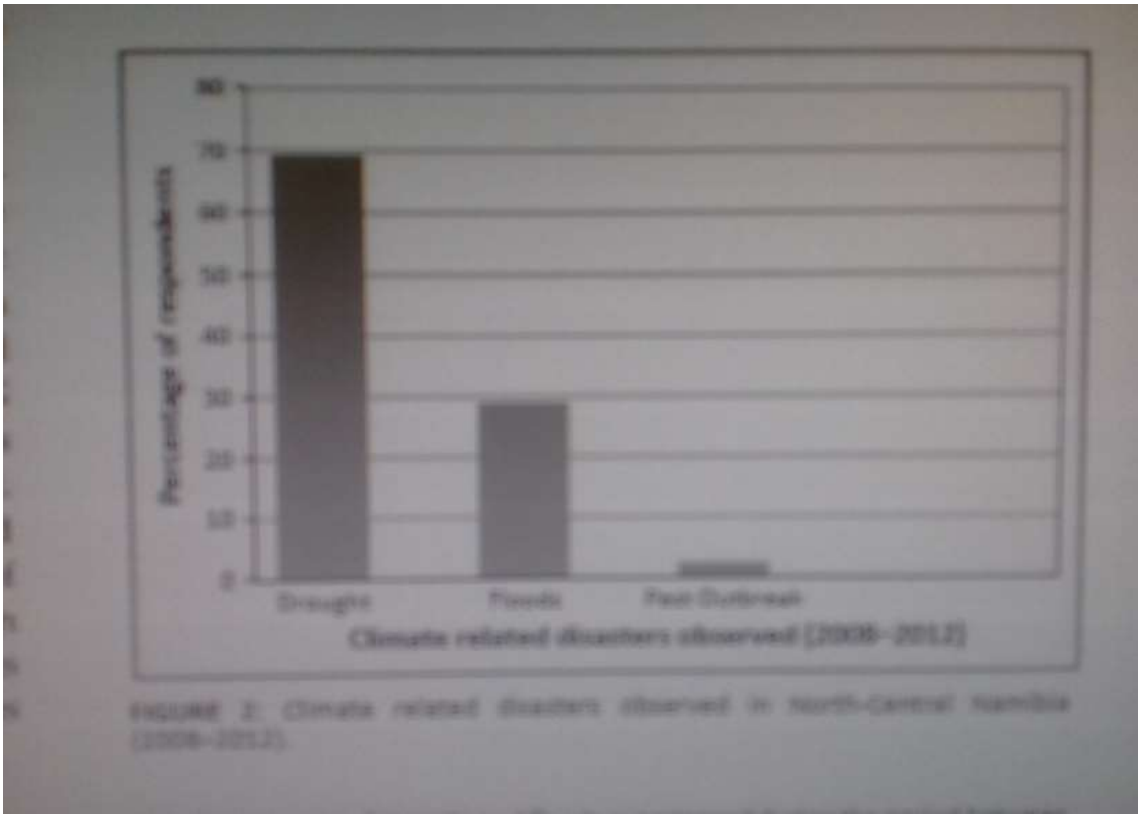

Figure 21. Climate change disasters observed since 2008 to 2012 (Adopted from http:// dx.doi.org/10.4102/jamba.v8i2.200

Figure 21 shows climate change disasters that were observed during 2008 to 2012 in Namibia. The graph indicates the danger of climate change effects – drought and flood. Unlike the 12th image which indicates danger of climate change effects the environment, image 13 below indicates exclusively the danger of flooding on human health.

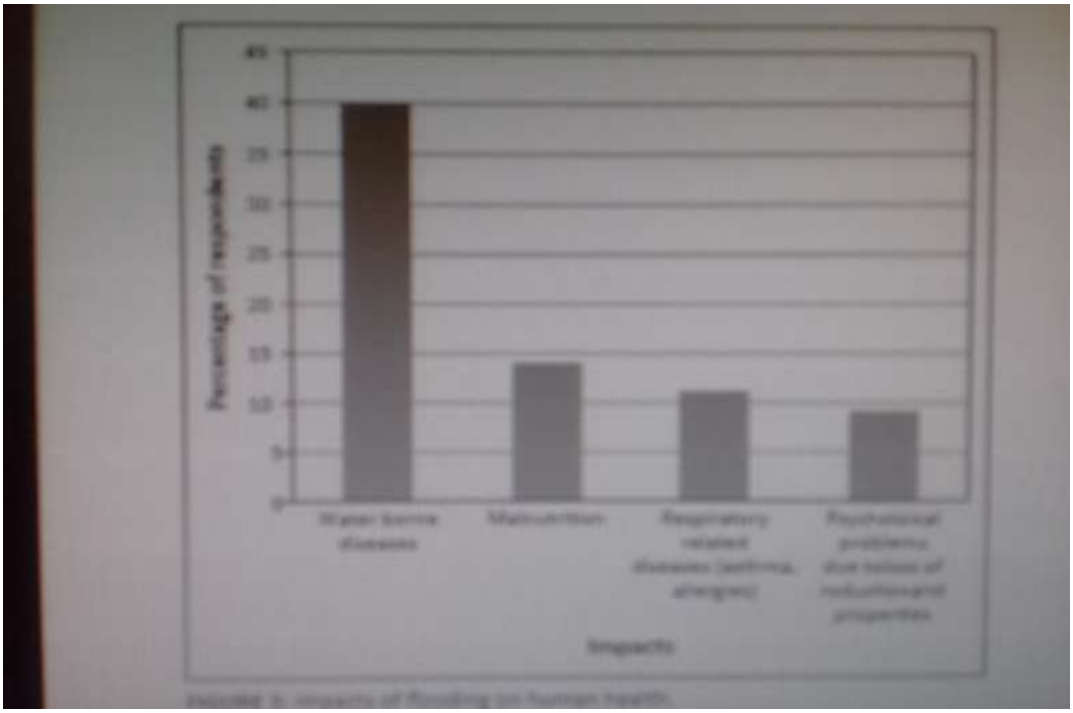

Figure 22. Impact of flooding on human health (Adopted fromhttp:// dx.doi.org/10.4102/jamba. v8i2.200

Figure 23 shows the impact of flooding on human health. The graph indicates water borne disease as the highest, malnutrition as the second highest impact of flooding. Coming in the third position and forth position respectively are respiratory related diseases (asthma, allergies) and psychological problem. Of course, the impact of flooding could have been more than what has been suggested by the graph, but the publication decided to portray only four effects as they are assumed to be the most effective in terms of persuasion.

Since the aim of the publication was to examine the factors contributing to subsistence farmers' vulnerability to impact on climate change, portraying the four elements of environmental impact on human health could be an effective strategy to persuade the readers about the danger of climate change. The publication claimed to have used qualitative and quantitative approach methodologies to obtain information from subsistence farmers in north central Namibia.

Overall, the publication seems to have achieved its intended purpose of using graphs to possibly enhance persuasion.

The fifteenth publication by De Klerk (2004) entitled “Bush encroachment in Namibia” on the other hand on its cover page opens with the picture of extreme bush encroachment condition. The author intended to catch the attention of the readers by depicting an image which portrays climate change in its extreme. Figure23 below illustrates the extreme danger of climate change.

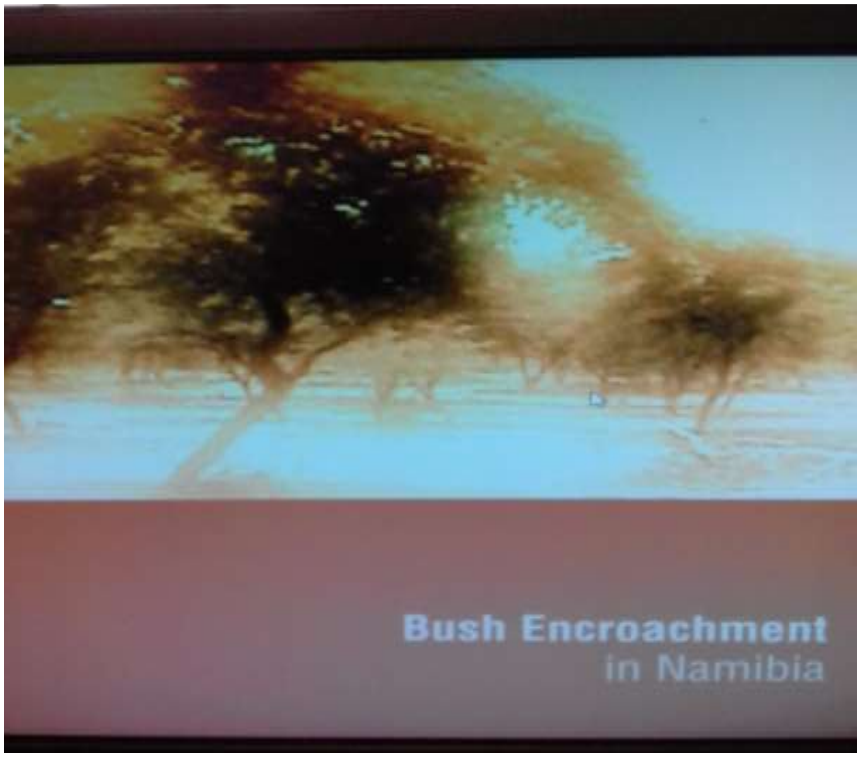

Figure 23. Bush encroachment in Namibia (Source: De Klerk, 2004)

After presenting the image depicting climate change in the extreme form, the publication claims that bush encroachment should explicitly be seen as a community and societal problem and not simply private issues for farmers. The publication also claims further that environmental problems emanating from bush encroachment should be handled as issues that farmers, government and the public need to take responsibility.

For using the economy as a bait to influence the readers about the danger of climate change, the publication argued that "a future wood industry would benefit from the establishment of a suitable institutional framework" (De Klerk, 2004, p. 16). The publication predicts further that in the long term a wood industry would likely offer vital option for sustainable solution to the problem and would likely create job opportunities for the inhabitants.

Figure 24. Wildlife affected by Climate change (Source: De Klerk, 2004)

Figure 24 shows how wildlife is affected by climate change. The publication could have chosen any other location to depict the image but has instead chosen this one. The depiction of Oryx and Kudu is likely to appeal to the largely Namibian readers. The animals depicted in the picture are some of the animals that contribute to the attraction of tourists to Namibia. Therefore, any use of the animals in the discourse about climate change has the potential to appeal to the Namibian people who are mostly dependent on the tourism sector for their livelihoods. Navigating from tourism to basing living on the climate change, the author appears

to have connected living to climate change in Figure 25 as a way to persuade policy makers to rethink the issue of climate change.

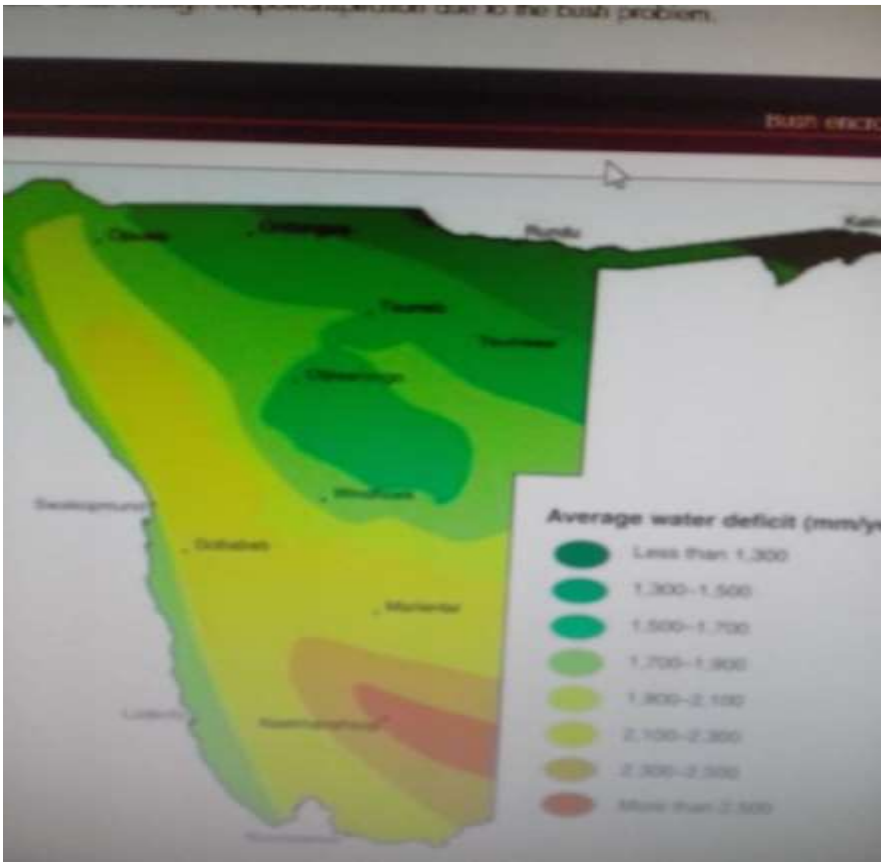

Figure 25. Average water deficit (Source: De Klerk, 2004)

The image shows average water deficit. The greener the area the more water is available and red area signifies that water is scarcely available. The image illustrates the danger most of the interior and southern part of the country is in when it comes to the availability of water in Namibia.

Finally, the publication concludes that bush encroachment is the single most important factor hampering sustainable livestock production and improved standards of living in rural areas.

Again, the publication connects living to climate change as a way to persuade policy makers to rethink the issue of climate change.

The sixteenth Publication by Nickanor and Kazembe (2015) entitled "Climate change and food security in Namibia" combines meteorological information and malnutrition reported at various health facilities in Namibia for the duration of 6 years and to examine the effects of climate change on food security. The publication opens with the claim that Namibia, like the rest of the world, is experiencing climate change. The publication's analysis relied on the global circulation models – interaction between the surface, atmosphere and the oceans to formulate projections for temperature and heavy wind regimes for the years going beyond 2050. To substantiate the claim, Nickanor and Kazembe (2015) present the following regional images as proof of rainfall and malnutrition.

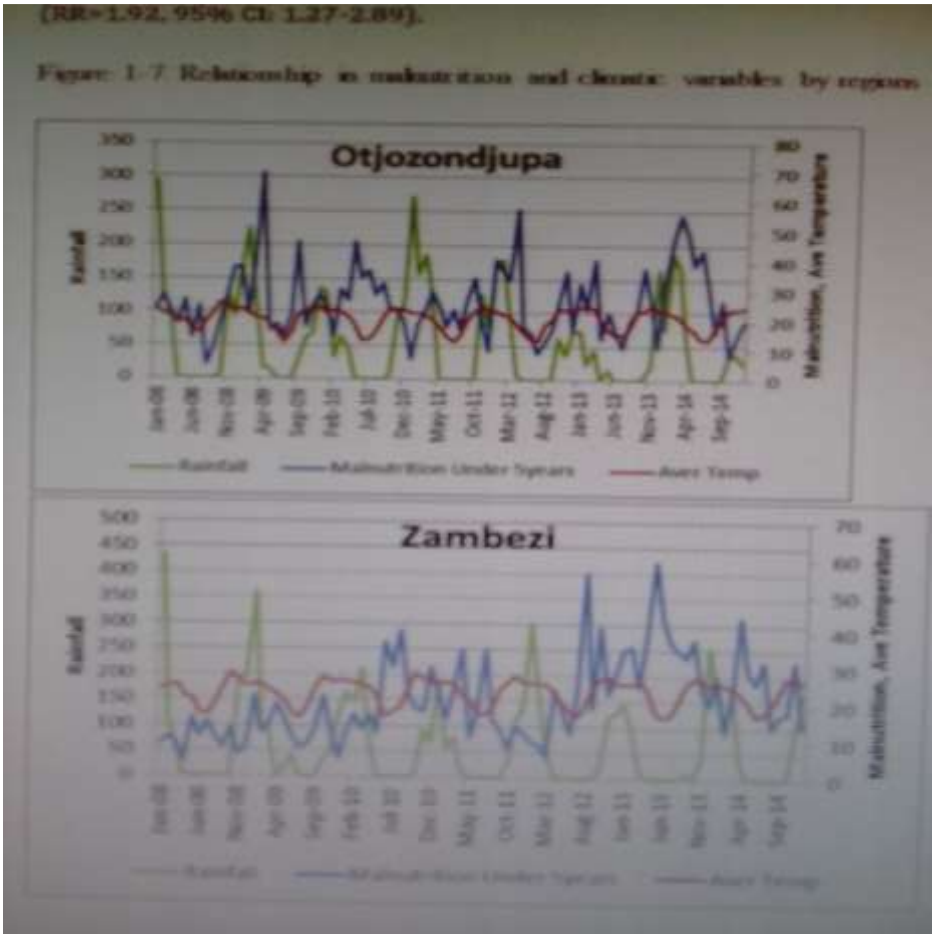

Figure 26. Connection between rainfall and malnutrition between Otjozondjupa and Zambezi regions. (Source: Nickanor and Kazembe, 2015)

Figure 26 illustrates what is believed to be the fact about the connection between rainfall and malnutrition between Otjozondjupa and Zambezi regions. In the same vein, below is another image (Figure 27) claiming to illustrate the connection between rainfall and malnutrition in different regions.

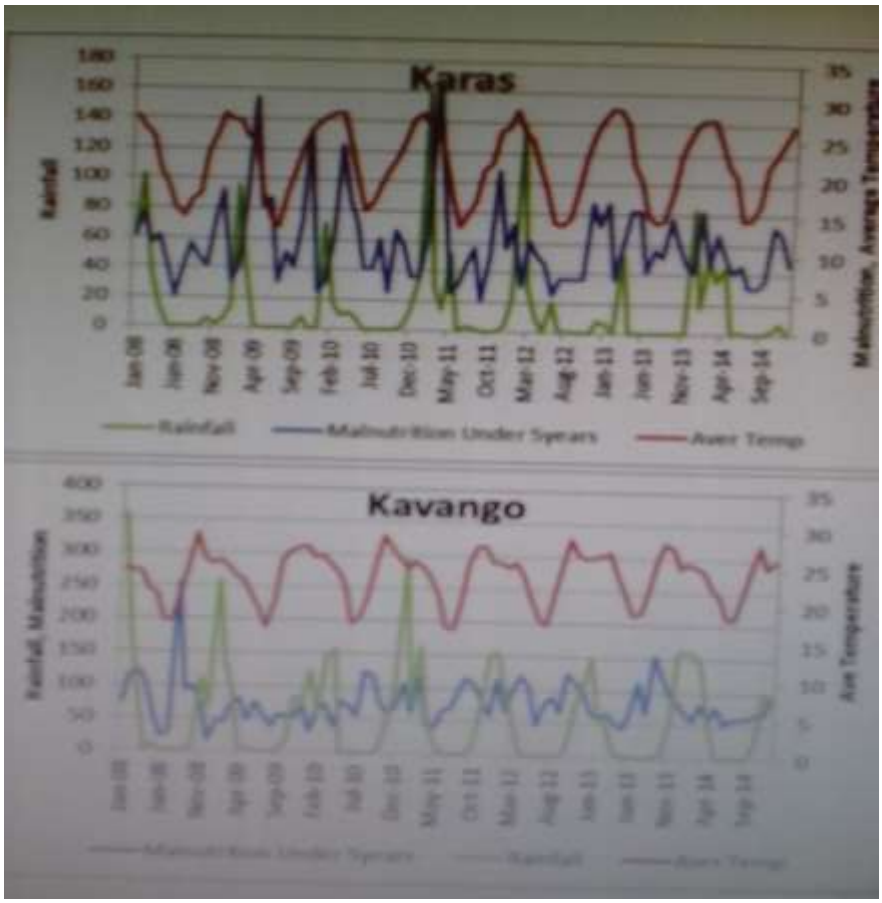

Figure 27. Connection between rainfall and malnutrition in different regions (Source: Nickanor and Kazembe, 2015)

As seen above, the publication presented the above images or graphs as proof that the impact of climate change in Namibia is already being felt. The display of the two images above was preceded by the claim that ground water recharge in different regions of Namibia has reduced and that agriculture dry-land crop productivity would be reduced as well by at least 50%. Of course, the images above paint a gloomy picture for the fragile agriculture sector which has since become a vital pillar of the economy and basis of livelihood of the majority of the people in Namibia. By linking the climate change to malnutrition, the publication may have succeeded in appealing to the readers.

Also, the rhetorical representation the above argument hold is that climate change and unpredictability continue to threaten the efforts made towards achieving hunger free world. The provided information above could equally be interpreted that the likely impact of climate change would result in an increased heat and limited rainfall and will aggravate food insecurity in areas vulnerable to hunger and malnutrition.

Nickanor and Kazembe (2015) argue that extreme weather such as drought and water shortage diminishes dietary diversity thereby changing the quantity and quality of food intake which may lead to malnutrition. From a rhetorical point of view, the publication combined meteorological data and malnutrition to explore the impact of climate change on food security out come as way to authenticate the findings and ultimately persuade the readers that the presented information is true.

In conclusion, the publication seemed to have succeeded in drawing parallel between the impact of climate change variability on food security and child malnutrition. The publication concluded that malnutrition is broadly used to monitor development and food security; therefore, the long-term implications of rising temperatures and changing rainfall patterns could spell human disaster.

The seventeenth Publication by Angula (2016) entitled, "Gender and climate change: a case study" opens with the declaration that Namibia is one of the driest countries in the sub-Saharan region and is often regarded as an arid country. Angula (2016) argues further that Namibia's climate is firmly influenced by the cold Benguela current that flows across the Atlantic Ocean. Because of the suppression of the cold currents, annual rainfall is reportedly low. As a result, the low rainfall can lead to high solar radiation as well as less humidity and high temperatures.

Thus, the amount of underground water aquifers that majority of Namibian dependent on get less than 1% replenishment.

To strengthen the argument for climate change mitigation and environmental protection, the publication presented the image below of men and women walking on dunes possibly for recreational purposes. The picture seems to be symbolically important and when tourists come to the country, they should be able to get sufficient portable water. The contrast between dark and light gives the image the dramatic effect needed to draw attention from the readers. Of course, it is known by most scholars that most images evoke an ethical appeal in order to frame climate change as a social problem by revealing that the ordinary people who at times pay a price for development do not benefit from their sacrifices.

Figure 28. Men and women walking on the dune for relaxation (Source: Nickanor and Kazembe, 2015, p.1)

Figure 28 above shows men and women walking on the dune for relaxation. The picture has the potential to appeal to the readers about the significance of environmental protection. As seen from the picture that environmental protection has economic benefits associated with it. The picture is likely to invite public participation in the debate about climate change.

The above argument concurs with what Olson and Goodnight (1994) note who argue that visual images constitute a form of oppositional argument which is uniquely capable of generating social arguments in that they seem to challenge norms of public participation, and equally widen the possibilities for deliberation. Olson and Goodnight (1994) further argue that when climate change activists employ visual image campaigns, they tend to challenge the pureness of social discourse and conventions and they do this by exploiting the means of communication taken for granted, images. As demonstrated above, climate change activists frequently use images to advocate climate change issues, but the analyses of different literature reveal that these images need to be more dramatic to get the exposure and ultimately inspire an audience who may not be initially engage with the issues.

The above argument is further supported by Scarce (1990) who claims that the more dramatic an image is; the more controversial it is and as a consequence the more publicity it gets. It should further be understood that climate change visual images of extreme activism tend to use emotional appeal to persuade the public perceptions that climate change problem is real, and the problems can be avoided if the public adopt a more traditional approach.

5.3 Develop a model for language of science interpretation

As stated before, models are tentative and, in many cases, they are provisional. Similar to stories and verbal constructs, models are constructed from a certain perspective. The model of

a motor bike may not include any inside engineering techniques needed to drive it. This is where rhetoric of science is significant. In the study models and rhetoric carried out by Heckelman and Dunn (2003) the findings are compelling. They argue that the writing component of science is deeply embedded in the language of modelling. Correspondingly, they argue that science entails brain storming, clustering and outlining as model building activities, nothing that this represent scientists' thinking. When scientists outline, it means they construct a model.

Several studies, focusing on the development of science models interpretations have been similarly carried out in the area of rhetoric of science. It has been observed that most scientific texts exhibit internal coherence structure which can easily be analysed as a tree structure of relations that bind between short segments (Reitter, 2010). Accordingly, through using rhetorical theory structure, a vector model was developed to help analyse variety of textual properties, including cue phrases, parts of speech, rhetorical context and lexical changing (Vaprik, 1995). In the vector model classifiers base their decisions on automatic knowledge acquired from sample documents. The model determines general characteristics of the samples that belong to each assigned category or relations. According to Vapnik (1995) the vector model machine analysis delivered superior results in its many applications.

Vapnik (1995) found certain factors that justify the use of vector model to analyse science texts. Vector model entails pattern recognition problem, so it is believed that it can deal with multi-class classification. Similarly, it is observed that vector model has features that are interrelated in terms of qualitative and quantitative features as it is designed to solve highly non-linear problems.

Vector model seems to be effective in dealing with large information, but it however lacks the epistemological and ontological interconnections between science and public interest. For example, the vector model classifiers make decisions on rhetorical relation by means of nuclearity (texts span nucleus). The model determines attachment preference for a text span by scoring alternative hypotheses. The model does not make philosophical provisions and pragmatic interpretations. The model is perhaps suitable for surface interpretations but seems to lack interpretation on the deeper level. Statistical analysis or rhetorical analysis is based on rule-based chart rather than ontological and epistemological perspective.

Another model which could help explain the epistemological connections between language and science is the one developed by Aristotle, the rhetorical triangle (Figure 29). This model is based on the three rhetorical appeals: ethos, pathos and logos.

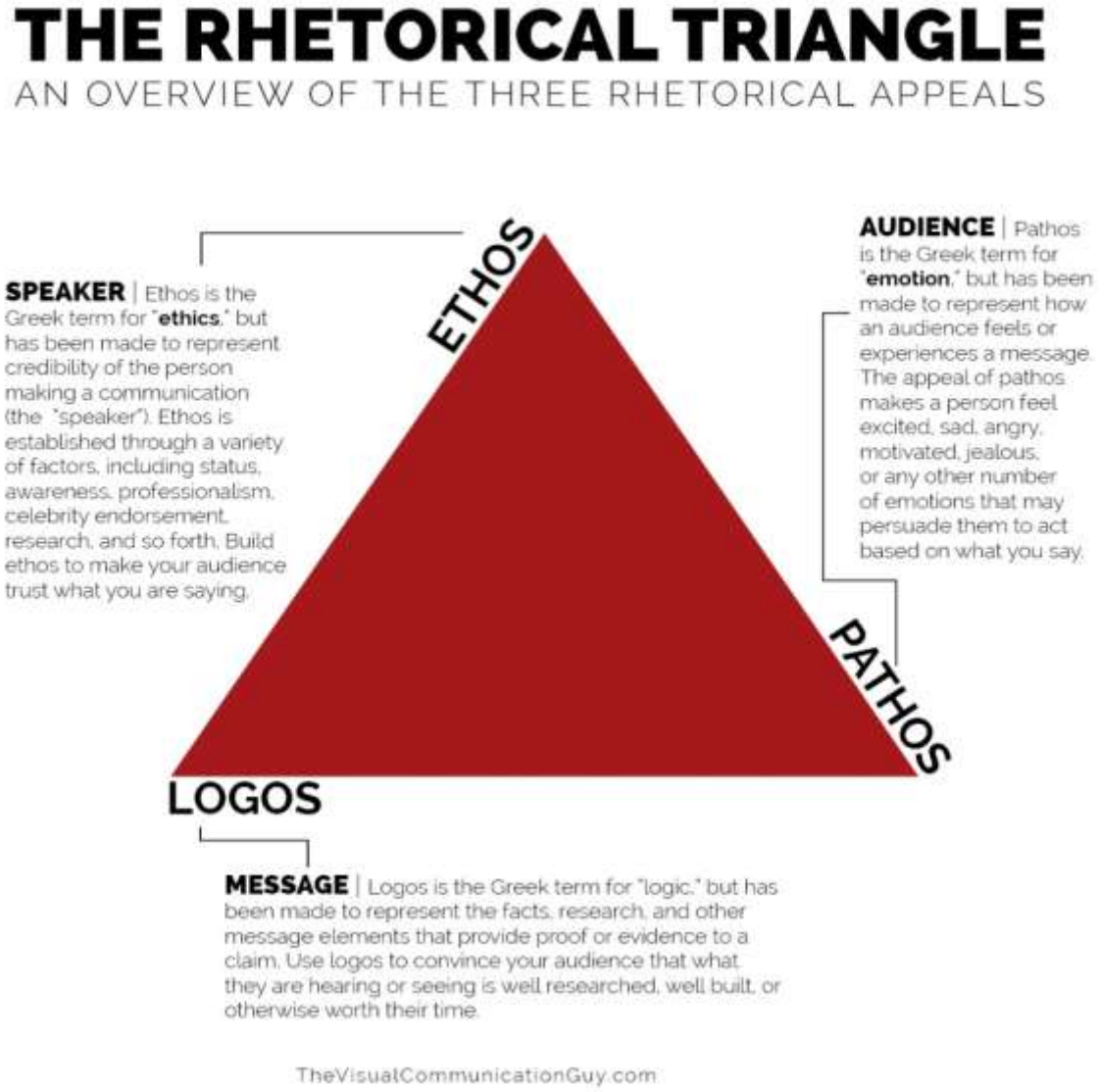

Figure 29. The Rhetorical Triangle (Adopted from thevisualcommunicationguy.com)

As seen above, the rhetorical triangle seems to be effective in explaining social issues. The model seems to lack the aspects of 'the undiscovered reality.' The model is better positioned to explain some aspects of science but not the scientificity of the whole concept of the future knowledge. It is common knowledge that ethos makes wider reference to what makes the situation credible. Scientists create communication by adopting rhetorical devices that make their communication appear credible. Needless to say, most scientists seem to know that

credibility can take over a long period of time to establish. Conversely, scientists also know that ethos can easily be damaged instantly if not jealously protected.

To build ethos, scientists rely on the usage of professional and appropriate language for their intended audience. In nutshell, scientists seem to design their communication professionally. They use a significant number of sources in their citations to create ethos and they also seem to use appropriate scientific jargons to express awareness among the readers. The above analysed chapters revealed scientists seem to follow established conventions and paradigms of science in general. By the same taken almost all the publications relied on logical connections between ideas and they seem to have avoided logical fallacies.

The triangle model encapsulates an element of logos. Just like ethos, logos according to the information on the triangle are based on building a logical argument around a situation. Various literatures in Chapter 2 and 4 revealed that scientists use statistics and other various established facts to build an argument. Scientists seem to do this by making constant reference to the research in support of their claim. Furthermore, they seem to rely on logical connections between concepts by being specific.

Pathos in science entails the use of images to wake emotions. Unlike in other areas of studies, all the analysed publications avoided using humour, emotionally charged words or place to evoke enthusiasm when communicating their findings. Despite the limited use of emotional language, science seems impossible to detach itself from images scientists use to argue their case. Rhetoric goes beyond just using emotional language and any form of argumentation intended to persuade the audience, be it emotional or otherwise is equally regarded as pathos.

Communicating scientific discourse seems a daunting task. To most scholars, communicating scientific discourse let alone climate change can be an intimidating endeavour. Some may wonder how communicating climate change differs from communicating other environmental problems, commercial challenges, risks, policy problem, and behavioural change issues. Moser (2010) even remarked that why it is that the insights from other communication experiences cannot simply be applied to climate change, asking if a separate area of scholarly attention for climate change is necessarily needed.

Perhaps apart from the institutional makeup and professional challenges, there is probably something in the nature of the climate change problem and also how human beings interact with the climate that makes it more challenging to communicate than other environmental challenges. Yieldingly, Moser (2010) reluctantly agreed that a number of challenging traits truly make climate change a difficult issue to deal with. From this remark, it can be argued that climate change perhaps requires a special communication scholarly attention; the special communication model the publication below contextualises.

The eighteenth publication entitled "Climate change counts mapping study: Namibia report" by Kotecha (2014) opens with the claim that southern Africa is one of the region's most vulnerable to the impacts of climate change. Furthermore, the publication argues that climate variability and vulnerability to extreme events such as floods and drought seems high, and this constrains food security and development. To contextualise its argument, the publication presented models to illustrate the variability and vulnerability of the climate phenomenon in order to persuade the readers.

The presented models serve the rhetorical function of persuasion. Thus, rhetoric should be viewed as an effort to elucidate on the significance discourse, advocacy, and an orientation of arguments through models towards the truths at a certain time and space. Respectively, rhetoric paves the way for understanding sophisticated and complex models of interpretations. Just because models are interpreted rhetorically, it does not mean that rhetoric is an empty communication as it is always regarded by most nonrhetorical scholars, but rhetoric goes beyond this one-dimensional understanding.

Notwithstanding the orientation to rhetoric which views rhetoric as a form of deceit, rhetoric in essence is a multifaceted term that entails multiple elements of persuasion, it does not mean that all models, visuals and arguments are meant to trick the public, or that somehow Namibians have been deceived into believing that climate change is a hoax. Certainly, rhetoric goes further than that. Rhetorical analysis of the visuals and models presented provides a platform to think through about how climate change affects everyone and how it should be dealt with, and how solutions should be sought, and how one should navigate the politics around it.

In that order, like it was argued before in Chapter 2, a climate is characterised by physical and social compositions, which demands human intervention. For that reason, the writer or the publication has presented the models as a way to persuade the public and the policy makers to work together and solve the menace of climate change. It should equally be argued that rhetoric, through the model presented, brings to the fore the knowledge that whatever is done to reduce the effect of climate change requires working together. Understanding national and international issues on climate change requires dialogue, and this dialogue is guided by networking and consensus. To substantiate the above argument, the image below in Figure 30, is presented to explain the networking phenomenon.

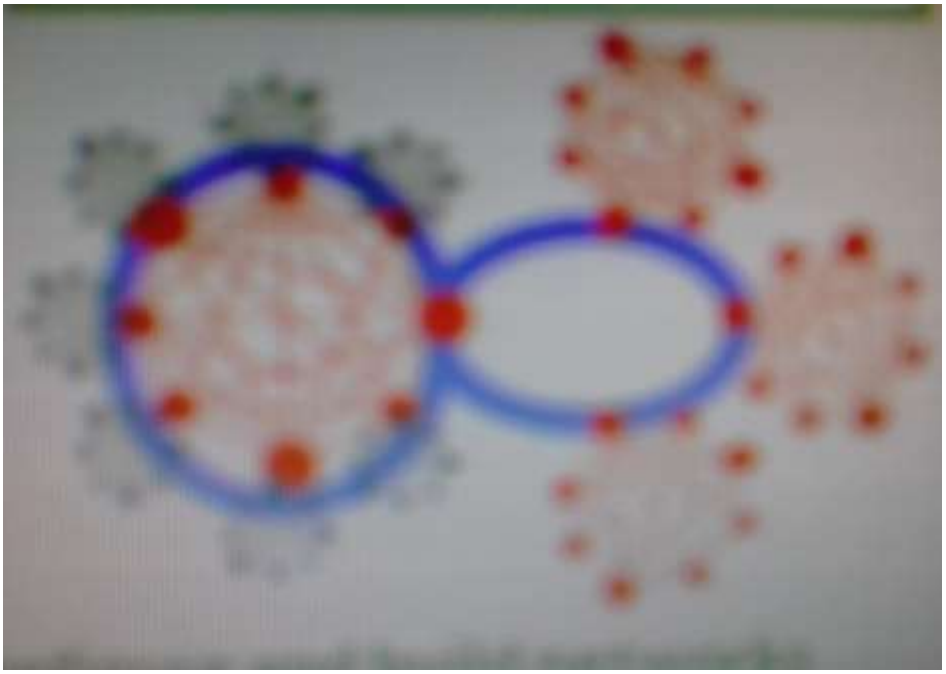

Figure 30. Programmes and actions as per knowledge co-production framework (Source: www.uaps2015.princeton.edu/papers)

Figure 30 indicates programmes and actions as per knowledge co-production framework to establish and grow collaborative networks in order to solve climate change problems. The publication seems to have achieved its goal of demonstrating to people how collaborative networks can help alleviate vulnerability.

In its quest to influence the readers, the publication again presented the climate change resilient development model to help explain some possible ways to mitigate climate change. The author of the model seems to create an impression that the presented model is fact, and as such should be implemented to mitigate climate change. The rhetorical function of the presented model is the response to the publication's claim that Namibia being in Southern Africa, the region considered as the most vulnerable to the effects of climate change, would likely experience extreme events such as flash floods, land degradation, loss of biodiversity and high drought – constrains food security and much needed development. Thus, the readers are reminded that

unless resilient measures are put in place, climate change would likely have catastrophic effects on social composition. Through this way, the public and the policy makers are persuaded to believe the model.

Fascinatingly, again HIV/AIDS and malaria are brought in the discussion as tools to convince the readers about the threat climate change poses. For example, the publication claims "Reduction of Namibia's structural poverty is further challenged by health threats such as malaria and HIV/AIDS. Climate change will compound many of these interlinked problems for national livelihoods, which are often based on subsistence agriculture" (Kotecha, 2014, p. 6). Health issues such as HIV/AIDS and malaria are foregrounded in the discussion in order to attract the attention of the readers. The two health issues are being used as rhetorical rallying points to canvass for support from the public and the policy makers alike. Equally, the country's high vulnerability to climate change is rhetorically being used to heighten the appeal to the readers and the public at large that climate change is a serious threat and ought to be dealt with as soon as possible.

In addition, by using other social challenges in the discussion about the impact of climate change, the publication intends to draw attention to the seriousness of the risks climate change is likely to pose. Also, the publication intends to persuade the public that the existing problems such as HIV (Human Immunodeficiency Virus) and AIDS (Acquired Immunodeficiency Syndrome), which are considered as serious problems in the various societal structures, could easily be exacerbated by climate change.

Broadly, the publication's use of developmental issues in the discussion about climate change could also be argued that the author wants to elevate climate change to the level where the

readers or the public should not view it as a simple environmental problem, but rather to take it as a critical developmental challenge that merit a national and international responses. Once the status has been elevated, the author could then argue that climate change has the potential to compound developmental pressures experienced by the inhabitants. To substantiate the argument above, the Kotecha (2014) presents an image in Figure 31 to explain sustainable development in the context of climate change.

Figure 31. Conceptual framework for Climate Compatible Development (Adapted from Mitchell and Maxwell, 2010)

Overall, the publication's images seem to be effective in its persuasive move. The models presented have the potential to persuade the readers as explained before.

The nineteenth Publication entitled **"**Climate change strategy and action plan" by the Ministry of Environment and Tourism (MET) (2009) claims that climate change stands out as one of the major challenges of the 21st century that threatens progress towards the achievement of national and millennium development goals (MDG) of various countries including Namibia. Furthermore, the publication contends that despite many challenges much remains broadly undisclosed as far as climate change is concerned. To all intents and purposes, the publication assumes that many people do not understand the meaning and implication of climate change.

Moreover, the publication opens with the background to the study. It claims that climate change effects are apparently predicted at global, regional and national scales and this is the publication's way to establish credibility with its potential readers. The publication highlights how susceptible Namibia is to climate change and establishes the scene for the need for climate change adaptation and mitigation. Equally, the background to the study outlines the rationale for carrying out the suggested study. This is in line with the dimension of scientific discourse in the invented dimension mentioned in Chapter 2, where it was argued that invented dimension has nothing to do with information being cooked up or made up, but the term merely refers to how scientists do not necessarily ramble on about their findings and theories but rather how they engage in coherent argumentation and presentational theatrical performance.

The performance, it was argued, entails inter alia, recognising appropriate purpose for the argument, pinpointing the exact position of departure – the writers situating themselves within existing body of knowledge, and sticking to orthodox criteria for reasonableness and usefulness, as a form of persuasion.

To further appeal to the potential readers, the publication on its cover depicts a computer-generated model that might appeal to the readers since it shows the limited green area in the northern part of the country, and the rest of the country is indicated in brown a sign that the area is dry. However, the computer-generated model can easily be manipulated. The designer can manipulate the map and turn it brown if he or she intends to persuade the readers that the vegetation is fading if nothing is done to mitigate climate change effects. Similarly, the model can be manipulated to turn the whole map into green as a way to deny climate change. Figure 32 in the image below indicates how computer-generated model can be manipulated.

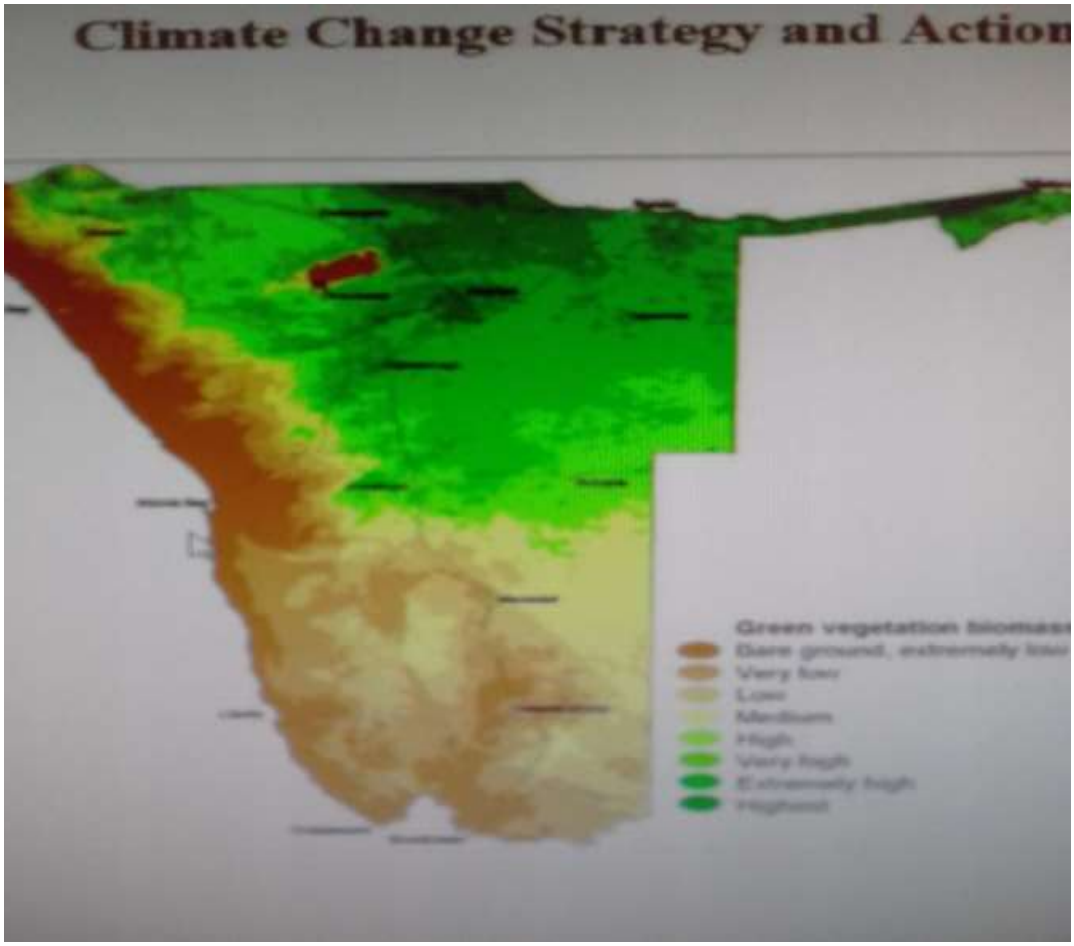

Figure 32. Manipulated computer-generated model (Source: National policy on climate change, 2010, p.1)

Often, climate change is projected in forms of graphs, charts and other visualisations of computerised simulations. At times because of these visual manipulations, some readers tend to disagree with the scientific findings while a good number of them maybe convinced. As a result, some people may accept the threat of climate change as exigency and argue for and against the response to take to neutralise the treat.

To further strengthen its logical rhetorical appeal to the readers, the author of the publication understudy appeals to the readers by reminding the public that logically Namibia's geographical location requires intervention against climate change. To substantiate the above argument, the publication reasons:

> Namibia is very vulnerable to effects of climate change due to its geographical location, variability in patterns of climate as well as due to socio-economic factors. Climate change impact predicted for Namibia will adversely affect the extent and the speed at which long term, medium and even short-term national development goals will be achieved (MET, 2009, p. 9).

The rhetorical aim of the above reasoning is to establish position and orientation from which an argument could be driven as far as persuasion is concerned. The author's claim that Namibia is "very" vulnerable is telling. Again, the rhetorical analysis of this argument points to the direction that the author is trying hard to convince the readers that Namibia cannot afford to delay further because its location dictates that action against climate change should take place now than later. As can be seen from above arguments, the arguments about climate change are mostly rhetorically constructed, and as a result can equally be deconstructed. Therefore, this is the area where authors push their agenda through persuasive means.

Rightly so, climate change is increasingly acknowledged as a threat facing human societies in the 21st century, but the manipulation of the visuals and models for convincing purposes is

compelling. What should be looked at while trying to understand this phenomenon is the way in which the conversation about climate change in a form of visuals and models, resonate in the public discourse. Extraordinarily, various researchers dealing with climate change seem to embrace more visuals and models as forms of interactional approach to science and society relations than ever before. It is almost agreed upon, like it is argued before; by various scholars that despite being shrouded by uncertainties as to its nature and manifestations, climate change is an authentic phenomenon that is likely to inevitably affect humanity in the foreseeable future, thus requires everyone's intervention.

Importantly, Vincent (2004) was very pragmatic in claiming that growing interest in climate change seems to have placed focus on the attention of inter-relationships between nature and human systems. Just like Vincent, various scholars and experts appear to concur that the rhetorical interpretations of climate using various models and visuals based on previous analogues of climate variability, seem to lack human-science connection as the focus is on manipulation of the model to achieve persuasion. Conversely, it is this kind of top down approach which brings simulation and failures to take into account the differential vulnerabilities of human populations to those environmental dangers. As a consequence, evaluating the likely impact of climate change is complex.

However, despite the above argumentation, the publication is effective in its persuasive move as it addresses the overwhelming evidence of global warming. The publication anchors its climate-related argument in the likely consequent effects of climate change on Namibia, so as to persuade Namibians or the readers that Namibia must take action against climate change.

In addition, the approach to visuals and model rhetorical interpretation appears to have come out as containing also numerous bottom-up studies of the way in which humans mediate climate change to produce impact. Surely, this area of rhetorical enquiry indeed confirms and marks one of a number of promising research areas of nature-society relations. Desolately, the development of the study seems to have been impeded, like it is stated before, by variety of paradigms and conceptual approaches, uncoordinated empirical studies and as a result lacks comparability on the broader scale of model interpretations. It is against this background that this study therefore fills an academic demand for the examination of climate change publications.

The appeal made through the model presented is seemingly used as a national strategy for climate change adaptation and mitigation and urges the public to take a necessary course of action. Through the model, the public is urged to take action that will lessen the threats from climate change and contribute to the necessity for cost efficient means of addressing climate change. The publication persuades its readers that the strategy that would be adopted would effective and should be trusted, suggesting "The national climate change strategy will be a necessary tool to facilitate climate change adaptation and mitigation to reduce its impact on socio-economic development of Namibia" (MET, 2009, p. 9).

Again, socio-economic development has been used by the author as a rallying point to drive an argument home, at the same time reminding the readers that in order to promote development and reduce poverty, the national climate change strategy should be implemented. In case the readers doubt about the authentic of the proposed national strategy to address climate change, the publication has roped in the constitution to cement its argument, insisting "This is enshrined in the constitution of Namibia and articulated in the vision 2030" (MET, 2009, p. 10).

Traditionally, climate change was viewed as a physical phenomenon that was observed, quantified and measured, and was mostly understood by scientists rather than the ordinary people. Nevertheless, Hulme (2009) observed that nations have been increasingly confronted with the observable realities of climate change and know of the repercussions that scientists claim lurking in the near future, and that climate change has turned from being a physical phenomenon to being social phenomenon, as such making it necessary for the implementation of national strategy.

Being a social phenomenon, writers who write on the subject of climate change have adapted to the situation in the manner that many write appealing their followers through social persuasive moves that resonate with the public. Since human beings have become active agents in the moulding and reshaping of physical climates the world over, using persuasive moves that appeal to the people is an effective way to persuade them to deal with climate change. Overall, the image is likely to have a significant impact on the potential readers.

Finally, in publication 20 entitled "Climate change impacts on Namibia's natural resources and economy" MacGregor (2008) presented model simulations for Namibia. The publication employs computable general equilibrium (CGE) model simulations for Namibia. Explicitly, the publication claims that climate change is likely to worsen the dry conditions already being experienced in the southern Africa, warning that when rainfall comes it would likely lead to erosion and flood damage. Remarkably, despite the early predictions the CGE model had little influence on policy makers in southern African countries (MacGregor, 2008). CGE model shown that in two decades to come, yearly losses to the Namibian economy could easily go up to more than 6% of the Gross Domestic Product (GDP). The model was seemingly used to

urge policy makers that if climate change is not mitigated, there would be serious repercussions.

The publication further reveals that poor people would be the hardest hit with possible job losses and decline in wages. Accordingly, the publication urged the policy makers to take measures that mitigate climate change. It can clearly be sensed that the model was probably meant to speed up the process of persuasion as the designer could effortlessly manipulate the model to suit the agenda of the publication, that of urging people to take drastic measures to curb climate change. Finally, the publication seems to have achieved its purpose of persuading the readers about the possible danger of climate change.

As seen from the arguments above, climate change computer generated models have the potential to carry meanings that are persuasive as they can simply be manipulated to suit the intention of the author. The rhetorical function of the computer-generated model is to convince the public to treat the model as a fact about climate change. If these computer-generated models are anything to go by, climate change appears to be changing our objective worlds and also altering the social world of things through the manipulation of the models. Therefore, computer-generated models too require meticulous rhetorical interpretations to arrive at possible independent solutions in order to deal with it.

In conclusion, Chapter 5 has set the scene for the research discussion under the theme: interpretation of the rhetorical effect of visuals used in the selected science publication. By the same token, this chapter has highlighted the wider rhetorical devices relevance for the contextual and visual analysis of rhetoric of science. Scientific persuasions through visuals and models used in science writing on climate change publications have been explored. The chapter

further underscored rhetorical tactics and devices employed by various writers, these included rhetorical background, comparison, evaluation and explanation of visuals and models. Moreover, the chapter dealt with the analysis of interpretation of the rhetorical effects of visuals used in the selected climate change science publications.

The above conclusion is in line with Wright and Mann (2013) who argue that rhetorical analysis is essential for examining and drawing attention to climate change as a socially and politically constructed phenomenon, closely intertwined with the ideological assumptions underpinning collective sense-making processes, be it in text or visuals. Rhetorical analysis of visuals and models appears to become increasingly significant to understanding how science publications use rhetoric to win the hearts and minds of its followers.

As a whole, rhetorical analysis of visuals and models of climate change can serve as a sign that visuals and models can be represented through the manipulative models of choice made by the author, without necessarily relying on the text. Befitting, rhetorical analysis of visuals and models also help uncover authority within the presented models, and that authority can be used to the advantage of the publication to argue for a point of view. From this vantage point, rhetorical analysis techniques of visuals and model have the potential to reveal wide range access to interpretational discourse as a way to persuade the public.

Thus, climate graphs and visuals raise interesting questions for rhetoricians of climate change science scholars; this is so because the authenticity of data based on speculation and estimation tend to be confusing and often results into questionable data in most models. From this observation it can be argued that climate writers have to deal with their personal ethos and professional ethos to produce graphs and visuals that are accurate for public use. Furthermore,

authors who produce these graphs and visuals, according Walsh (2010), some of them belong to political parties. It is this political involvement that tends to lead to the discrediting of their scientific findings. Finally, this chapter concluded with the analysis of the models developed and discussed by various scholars.

5. 4 Conclusions

The chapter presented interpretation of the rhetorical effect of visuals used in the selected science publications on climate change and the development of various models for language of science interpretation. It set the scene and provided the visual overview analysis of the publications under this chapter. The chapter began with the analysis of rhetorical visuals of the selected science publications and it concluded with the analysis of the models developed and discussed by various scholars. It also analysed rhetorical devices that have been embedded within those visuals and models employed by various authors.

CHAPTER 6: CONCLUSIONS

6.1 Introduction

This chapter concludes the present study. The chapter draws the major findings in relation to the study's objectives which broadly entail an overview of the summary of the main arguments of the discussion in Chapter 1, 2, 3, and 4. Hence, the study revealed how the thesis answered the research objectives. Accordingly, Chapter 6 examined the following: the methodology used to answer the research objectives, the importance of the study from a scientific perspective, contribution to a body of knowledge and study discipline, implications of the findings for theory development and suggestion for future research. Also, the limitation and delimitation of the study were looked at in this chapter.

6.2 The main findings of the study

The present study was guided by three research objectives, namely to:

1) Analyse scientific persuasion and how language forms are used in the selected academic science publications;
2) Interpret the rhetorical effect of visuals used in the selected science publications; and
3) Develop a model for language of science interpretation for environmental policy makers and the general populace for easy understanding of scientific discourse.

Drawing from the scientific analysis, research objective one was thoroughly marshalled in Chapter 2 and 4. Equally, the same chapters addressed objective two. However, research objective three was addressed in Chapter 4. Explicitly, research objective one broadly explored scientific persuasion and how language forms were used in the selected academic science publications. Research objective two similarly explored and interpreted the rhetorical effect of

visuals used in the selected science publications. Lastly, objective three was presented in a form of a new model in Chapter 5.

Scientific persuasion entails the use of language of science. Richards, Platt, and Webber (1985, p. 159) define language of science as "language used for particular and restricted types of communication, containing lexical, grammar and other linguistics features which are different from ordinary language." Often, it is argued that language of science is made up of informative texts, and the texts dominant appeal form is logos as the sender needs to persuade the receiver that the texts presents a credible picture of subject matter (Helder, 2001). Bhatia (2002) similarly observed that to reach communicative goals, reasonable and considerable changes to the language of science use have been significantly introduced.

To use Gross' (1993) argument on rhetoric, it can be concluded that facts alone presented by the publications under the study mean nothing; only statements mean something. As such, the fact that language was used to present those statements, it became increasingly difficult to separate persuasion from the intended objectivities of the publications under study.

The findings demonstrated the dynamic context and helped unravel the scientific claims that science is objective and thus detached from human persuasion. The fact that language was used to convey scientific findings represented a challenge for scientists to be non-persuasive. Throughout Chapter 2, it was argued that texts are set of words that have no inherent meaning or connection to the objective world of things; as such interpretation of the climate findings was also uncertain.

It can be concluded that different rhetorical moves and strategies were used by the authors of the analysed documents, to try and influence policy makers and the public. Furthermore, for the publications on climate change in Namibia to resonate well in the public discourse on climate change, the public and environmental policy makers must trust those who are trying to convince them, as such rhetoric was central to the conveyance of the message throughout the discussion in Chapter 4 and 5. By the same token, exaggeration was also observed.

The authors tried to exaggerate certain climatic situations in order to drum up support for their findings. Rhetoric played a significant role in the reconstruction of knowledge and moral order within the confines of this science publications understudy. It was observed throughout the discussion in Chapters 2 and 4 how scientists ontologically perceive reality and truth, and how they process that reality and truth to become knowledge that the public and policy makers must trust and believe. The use of scare tactics in the central part of Namibia can be viewed as a way of to drum up support for climate change as water has become a sensitive topic in the Khomas Region.

As such, appealing to pathos of the inhabitants in that part of the country evokes emotion and drum up support for the cause. Since the study was aimed to respond to the three objectives: one of which was how language forms were used in the selected academic science publications, the study explored in Chapter 2 and 3 how the language forms are used by the scientists to try and persuade their sceptical peers.

Moreover, the study revealed the presence of language forms that seem to rely on perpetual persuasive techniques in order to persuade the current and future generations. The language forms were designed to accommodate posterity.

To answer second objective, it should be explained that most visual images and graphs that accompanied written arguments served certain functions: it appealed to pathos and clarified numerical data, in the case of graphs. In the present study the focus was on an appeal to emotions through images and graphs. Apart from using visual images and graphs to appeal to the emotions of the audience, images of threat were also used to persuade the audience of the visuals, some visuals and graphs used in the science publications on climate change entailed emotional appeal, flattery and threat.

The above argument concurs with what Olson and Goodnight (1994) noted when they argued that visual images constitute a form of oppositional argument which is uniquely capable of generating social arguments in that they seem to challenge norms of public participation, and equally widen the possibilities for deliberation. Olson and Goodnight (1994) argue that when climate change activists employ visual image campaigns, they tend to challenge the pureness of social discourse and conventions and they do this by exploiting the means of communication taken for granted, images. As demonstrated above, climate change activists frequently use images to advocate climate change issues, but the analyses of Chapter 2 and 4 revealed that images needed to be more dramatic to get the exposure and ultimately inspire an audience who may not be initially engaged with the issues.

The above argument agrees with the earlier argument by Scarce (1990) who claims that the more dramatic an image is, the more controversial it is, and as a consequence the more publicity it gets. It should further be understood that climate change visual images of extreme activism tend to use emotional appeal to persuade the public perceptions that climate change problem is real, and the problems can be avoided if the public adopt a more traditional approach. The analysed publications revealed how writers use visual images in a dramatic fashion to appeal

to their peers, followers and general public. The analysed images were dramatically presented to heighten the effects of persuasion.

To respond to objective three, numerous studies in Chapter 5 focused on the development of science model interpretations in the area of rhetoric of science. Accordingly, through rhetorical analysis a model below was developed to help explain the language of science on climate change because in the present study it was found that both deficit model and contextual model discussed in Chapter 2 lack provisions for natural and political space for manoeuvres as models tend to be time bound.

The study revealed further that models discussed in Chapter 2 and 5 seem to be effective in dealing with large information, but they lack the epistemological and ontological interconnections between science and public interest. For example, the vector model classifiers made decisions on rhetorical relation by means of nuclearity (texts span nucleus). The model determined attachment preference for a text span by scoring alternate hypotheses. However, the model did not make philosophical provisions and pragmatic interpretations between science and the public. The discussed models were rule-based and suitable for surface interpretations, but they lacked interpretations on the deeper levels.

The study resulted in the development of the new model (Figure 33) of the language of science interpretations.

6.3 New language filter model of science interpretations

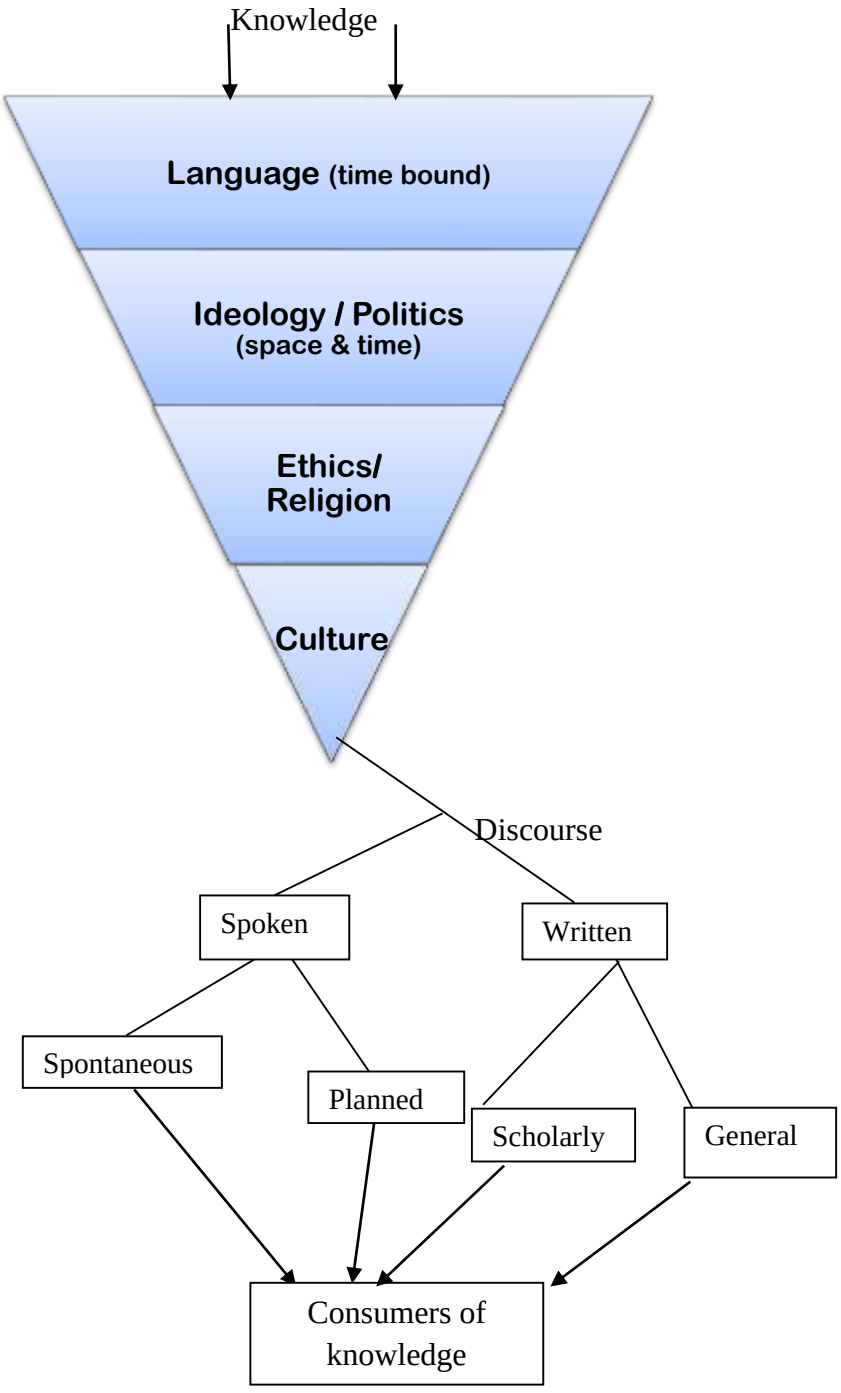

Figure 33. New language filter model of science interpretations

The language filter model of science interpretations shows that knowledge exists in space and time. Debatably, there was no language before the existence of the first human being. From a relative obscurity, it seems language was possibly developed by human beings who may have existed in time. The human beings might have used the language to interpret knowledge and perceptions. As argued before, language rests on unstable symbols of meaning, written and spoken forms. As such, the truth can be revealed through spoken or written form, compromising objectivity.

The language filter model of science interpretations is intended to demystify the language of science. It shows how knowledge as perceived by scientists goes through different stages before it reaches the consumers of that knowledge. Subsequently, the perceived knowledge goes through the language interpretation and in the process the language is affected by time. For example, a certain language can be used to interpret that perceived knowledge but later that language dies (Latin – as an example). Of course, it is common knowledge that language derives its meanings from social context within the period of time of usage and as such interpretation is also based on social contexts. The social contexts are likely to be limited to time when the language is still in use. Inadvertently, when one uses another language to interpret the perceived knowledge, social contexts and culture of that language would most certainly have profound impact on the interpretation of that knowledge.

Moreover, after going through language interpretation the perceived knowledge goes through an ideological or political interpretation. For example, the issue of climate change (knowledge) seem to play out along party lines. A case in particular is an American scope for explaining how views about the reality of climate change are seriously affected by one's political and ideological views (Hamilton, 2011 and Dunlap, 2011). The two parties, Democrats and

Republicans, both self-reported the understanding of climate change and their reports demonstrated an increase in concern about climate change for the Democrats, but a little concern for the republicans (Dunlap, 2011).

The model further shows how the perceived knowledge goes from ideological/ political interpretation to ethics and religion. To contextualise the above information in a philosophical fashion, one is tempted to argue that what we know of the world today is that it exists of a developing set of human understandings and partial cooperation. The world appears to entail a considerable number of conflicting interpretations of reality. We know for a fact that a bad conflicting reality creates problems for the people who duly have rested interests in some interpretations over the other. Thus "each society evolves a body of rules by which one version of reality may be legitimated and the other competing versions desecrated'' (Wander, 2009, p.226).

Wander (2009) postulates that there was a moment in time when religion viewed reality or knowledge and secured the principle rules for its validation through God on earth and via interpretation of the holy bible. So, any views that were seen as opposing the bible were viewed as an abomination or disrespecting to the living God. Equally, science today has its own reality: any opposing views that do not conform to standardisation, compartmentalisation and systematicity are viewed as unscientific. Therefore, religion plays a significant role in the interpretation of the perceived knowledge.

Culturally, any knowledge perceived by the scientists has to go through a sieve. As argued before, climate change entrance into public discourse or domain is an open secret for most scholars such as Gross (1993), Hulme (2009) and Pera (1994). Traditionally, climate change

was viewed as a physical phenomenon that was observed, quantified and measured, and was mostly only understood by scientists (Hulme, 2009). Hulme (2009) observes that nations have been increasingly been confronted with the observable realities of climate change and know of the repercussions that scientists claim lurking in the future and that climate change has turned from being a physical phenomenon to being social phenomenon.

Regardless of how scrupulous scientists can be in describing the observable elements of phenomena, cultural meanings and cultural bias are likely to subvert the aim of objectivity. This is learned from social sciences that human beings are fallible and so does the language they employ. Because of the above challenges, it becomes increasingly complex for scientists to rule out biases even from the conceptual stage of their investigation. The production of scientific knowledge, therefore, rests on the notion that knowledge becomes accepted by the public as a reasonable interpretation of what transpires in Nature.

As seen from the arguments above, climate change has the potential to carry different meanings and it implies different courses of action, depending on the various vantage points one stands. For Aristotle, it was more of an oral culture and male culture to see the available means of persuasion ubiquitously in each case, and effectively utilise those means with the desire of reinforcing conviction and deed.

Thus far, the present study looked at what rhetoric is and how it is moulded through the discussion about climate change. Equally the present study demonstrated the significance of rhetoric and how rhetoric functions in the analysis of climate change publications in Namibia. Furthermore, the analysis of the texts in Chapter 2, 4 and 5 revealed that the premise of discussions and argumentations set the agenda on climate change.

Moreover, the analysed publications demonstrated connections and relationship of ideas and knowledge about climate change. For example, an increase in atmospheric pressure and temperature are connected to climate change, which in turn is connected to human activities. Similarly, the analysed publications appeared to have changed the world view of the readers through the manipulations of data, particularly the visuals and models in Chapter 4 and 5 respectively.

Finally, the present study underscored the value of the qualitative method approach adopted in enabling an in-depth understanding of the scientific and dynamic context of climate change in Namibia. The flexibility of the qualitative methodology made it effortless to interpret documents and draw conclusions, thereby adding to the value of the data collected. The exploratory nature of the study allowed this writer to infer meanings and draw conclusions. In consequence, the qualitative approach provided a wider understanding of the dynamic of climate change phenomena in Namibia. Apart from contributing to the broader debates on climate change, this present study contributed knowledge to practical gap in qualitative approach on the interpretation of documents.

6.7 Recommendations

This section recommends areas of rhetoric of science that requires further interrogations. The present study demonstrated how the analysed publications used rhetoric in their writings, but the analysed publications lacked the model which explains and connects the existing knowledge of science and the unknown or undiscovered knowledge. Findings by various authors lacked an insight understanding of a rhetorical representation of the 'unknown knowledge.'

The above situation could be attributed to the rhetoricians for either being apprehensive or hesitant to explain further about the rhetoric of predictions in science which climate change seems to be characterised with. Studies carried out by various scientists in Chapter 2 and 4 focused on the physical nature of science but not on the language of science on weather prediction. Despite this present study's effort to develop a model to demystify the language of science interpretation through various stages of interpretations, the rhetoric of predictions on climate change studies still requires further interrogations. More studies on the rhetoric of climate change predictions should be carried out.

Moreover, given the seemingly inability for countries to cooperate on what to do to mitigate climate change and the fact that politics plays role in many studies on climate change, the issue that should be tackled should be exploring and examining arguments scientists are making to determine non-bias truth. More studies should be devoted into developing tools for non-bias truth in the language of science interpretations.

Since human beings have become active agents in the moulding and reshaping of physical climates the world over, while at the same time absorbing cultural, political, social and ethical practices in reinterpreting what climate change is, studies should be carried out to provide clear understanding on the rhetoric of climate change.

REFERENCES

Ali, A. (1996). *Fundamentals of Research in Education*. Anambra State: Meks Publishers.

Angula, M. (2016). *Gender and climate change: A case study*. Cape Town: Heinrich Boll Foundation.

Aucamp, P. J. (2010). *Environmental impact assessment: A practical guide for the discerning practitioner*. Pretoria: Van Schaik Publisher.

Audigier, J. Y. (1991). *Connections*. New York: Lanham Ltd.

Augustinos, M., & Callaghan, P. (2013). Reified versus consensual knowledge as rhetorical resources for debating climate change. *Revue Internationale de Psychologie Sociale, 26*(3), 11-38.

Barnes, J., Macgregor, J., & Alberts, M. (September 2012). Expected climate change impacts on land and natural resource use in Namibia: Exploring economically efficient responses. *22,* Retrieved from: https://doi.org/10.1186/2041-7136-2-22

Bazerman, C. (1988). *Shaping written knowledge: the genre and activity of the experimental article in science.* Madison: University of Wisconsin Press.

Beck, U., Anthony, G., & Scott, L. (1994). *Reflexive modernisation: Politics, tradition and aesthetics in the modern social order*. Stanford: Stanford University Press.

Behrendt, H. (Ed). (2001). *Research in science education: Past, present and future.* Amsterdam: Kluwe.

Bhatia, V. K. (2002). Applied genre analysis: A multi perspective model. *Iberica, 4*(3), 3–19.

Bitzer, L. (1968). The rhetorical situation. *Journal of Philosophy and rhetorical, 1*(1), 1-14.

Bizzel, P., & Herzberg, B. (2001). *Rhetorical tradition: Readings from classical times to the present*. Boston: Bedford.

Blackstone, E. H. (2004). Let the data speak for themselves? Retrieved on the 8th of August 2018 from www.ncbi.nlm.nih.gov/pubmed

Brinton, L., J. (1996). *Pragmatic markers in English: Grammaticalization and discourse functions*. Berlin: Walter de Gruyter.

Brown, O., Hammill, A., & Mcleman, R. (2007). *Climate change as the new security threat: Implications for Africa.* New York: Blackwell Publishing Ltd.

Brown, R. (2004). *Reason, politics, and the politics of truth: How science is both autonomous and dependent*. Cambridge: Cambridge University Press.

Bulhof, I. (1992). *The language of science of science: A study of the relationship between literature and science*. Brill: Leiden Ltd.

Bulkeley, H., & Betsill, M.M. (2005). Cities *and climate change, urban sustainability and global environment governance*. London: Routledge.

Burke, B. (2015). What environmental discourse analysis reveals about efforts to address urbanization and climate change. *Human Organization*, *74*(1), 185–196.

Burke, K. (1966). *Language and symbolic action.* Berkeley, CA: University of California Press.

Ceccarelli, L. (2001). *Shaping science with rhetoric: The cases of Dobzhansky, Schrödinger, and Wilson.* Chicago: University of Chicago Press.

Ceccarelli, L. (2011). Manufactured scientific controversy: science, rhetoric, and public debate. *Rhetoric and Public Affairs*, *14*(2), 195–228.

Ceccarelli, L. (2017). *Defending science: How the art of rhetoric can help*. Washington: University of Washington Press.

Chang, Y. (2012). Rhetorical functions and structural patterns of analogy. *Theory and Practice in Language Studies, 2*(12), 2587 – 2592.

Christensen, J. H. (2007). *Climate change: The physical science basis*. Cambridge: Cambridge University Press.

Clark, U., &, Zyngier, S. (2003). Toward pedagogical stylistics. *Language & Literature, 12*(4),339–351.

Colleran, J. M. (1988). *The dissenting writers in South Africa: A rhetorical analysis of the drama of Athol Fugard and short stories of Nadine Godimer.* (Unpublished doctoral thesis), Ohio State University, Ohio.

Cope, M. (2010). *Coding transcripts and diaries*. London: Sage Press.

Cox, R. (2006). *Environmental communication and the public sphere*. Oaks: Sage Publications.

Crystal, D. (2006). *Language and the Internet*. New York: Cambridge University Press.

Daughton, A. M. (2016). *Modern rhetorical criticism* (3rd ed.). London: Routledge.

Davies, S. R. (2008). Constructing communication: Talking to scientists about talking to the public. *Science Communication, 29*(4). 413-434.

Davison, J. (2007). *Rhetoric, repetition, reporting and the "dot.com" era: words, pictures, intangibles*. Egham: University of London Press.

De Klerk, J.N. (2004). *Bush encroachment in Namibia*. Windhoek: John Meinert Printing.

Delicath, J., & DeLuca, K. (2003). *Image events, the public sphere, and argumentative practice: the case of radical environmental groups*. New York: Guilford Press.

DeLuca, K. (1999). *Image politics: The new rhetoric of environmental activism*. New York: Guilford Press.

Doyle, J. (2007). Picturing the climatic: Greenpeace and the representational politics of climate change communication. *Science as Culture, 16*(2), 129–150.

DuPisani, P. (2010). Windhoek Namibia: a case study in water supply in an arid environment. Retrieved on 3rd of March 2017 from: http://www.windhoekcc.org.na

Dunlap, R. E. (2011). The politicization of climate change and polarization in the American public's views of global warming 2001-2010. *The Sociological Quarterly*. *52*(5), 155-194.

Fahnestock, J. (1999). *Rhetorical figures in science.* New York: Oxford University Press.

Fahnestock, J. (1986). *Accommodating science: The rhetorical life of scientific facts*. New York: Oxford University Press.

Finnegan, C. (2008). *Visual rhetoric: A reader in communication and American culture*. Chicago: Sage Publication.

Fisher, W. R. (1994). Narrative rationality and the logic of scientific discourse. *Argumentation,8*(2), 21–32.

Foss, S. K. (1994). *Rhetorical Schema for the Evaluation of Visual Imagery*. Madison: University of Wisconsin Press.

Foss, S. K., & Graffim, C. L. (1995) *Beyond Persuasion: A Proposal for an Invitational Rhetoric.* Madison: University of Wisconsin Press.

Fraenkel, J. R., & Wallen, N. E (2009). *How to design and evaluate research in education*. New York, NY: McGraw Hill.

Frye, C. D. (Ed.). (1996). Review *of the Rhetoric of Science.* Retrieved on the 10th April 2017 from: http://www.techsoc.com/rhetosci.htm

Gale, T. (2005). Rhetoric of science and technology. Retrieved on the 16th of December 2017 from http://www.encyclopedia.com

Goklany, I. (2008). *How the IPCC portrayed a net positive impact of climate change as a negative.* Retrieved on the 13th November 2017 June 15, 2009, from:

http://www.cato-at-liberty.org/2008/09/18/how-the-ipccportrayedanetpositiveimpact-of-climate-change-as-a-negative/

Goldberg, J. (2017). *The rhetoric of climate change alarmists grows ever more hysterical.* New York: National Review Press.

Gould, P. (1981). Letting data speak for themselves. *Annals of the Association of the American Geographers*, *71*(2), 166 – 176.

Gross, A. G. (1990). *The Rhetoric of Science*. Cambridge: Harvard University Press.

Gross, A. G. (1993). *The roles of rhetoric in the public understanding of science: Theoretical perspective.* Minnesota: University of Minnesota.

Grubb, M. (1999). *The Kyoto protocol: A guide and assessment*. Washington: Brookings Publishers.

Gunter, B. (1987). *Poor reception: Misunderstandings and forgetting broadcast news*. Nillsdale, NJ: Lawrence Erlbaum.

Halliday, M. (1998). *Things and relation: Regrammaticing experience as technical knowledge*. New York: Routledge.

Halliday, M. A. K. (1994). *An Introduction to functional grammar*. London: Edward Arnold.

Hamilton, L. C. (2011). Education, politics and opinions about climate change evidence for interaction effects. *Climatic Change*, *104*(2), 231-242.

Handal, B. (2009). *Philosophies and pedagogies of mathematics*. Retrieved 28th 1October, 2017 from: http://scholar.google.com/citations?user

Harding, L. (2013). *The power of images in global climate change discourse: A critical visual rhetorical analysis of Our Changing Planet*. Dallas: Texas Tech University Press.

Harris, R. (1991). Rhetoric of Science. *College English,53*(10), 282 – 307.

Hartman, A. (2016, May 31). Desalination solution in time of drought. *The Namibian,* p. 3.

Hashim, A. (2010). *Print advertisements in Malaysia and the west29*(3), 378-393. Retrieved from: http://www.ccsenet.org/ass

Heckelman, R., & Dunn, M. (2003). *Models in algebra and rhetoric: A new approach to integrating writing and mathematics in a Learning Community*. Montgomery: Montgomery Press.

Heila, S., & Urquhart, P. (2014). Climate change counts mapping study: Namibia country report. *Sarua*, *2*(6). 11 – 117.

Helder, B. (2011). *Textual analysis: An approach to analysing professional texts.* Denmark: Sam Funds Litteratur.

Hønneland, G. (2004). Fish discourse: Russia, Norway, and the Northeast arctic cod. *Human Organization*, *63*(1), 68–77.

Hossain, M., & Marinova, A. (2011). *Climate change rhetoric in Bangladesh: A curse or a blessing.* Curtin: University of Curtin Press.

Houghton, J. T. (1996). *Climate change: The science of climate change contribution to the second assessment report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press.

Houghton, J. T. (2004). *Global warming: The complete briefing*. Cambridge: Cambridge University Press.

Hougton, J. T. (2002). *Climate variability, extreme events and agricultural productivity in mountain regions*. Retrieved on 28th October 2017 from http://www.books.google.com.na/books?id

Hughes, E. (2017). *Why we must change the rhetoric of climate change*. Retrieved on 14thof December 2017 from http://wesleyanagus.com/2017/03/30/

Hughes, H. (2012). *The visual rhetoric of climate change documentary: Climate change politics.* New York: Cambria Press.

Hulme, M. (2009). *Why we disagree about climate change: Understanding controversy, inaction and opportunity*. Cambridge: Cambridge University Press.

Ilynska, L., Ivanova, O., & Senko, Z. (2016). *Rhetoric of scientific text translation*. Latvia: Riga Technical University Press.

Jasanoff, S., & Wynne, B. (1998). *Scientific knowledge and decision*. Columbus, OH: Battelle Press.

Jasanoff, S. (2010). A new climate for society. *Theory, Culture & Society*, *27*(2), 233–253.

Joubert, L. S. (2006). *Scorched: South Africa's changing climate.* Johannesburg: Wits University Press. .

Kaundjua, B. M., Angula, N., & Angombe, T. (2012). Community perceptions of climate change and venerability impacts in Oshana and Ohangwena Regions. *Journal for studies in humanities and social sciences*, *1*(1), 21 – 31.

Kaundjua, B. M., & Angula, M.N. (2016). The changing climate and human vulnerability in north-central Namibia. *Jàmbá: Journal of Disaster Risk Studies,8*(2).

Keller, E. (1985). *Reflections on gender and science.* New Haven: Yale Ltd.

Kendall, A. R. (2005). *Computer Simulations in Computational Science: Mimesis of a Virtual Nature*. Cambridge: University of Cambridge Press.

Kennedy, G. A. (1991). *On Rhetoric: A theory of civic discourse*. New York: Oxford University Press.

King, J., &. Watanabe, T. (1996). *Learning mathematics*. Retrieved on 28th October, 2017 from: http://www.scholar.google.com/citations?user

Kjeldsen, J.E. (2011). Visual Tropes and Figures as Visual Argumentation. *Proceedings 7th Conference on argumentation of the international society for the study of argumentation*; June 29–July 2.

Kohlani, M.A. 2010. *The function of discourse markers in Arabic newspaper opinion articles*. (Unpublished doctoral dissertation). Georgetown University, Washington.

Kotecha, P. (2014). *Climate change counts: mapping study*. Retried on 7th April 2018 from http://www.saruaclimatechange/counts/mapping

Koteyko, N., & Atanasova, D. (2015). *Metaphors on climate change: War, religion, and politics*. Cambridge: University of Cambridge Press.

Kurz, T., & Crabb, S. (2010). Contesting the national interest: a discursive analysis of political rhetoric around climate change. *British Journal of Social Psychology*, *49*(3),601-625.

Lakatos, I. (1986). *A renaissance of empiricism in the recent philosophy of mathematics.* Cambridge: Cambridge University Press.

Latour, B. (1987). *Science in action: How to follow scientists and engineers through Society*. Cambridge, MA: Harvard University Press.

Levine, A., & Kline, R. (2017). Why climate change rhetoric simultaneously succeeds and fails. Retrieved on the 14th December, 2017 from: http://www.huffingtonpost.com/author/reuben-kline

Logan, R. A. (2001). Science mass communication: its conceptual history. *Science communication*, *23*(2), 135-163.

Lubinda, M. (2015). *Climate change: The definition, causes, effects and responses in Namibia.* Retrieved on the14th of April 2017 from: www.enviro-awareness.org.na

Lyotard, J. F. (1984). *The postmodern condition: A report on knowledge*. Minneapolis: University of Minnesota Press.

MacGregor, J. (2008). *Climate change impacts on Namibia's natural resources and economy.* Retrieved on 20th of august, 2018 from: https://www.researchgate.net/publication/233581378

Malone, E. (2004). *Rhetorical analysis of arguments made in the climate change debate*. (Unpublished doctoral dissertation). University of Maryland, Maryland.

Mann, C., Bradley, R, & Hughes, M. (1998). *Global-scale temperature patterns and climate forcing over the past six centuries*. Los Angeles: University of California**.**

Mann, C., & Thompson, S. (1987). Rhetorical structure theory: a framework for the analysis of texts. *Information Sciences Institute, 1*(7),181 – 350.

Mann, C., & Thompson, S. (1986). *Rhetorical structure theory*. Los Angeles: University of California.

McIntyre, S., & McKitrick, R. (2003). Corrections to the Mann et. al. (1998) Proxy Data Base and Northern Hemispheric Average Temperature Series. *Journal of Energy and Environment, 14*(6), 751-771.

McKitrick, R. (2007). *Independent summary for policy makers.* Retrieved on the 13th November 2017, from: http://www.fraserinstitute.org/Commerce

McLean, J. (2008). *The IPCC under the microscope*. Retrieved on the 13th November 2017 from: http://mclean.ch/climate/IPCC.htm

Millennium Ecosystem Assessment. (2005). *Ecosystem and human well-being: Biodiversity synthesis*. Washington, D. C: World Resources Institute publisher.

Miller, C. (1992). *Kairos in the rhetoric of Science*. Carbondale: Southern Illinois University Press.

Ministry of Environment and Tourism (MET). (2008). *Climate change vulnerability & adaptation assessment Namibia*. Windhoek: Government Printers.

Ministry of Environment and Tourism. (2010). *National policy on climate change for Namibia*. Windhoek: Government Printers.

Ministry of Environment and Tourism. (2011). *National policy on climate change for Namibia*. Windhoek: Government Printers.

Ministry of Environment and Tourism. (2009). *Climate change strategy and action plan*. Windhoek: Government Printers.

Moser, S. (2010). *Communicating climate change: history, challenges, process and future directions*. Santa Cruz: University of California Press.

Mura, R. (1995). Images of mathematics held by university teachers of mathematical sciences, *Journal* for *Educational Studies in Mathematics*,*25*(4), 375–385.

Murphy, J.M. (1994). Presence, Analogy, and Earth in the Balance. *Argumentation and Advocacy*. *31*(5), 1-16.

Myers, G. (1990). *Writing biology: texts in the social construction of scientific knowledge.* Madison: University of Wisconsin Press.

National Planning Commission. (2014). The root causes of Poverty. Retrieved on the 25th March 2019 from: https://www.npc.gov.na/?wpfb_dl=303

Nelson, J., & Boynton, G. (1995). *How music and image deliver argument in political advertisements on television*. Cambridge: University of Cambridge Press.

Nelson, J., Megill, A., &. McCloskey, D.N. (1987). *The rhetoric of human sciences*. Madison: University of Wisconsin press.

Newsham, A. J., & Thomas, D. S. G. (2011). *Knowing, farming and climate change adaptation in north-central Namibia*. Brighton: University of Sussex.

Nhemachena, C., & Hassan, R. (2007). *Micro-level analysis of framers' adaptation to climate change in Southern Africa.* Washington: University of Exeter Press.

Nickanor, M. N., & Kazembe, L. (2015). Climate change and food security in Namibia. Retrieved on the 8th of September, 2018 from: www.climate*uaps2015.princeton.edu/papers/150784*

Nworgu, B. G. (1996). *Educational Research: Basic Issues & Methodology*. Ibadan: Wisdom Publishers Limited.

Oertzen, D. (2010). *Impact of climate change on human health in Namibia*. Retrieved on the 2nd of March, 2017 from: https://www.voconsulting.net/environment/impact

Olson, K., & Goodnight, G. (1994). Entanglements of consumption, cruelty, privacy, and fashion: The social controversy over fur. *Quarterly Journal of Speech, 80,* 249–276.

Ornatowski, C. (2007). *Science and rhetoric: A changing relationship*. Retrieved on the 20th of December 2017 from: http://writinginstructor.com

Overington, M. A. (1977). The scientific community as audience: Toward a Rhetorical Analysis of Science. *Philosophy and Rhetoric, 10*(6), 143 – 164.

Pera, M. (1994). *The discourses of science*. Chicago: University of Chicago Press.

Perelman, C., & Olbrechts, L. (1969). *The new rhetoric: A treatise on argumentation*. London: University of Notre Dame Press.

Perlmutter, D. (2003). *The internet: Big pictures and interactions*. Minneapolis: University of Minnesota Press.

Potter, M. (2011). *Visual argumentation in an Al Gore keynote presentation on climate change.* University of Bergen: Windsor Press.

Prelli, L. (1989). *Rhetoric of science: Inventing scientific discourse*. South Carolina: University of South Carolina Press.

Rayner, S., & Malone, E. (1998). *The challenge of climate change to the social sciences: Human choice and climate change*. Columbus, OH: Battelle Press.

Reeves, C. (2005). *The language of science*. New York: Routledge.

Reid, H., & MacGregor, J. (2007). *The economic impact of climate change in Namibia: How climate change will affect the contribution of Namibia's natural*. Retrieved on the 9th November, 2017 from: https://www.researchgate.net/publication/237559917

Reitter, D. (2010). *Simple signals for Complex rhetoric: On rhetorical analysis with rich-feature support vector models.* Budapest: Springer.

Republic of Namibia. (2004). *Promulgation of water resources management, Act 2004 (Act No. 24 of 2004) of 23 December 2004.*Windhoek: Government Gazette.

Richards, J., Platt, J., & Weber, H. (1985). *Longman dictionary of applied linguistics.* Harlow: Longman.

Rickert, J. (2013). *Let the data speak for themselves*. Retrieved on the 6th of July 2018 from: www.revolutionalytic.com/let-the-data-speak-for-theselves.html

Salomon, S. (2007). *Climate change: The scientific basis contribution of working group*. Retrieved on the 28th October 2017 from: http://www.books.google.com.na

Scarce, R. (1990). Environmental Problems and Protection. *The Public Opinion Quarterly, 55*(4),651-672.

Schiffrin, D. (1987). *Discourse markers.* Cambridge: Cambridge University Press.

Schneider, S. (2005). *The dangers of climate change*. Retrieved on the 14th November 2017 from: http://wwwglobalpublicmedia.com/node/448

Scott, L. (2008). *Christians, the care of creation and global climate change*. New York: Pickwick Publications.

Scott, L (2008). The Chicago guide to communicating science. *Integrated Environmental Assessment and Management, 4*(2), 270 – 290.

Seizer, J. (1993). *Understanding scientific prose*. Cambridge: Cambridge University Press.

Shapin, S. (2008). *The Scientific Life.* Chicago: University of Chicago Press.

Silverman, S. J.(2000). *Proposals that work: A guide for planning dissertation and grant proposals*. London: Sage.

Sindano, G. (2013). *A study of rhetorical devices used in selected car advertisements in the Namibian newspaper.* (Unpublished Master Thesis), University of Namibia, Namibia.

Sindano, G. Utete, C., & Ilukena, M. (2018). Environmental protection using Indigenous knowledge (IK) methods and skills for sustainability: Case Study in the Kavango East Region, *Namibia CPD Journal for educators*. *4*, 106 -122.

Smit, E. (2019, June 7). Climate change disastrous. *Namibian Sun*, p. 5

Southern African Development Community, Regional Environmental Educational Program (2011). *Teacher education workbook for environment and sustainability education in Southern African.* Share – Net, Howwick. South Africa.

Southwell, B. (1999). *Internationalisation and globalisation in mathematics and science education*. Retrieved on the 28th October, 2017 from http://www.scholar.google.com/citations?user

Steynor, A. (2017). *Perception matters: A perspective on the psychological proximity of climate change in an African context.* New York: Cambridge University Press.

Swales, J. M. (1990). *Genre Analysis: English in Academic and Research Setting*. Cambridge: Cambridge University Press.

Syfert, C. (2013). *Visual Images and the Rhetoric of Environmental Advocacy*. Retrieved on the 2nd December 2017 from: http://digitalcommons.uri.edu/theses/20

Szasz, A. (1994). *Eco populism: Toxic waste and the movement for environmental justice.* Minneapolis: University of Minnesota Press.

Trimble, L. (1985). *English for science and technology, a discourse approach.* Cambridge: Cambridge University Press.

Tuan, L. (2010). *Rhetorical structure in the language of Vietnamese Advertisements*. Retrieved from: www.ccsetnet.org/ass

United Nations Development Programme. (2007*). UNDP project document. Barrier removal to Namibian renewable energy programme.* New York: United Nations.

United Nations Framework Convention on Climate Change (2007). *Climate change: impacts, vulnerabilities and adaptation in developing countries*. Retrieved on the 11th of April, 2019 from: https://unfccc.int/resource/docs/publications/impacts.pdf

Vapnik, V. N. (1995): *The nature of statistical learning theory*. New York: Springer.

Vincent, K. (2004). *Creating an index of social vulnerability to climate change for Africa.* Norwich: Anglia Press.

Walsh, L. (2015). The visual rhetoric of climate change. *Wires Climate Change Journal. 6*(4), 361 – 368.

Wander, P.C. (2009). *The rhetoric science*. San Jose: San Jose State University Press.

Watson, C. (1999). *Design, implementation, and operation of a modular integrated tropical cyclone hazard model*. Retrieved on the 3rd of September, 2018 from: http://www.enkiops.org/enki_research/papers/asce_climate.pdf

Weimer, W. B. (1977). Science as a rhetorical transaction: towards a non justificational conception of rhetoric. *Philosophy and Rhetoric,10*(5), 1 – 29.

Welldon, J. E. C. (1886). *The rhetoric of Aristotle*. New York: Macmillan and Co.

Wilhelm, M. (2012). *Impact of climate change in Namibia: A case study of Omusati Region*. (Unpublished Master Thesis). Polytechnic of Namibia, Namibia.

Willbanks, T. J., &. Kates, R.W. (1999). Global change in local places: How small scales matters. *Climate Change, 43*(3), 601-628.

Willemse, L. (2006). *Effects of promoting reading comprehension skills among first year university students.* (Unpublished Master's Thesis). University of South Africa, Pretoria, South Africa.

Winsor, M. (2016). *Climate change in Africa: African global warming role small but crucial to crisis solution*. New York: Springer.

Woolgar, S. (1979). *Laboratory life*. Cambridge: Cambridge University Press.

Wright, C., & Mann, M. (2013). Future imaginings and the battle over climate science: An interview with Michael Mann. *Organization*, *20*(5), 748–756.

Zarefsky, D. (2009). Spectator Politics and the Revival of Public Argument. *Communication Monographs*, *59*(4), 411-414.

Zeidler, J., Kandjinga, L., David, A., Turpie, J., & Malema, D. (2012) *Climate governance and development: Case study*. Cape Town: Heinrich Böll Stiftung Publisher.

Zeidler, J., Kandjinga, L., & David, A. (2010). *Study on the effects of climate change in the Cuvelai Etosha basin and possible adaptation measures*. Cape Town: Heinrich Böll Stiftung Publisher.

Appendix