AN ANALYSIS OF CLIMATE CHANGE SCIENCE COMMUNICATION IN POST-APARTHEID SOUTH AFRICA OVER THE PERIOD 1996 TO 2016

by

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Thesis submitted in fulfilment of the requirements for the degree

DOCTOR OF PHILOSOPHY IN ENVIRONMENTAL MANAGEMENT

In the

Department of Environmental and Occupational Studies

FACULTY OF APPLIED SCIENCES

CAPE PENINSULA UNIVERSITY OF TECHNOLOGY

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November 2025

DECLARATION

I, **RENDANI MULAUDZI**, declare that the contents of this thesis represent my own unaided work, and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

Signed  **Date** 10 November 2025

ABSTRACT

Climate change is arguably one of the biggest challenges facing the world today. It is well documented that the issue has been garnering significant attention in news media across the United States and Europe. In Africa, the most vulnerable continent, news media coverage of climate change is underrepresented. The understanding of news media representation of climate change science, particularly objective facts, is therefore of particular importance. This study explored the portrayal of three objective facts about climate change science (observed climate trends, climate change impacts and climate projections) in three leading South African broadsheet newspapers between 1996 and 2016. In addition, the study examined the manner in which the United Nations climate change conferences or Conference of the Parties (COP) events influence newspaper coverage of climate change science. The study further interrogated the effects of news media on newspaper readers' opinion. This study provided an understanding of South African news media reporting on climate change science by bridging the existing knowledge gap in the literature.

The study conducted a quantitative content analysis of 266 news articles from the City Press, The Sunday Independent, and Sunday Times. In order to explain public opinion about climate change science in the press, this study conducted a questionnaire survey among active readers of the Sunday broadsheet newspapers from a rural community in Limpopo, South Africa.

The findings showed that newspaper attention devoted to objective facts remained low between 1996 and 2016, but their proportion rose slightly between 2006 and 2007. The analysis further revealed that political agenda had taken precedence over scientific agenda. The results have shown that South African newspapers were highly dependent on news agencies from the Global North. COP events coverage was at the highest peak in 2011, however, the study asserted that the focusing events did not strongly shape portrayal of objective facts in the press. The findings suggested that the dearth of scientific agenda in news articles had a major impact on newspaper readers' opinion on climate change. The results also showed that there has been newspaper reader scepticism on climate change projections.

This research provided useful insights on how objective facts on climate change science are portrayed in news articles across the major broadsheets in South Africa. The

conclusion of this study was that there was a considerable disconnect between the scientific agenda on climate change and print media. The study recommended the development of a guidebook to bridge the gap between climate change science and newsrooms and highlighted key areas for future research.

ACKNOWLEDGEMENTS

I would like to thank my supervisor Professor Joseph Kioko for the constructive criticism and guidance over the years. I am also grateful to newspaper readers for their participation in the study. I thank my family for the support and encouragement throughout the journey. I would also like to thank my colleagues in the Department of Environmental and Occupational Studies at the Cape Peninsula University of Technology. I am thankful to the Academic Doctorate Advancement Programme Towards Transformation (ADAPTT) team for providing writing retreat opportunities. I would also like to extend my heartfelt thanks to all my colleagues at ADAPTT.

The financial assistance of the ADAPTT towards this research is acknowledged. Opinions expressed in this thesis and the conclusions arrived at, are those of the author, and are not necessarily to be attributed to the ADAPTT.

DEDICATION

This work is dedicated to Tackson and Khwathelani Mulaudzi.

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LIST OF ABBREVIATIONS AND ACRONYMS

AR4	Fourth Assessment Report
AR5	Fifth Assessment Report
ARs	Assessment Reports
CBD	Convention on Biological Diversity
CCI	Climate Change Impacts
CCP	Climate Change Projections
CDM	Clean Development Mechanism
CMP	Conference of the Parties Serving as the Meeting of Parties to the Kyoto Protocol
CMP1	First session of the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol
COP	Conference of the Parties to the United Nations Framework Convention on Climate Change
COP1	First session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
COP2	Second session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
COP3	Third session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
COP4	Fourth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
COP5	Fifth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
COP6	Sixth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
COP7	Seventh session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
COP8	Eighth session of the Conference of the Parties to United Nations Framework Convention on Climate Change
COP9	Ninth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
COP10	Tenth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
COP11	Eleventh session of the Conference of the Parties to the United Nations Framework Convention on Climate Change

COP12	Twelfth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
COP13	Thirteenth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
COP15	Fifteenth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
COP16	Sixteenth session of the Conference of Parties to the United Nations Framework Convention on Climate Change
COP17	Seventeenth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
COP18	Eighteenth session of the Conference of Parties to the United Nations Framework Convention on Climate Change
COP19	Nineteenth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
COP20	Twentieth session of the Conference of Parties to the United Nations Framework Convention on Climate Change
COP21	Twenty-first session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
COP22	Twenty-second session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
COSATU	Congress of the South African Trade Unions
CRU	Climatic Research Unit
CZMS	Coastal Zone Management Sub-group
DA	Democratic Alliance
EFF	Economic Freedom Fighters
FAR	First Assessment Report
G-8	Group of Eight
GCF	Green Climate Fund
GCM	General Circulation Models
GEF	Global Environment Facility
GHG	Greenhouse Gas
IAMs	Integrated Assessment Models
IPCC	Intergovernmental Panel on Climate change
LDCs	Least Developed Country Parties
MECCO	Media and Climate Change Observatory
NASA	National Aeronautics and Space Administration
NWP	Nairobi Work Programme

OCT	Observed Climate Trends
RCPs	Representative Concentration Pathways
RM	Response Measures
SAR	Second Assessment Report
TAR	Third Assessment Report
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Convention on Climate change
US	United States
USA	United States of America
WMO	World Meteorological Organization

CHAPTER ONE: INTRODUCTION

1.1 Background

Global climate change is viewed as one of the most pressing problems in the 21st century. Increasing scientific evidence has shown that climate has been rapidly changing over the last three decades (IPCC, 2013; Ziervogel *et al*., 2014; Davis-Reddy and Vincent, 2017; The Conversation, 2021). Evidence in recent years has articulated the role of human activities as the main drivers of climate change. It is evident that human activities such as deforestation and burning of fossil fuels are releasing greenhouse gas emissions into the atmosphere (Quadrelli and Peterson, 2007; Van der Werf *et al*., 2009; Pendrill *et al*., 2019). Previous studies have reported that excessive concentrations of greenhouse gases are increasing global average temperature (Shakun *et al*., 2012; Hawkins and Jones, 2013). It must also be acknowledged that the period 2011 to 2020 was the hottest on record since 1880.

Although there is a greater consensus around the drastic increases in temperature (Warren et *al*., 2011; Perkins-Kirkpatrick and Gibson, 2017), there are three important questions on the changing climate. First, the main question is centred around how observed climate trends have increased over the past decades. While there is unanimity regarding the relationship between global greenhouse gas emissions and global temperature (Lüthi *et al*., 2008; Humlum *et al*., 2013), other observed climate trends, like extreme weather events, melting ice, and sea level rise are equally important. For instance, evidence has demonstrated that increasing intensification and occurrence of extreme weather events are fuelled by climate change globally, from droughts in Kenya (Ayugi *et al*., 2020; Thomas *et al*., 2020) and South Africa (Ujeneza and Abiodun, 2015; Araujo *et al*., 2016; Baudoin *et al*., 2017; Botai *et al*., 2017), floods in Australia (Keogh *et al*., 2011; Head *et al*., 2014; Gu *et al*., 2020), heatwaves in France (Bador *et al*., 2017; Pascal *et al*., 2021) and Russia (Flach *et al*., 2018; Schaller *et al*., 2018; Basarin *et al*., 2020). According to recent studies (Sakai and Fujita, 2017; Wu *et al*., 2020), it is evident that observed melting of glaciers and ice sheets can be attributable to climate change. The shrinkage of ice sheets is contributing to sea level rise. There is strong evidence to suggest that rapid sea level rise is fuelled by global ice loss (Nowicki and Seroussi, 2018; Golledge, 2020).

The second question looks at how increasing greenhouse gas concentrations are affecting humans and the biophysical environment. Several accounts have shown strengthening results about the linkage between heat stress and climate change (Gao *et al*., 2018; Lorenz *et al*., 2019; Parkes *et al*., 2019). Climate change threats on ecosystems and biodiversity have received much attention in the literature. Recent studies have found that extinction of species is often associated with the changing climate (Sintayehu, 2018; Nunez *et al*., 2019; Román-Palacios and Wiens, 2020).

The last question focuses on the extent of the projected changes in climate and what action is required to combat climate change and its impacts. Global climate change projections suggest that the frequency and intensity of climate extremes will be significant towards the end of the 21st century (Liang *et al*., 2020). Over the last few years, there has been mounting calls for greater action on the issue of climate change. A crucial challenge for news media is to report factual information on climate change issues, while shaping public understanding (Bolsen and Shapiro, 2018).

To understand news media representation of climate change science, it is critical to look at the extent to which basic factual and baseline information is disseminated to the public. Arguably, observed climate trends (i.e. increased greenhouse gas concentrations, increasing global temperature, change in precipitation, extreme weather events, melting ice, sea level rise and ocean acidification), climate change impacts, and climate change projections are three fundamental objective facts which describe how climate system is changing (Karl *et al*., 2009; Stott *et al*., 2010; Gillett *et al*., 2012; Philippon *et al*., 2012; Malherbe *et al*., 2013; Santer *et al*., 2013; Masih *et al*., 2014; Doyle *et al*., 2015; Vincent *et al*., 2015; Box *et al*., 2019).

Where do the objective facts and the general public meet? Climate change leads to significant impacts on the physical environment and society (Ziervogel *et al*., 2014; Davis-Reddy and Vincent, 2017; Descheemaeker *et al*., 2018). Several studies have suggested that anthropogenic activities are significantly contributing to atmospheric concentrations of greenhouse gases (GHG), including carbon dioxide, nitrous oxide and methane (Ruddiman *et al*., 2016; Santer *et al*., 2017; Pidwirny, 2018). It is well established that there is a scientific consensus that emission of greenhouse gases will have damaging consequences on the biological, chemical and physical components of the earth system beyond the 21st century.

Strong scientific evidence has shown that the African continent is vulnerable to increasing surface temperature, leading to extended dry seasons (Davis-Reddy and Vincent, 2017). Rainfall analysis across the continent reveals that average seasonal rainfall is projected to decrease in certain parts over the southern African region (Harris *et al*., 2013; Engelbrecht *et al*., 2015; Davis-Reddy and Vincent, 2017).

Even though available evidence has generally given rise to climate change issues, in part due to the publication of a series of Assessment Reports (ARs) by the Intergovernmental Panel on Climate Change (IPCC), a few studies have discussed South African news media coverage of the relationship between problem indicators, focussing events and societal feedback. According to studies elsewhere, chief among the hindrances is the disconnection between media, public and scientific knowledge (Olausson, 2011; Leiserowitz *et al*., 2013; Capstick *et al*., 2015; Howarth *et al*., 2020). The ARs are regarded as the point of reference during the global climate talks. In newspapers, it is widely recognised that both ARs and Conference of the Parties (COP events) are some of the main drivers of climate change issue attention (Carvalho and Burgess, 2005; Boykoff and Rajan, 2007; Sampei and Aoyagi-Usui, 2009; Bohr, 2020). However, it is important to note that soaring attention does not necessarily mean that newspapers are focussing on factual information. Studies have shown that climate change scientific content is often overshadowed by political agenda and controversies (Maibach *et al*., 2012; Grundmann, 2013). The 2009 Climategate scandal is an example of a controversial event that undermined the dominance of the scientific agenda within news articles in newspapers across the globe. The Climategate scandal is an event in which hundreds of emails were leaked from the Climate Research Unit at the University of East Anglia. Climate change sceptics used the emails to drive the narrative that scientists were manipulating climate data. The controversy diverted attention from the problem indicators and focussing events on climate change (Ryghaug and Skjølsvold, 2010; Anderegg and Goldsmith, 2014).

Despite a considerable number of studies regarding newspaper attention to climate change elsewhere (Lyytimäki, 2011; Shehata and Hopmann, 2012; Schmidt *et al*., 2013; Saunders *et al*., 2018; Bohr, 2020), work examining portrayal of objective facts and international climate change conferences, particularly COP events has been scarce in South Africa. The manner in which news media reports about factual and baseline information can influence public perceptions on climate change (Borah, 2016). Over the past decade, public concern about climate change has become a subject of important interest in media studies literature. Previous work suggests that media impact on public opinion and perception on climate change has its roots in media effects theory. Various

studies have explained the development of the theory by giving its foundational phases (Esser, 2008; McQuail, 2010). For example, Esser (2008) shows that media effects theory has a long history. To understand the evolution of the theory, Esser (2008) provides a good account of four important phases. The first phase emerged during the 1920s and 1930s. It was assumed that the media has strong and large effects on society. This is thought to be due to the growth of print and broadcast media. Borah (2016) argued that the observed mass media expansion shaped the opinion, belief and behaviour of the audience.

The second phase started in the late 1930s. It is largely accepted that the influence of the media was not significant during this phase. This minimal media effect is likely to have been driven by a theory shift. Between the late 1930s and 1960s, evidence demonstrates that the perceived importance of media effect on society declined because the influence was not as strong as previously reported. Apart from selective exposure, people were using selective perception. It is regarded as one of the reasons for the rise of the limited effects model of mass media communication (McQuail, 2010). The theoretical approach argues that media has an inconsequential effect on the audience. In the late 1960s and 1970s, a third phase was recorded. There is an assumption that there was a significant media effect during this period. The popularity of television was clearly on the rise and may have played an active and influential part (Borah, 2016). The fourth phase emerged in the 1990s. And despite a minimal media effect, constructivism was at the highest level. This suggests that people construct their own views based on experiences (McQuail, 2010).

The concentration of the current research is on issue attention cycle and agenda-setting theories. They provide a useful model for the examination of news media reporting of climate change and the influence of media in shaping public opinion. Based on reviewed literature on climate change coverage in newspapers, it is unsurprising that previous studies have been reliant on issue-attention cycle theory and agenda-setting theory (Schäfer *et al*., 2014; Saunders *et al*., 2018).

The focus of this research is two-fold. First is to analyse the portrayal of objective facts on climate change science in the *City Press*, *The Sunday Independent*, and *Sunday Times* news articles from 1996 to 2016. In this respect, observed climate trends, climate change impacts and climate change projections were selected. They are widely recognised as the main facts often discussed in relation to the science of climate change (Davis-Reddy and

Vincent, 2017). From this perspective, an attempt is made to provide a deeper understanding of how news media outlets represent climate change scientific facts. The choice of newspapers is guided by the overall national reach and in-depth content coverage of news. The three broadsheet newspapers are considered to be agenda-setting outlets for the public. They cover a substantial amount of political, economic, social and environmental issues. In addition, the thesis aims to examine the role of COP events in newspaper coverage of climate change. Although studies in the Global North show how COP events influence climate change coverage in newspapers (Schmidt *et al*., 2013), there is still poor examination in developing countries, particularly in South Africa. Second, the thesis explores regular newspaper reader opinion on climate change information disseminated by the broadsheet newspapers in South Africa. The approach taken by this body of work is to provide cogent accounts which can be vital to our understanding of climate change scientific information in news media, as well as its influence in shaping public opinion.

1.2 Problem statement

In recent years, there has been a surge in the exploration of newspaper coverage of climate change issue across the globe (Carvalho and Burgess, 2005; Ahchong and Dodds, 2012; McKewon, 2012; Schmidt *et al*., 2013; Painter and Gavin, 2016; Mariotto and Venturini, 2017; Keller *et al*., 2020). While most accounts demonstrate the importance of extreme weather events, ARs and COP events in issue attention, very few studies provide excellent quantitative analysis of climate change science coverage in newspaper articles, with objective basic facts as the central component (Romps and Retzinger, 2019). Moreover, most existing studies have been conducted in the UK and USA. There is also evidence that studies on the public opinions, perceptions and behaviour are prolific in the developed countries (McCright and Dunlap, 2011; Brewer, 2012; Anderegg and Goldsmith, 2014; Garud *et al*., 2014; Capstick *et al*., 2015). In spite of strong evidence regarding the observed climate trends, climate change impacts and projections in Africa (Malherbe *et al*., 2013; Ziervogel *et al*., 2014; Davis-Reddy and Vincent, 2017), research on how newspaper coverage of basic facts and focussing events influence public opinion about climate change science is not well understood in rural Africa. Although climate change is still a complex phenomenon, particularly in Africa, researchers pointed out that improved basic climate literacy is important in increasing not only public awareness of climate change, but commitment to actions (Lee, *et al*., 2015). However, there are limited studies thus far which significantly give an in-depth analysis on how objective facts are

portrayed within three leading broadsheet newspapers in South Africa over a twenty-year period in a post-apartheid era. In addition, the role of COP events in newspaper coverage of climate change has been neglected. Examining newspaper portrayal of objective facts and focussing events is therefore crucial with a specific consideration on the news media effects on public opinion.

1.3 Motivation and rationale

Globally, there is evidence to suggest that climate change issue in news media began to explode in popularity during the late 1980s and early 1990s (McComas and Shanahan, 1999; Ungar, 1999; Boykoff and Boykoff, 2007; Boykoff and Luedecke, 2016). It is well documented that the formation of the IPCC and publication of FAR immensely contributed to news media attention to climate change (Brossard *et al*., 2004; Grundmann and Krishnamurthy, 2010; Hulme and Mahony, 2010; Aykut *et al*., 2012; Schmidt *et al*., 2013; Vardy *et al*., 2017). Moreover, the subject matter may have gained strength due to cumulative impacts of climate change. Several accounts explained that the Rio Earth Summit was a fertile ground for accelerating climate actions (Hermwille *et al*., 2017; Grubb *et al*., 2019; Xavier *et al*., 2019). It is frequently stated that the meeting gave birth to the United Nations climate change conferences or Conference of the Parties (COP).

The news media focus on COP events has been generally rooted in the adoption of the Kyoto Protocol in 1997 and its enforcement in 2005 (Sampei and Aoyagi-Usui, 2009). For instance, the Kyoto Protocol was the first international-driven treaty to reduce greenhouse gas emissions. It was the extension of the 1992 United Nations Framework Convention on Climate Change (UNFCCC) negotiations or the Rio Earth Summit. While the Kyoto Protocol remained the most important climate treaty for nearly two decades, many studies have shown that the press attention shifted to the 2009 Copenhagen conference, 2010 Cancun conference, 2011 Durban conference, and 2015 Paris conference (Schmidt *et al*., 2013; Hulme, 2016; Kumpu, 2016; Eskjær, 2017; Gurwitt *et al*., 2017; Lidberg, 2018; Saunders *et al*., 2018). Part of the reason for the shift had to do with the search for Kyoto Protocol replacement.

A central focus of this study is the understanding of climate change science content portrayal in the leading news media outlets and its influence on public opinion. Based on the analysis of how coverage of objective facts and focussing events had evolved over the past decades, the approach of this study is to make contribution in the nature of news

media representation of climate change science in South Africa. This study is undoubtedly one of the few studies which specifically examine newspaper coverage of three main objective facts (observed climate trends, climate change impacts and climate change projections) and public opinion on climate change.

1.4 Aim and objectives

The aim of the study was to explore how major broadsheet newspapers portray climate change science in South Africa for the period 1996 to 2016, and the influence of that portrayal to public opinion. The specific objectives of the study were to:

- To analyse the prevalence of three main objective facts of climate change science within news articles in the *City Press*, *The Sunday Independent*, and *Sunday Times* from 1996 to 2016.
- To examine the influence of climate change focussing events on newspaper coverage of climate change science objective facts.
- To establish newspaper reader opinion about climate change science content.

1.5 Research question

What is the portrayal of the three main climate change science objective facts (observed climate trends; climate change impacts; and projected climate change futures) and climate change focussing events in the *City Press*, *The Sunday Independent*, and *Sunday Times* for the period 1996 to 2016, and how it influences public opinion about the subject matter? The following are the sub-questions:

- What is the prevalence of climate change science objective facts in South African major broadsheet newspapers?
- Do climate change focussing events influence newspaper coverage of climate change science objective facts in the South African press?
- What is the opinion of newspaper readers about climate change science content?

1.6 Theoretical framework

This research is guided by issue-attention cycle theory and agenda-setting theory. These two theoretical approaches have long been the vital elements in media and public agenda studies (McComas and Shanahan, 1999; Schäfer et al., 2014; Saunders *et al*., 2018). Issue-attention cycle theory is rooted in the most influential work of Downs (1972). It argues that people tend to pay serious attention to a recent problem for a short period of time. The theory adds that public attention to an issue is not sustained over time regardless of any actions to address the problem. Furthermore, the interaction between media and the public is an essential part of the theory (Brossard *et al*., 2004; McDonald, 2009; Schmidt *et al*., 2013; Uzelgun and Castro, 2015; Saunders *et al*., 2018). For instance, Downs (1972) demonstrated cycles of media attention and public interest by suggesting five stages: (1) pre-problem stage, (2) alarmed discovery stage, (3) cost of significant progress stage, (4) decline of public interest stage, and (5) post-problem stage. The starting point is that an issue appears in the public, and it has not yet gained substantial attention. Second, a significant discovery of the issue by the public leads to more attention. Third, the public starts to take into consideration the cost of dealing with the issue. Fourth, public interest gradually declines due to the direct impact of a new issue appearing in the public agenda. Lastly, there is an entirely new issue which is capturing public attention. There is compelling evidence to suggest that issue-attention cycle theory is more prolific in the studies about newspaper coverage of climate change (Holt and Barkemeyer, 2012; Schmidt *et al*., 2013; Schäfer *et al*., 2014; Saunders *et al*., 2018). Clearly, the theory informs the discussions of major findings on news media attention to climate change.

The body of research on agenda-setting theory emerged in the early 1970s (McCombs and Shaw, 1972; Weaver, 1991; McCombs *et al*., 2014). The study by McCombs and Shaw (1972) has been central to the understanding of the theory. In their research on the examination of the role of media in public opinion during the 1968 US presidential election, the authors asserted that media coverage of news determines the importance of an issue on public agenda. According to Rogers and Dearing (1988), there are three types of agenda-setting: the public agenda-setting, which shows how the public shapes the agenda; the media agenda-setting, which concentrates on the influence of media on the public; and policy or political agenda-setting, in which public agenda and media agenda are influencing decision making of policymakers.

As elaborated by McCombs (2004), broadsheet newspapers have a strong impact in terms of setting agenda for the public and policymakers (Carvalho and Burgess, 2005). One of the fundamental aspects is that other forms of news media such as television and radio are highly dependent on broadsheet newspapers for setting their agendas (Barkemeyer *et al*., 2017). At a time when social media is dominating the media space, broadsheet newspapers are still playing a key role in influencing public opinion in the context of climate change (Sampei and Aoyagi-Usui, 2009; Pasquaré, and Oppizzi, 2012; Barkemeyer *et al*., 2017; Blanco-Castilla *et al*., 2018; Su and Borah, 2019). The outcomes from these studies have demonstrated that agenda-setting is a central piece in the discussions of broadsheet newspaper coverage of climate change. For example, in a study of climate change coverage in 113 leading broadsheets from 41 countries, Barkemeyer et al (2017) highlighted that agenda-setting theory has long been given attention by researchers across the globe. With specific reference to US broadsheets, evidence suggests that the theory has gained traction in the past decades (Saunders *et al*., 2018). Studies on newspaper coverage of climate change have also increased markedly in Europe (Schäfer *et al*., 2014). The theory is of greatest interest to the present research. It provides an easy means of accurately answering the research questions. The reason for using agenda-setting theoretical approach has more to do with its position on newspaper issue attention and public opinion. Several studies have justified the adoption of agenda-setting theory through the recognition of its key role in the advancement of knowledge about newspaper coverage of climate change (Liu *et al*., 2008; Schäfer *et al*., 2014; Bohr, 2020).

The standpoint of the current study concurs with previous research in that the theoretical approach is ideal for examining the relationship between broadsheet coverage of climate change and public opinion. Some examples of research demonstrate a consensus about the importance of agenda-setting theory in improving understanding of news media and public opinion dynamics in the subject of climate change (Schäfer *et al*., 2014; Saunders *et al*., 2018). Pralle (2009) argues that agenda-setting has great importance to climate policy politics. For example, the study shows that the public has an influential role in climate change policymaking but cautioned that public concern does not necessarily translate to issue importance. Thus, the agenda needs to be important to policymakers. In a study of climate change adaptation in European countries, Keskitalo *et al* (2012) reveal a valuable contribution of agenda-setting theory in the development of adaptation strategies. In the case of newspaper agenda-setting research, studies have clearly shown that newspapers use problem indicators and focussing events to shape the public agenda (Liu *et al*., 2011; Schäfer *et al*., 2014; Saunders *et al*., 2018). These are the integral

elements of the current research, hence the justification of building on studies that give a contextual knowledge about the connectivity of scientific and political aspects of climate change.

This research is underpinned by the relationship between agenda-setting theory and issue-attention cycle theory. It starts by looking at the issue-attention and setting of agenda about climate change objective facts in South African broadsheets. The research also pays attention to the influence of focussing events (UN climate change conferences) on newspaper coverage of climate change. Lastly, the focus is on the influence of broadsheets on the public opinion about disseminated climate change science content.

1.7 Brief overview of the chapters

This introduction sets the context of the study. The chapter provides a background of the pivotal information that is of particular importance and interest to the study. It provides a clear articulation of the problem statement, motivation and rationale, aim and objectives, research question, and theoretical framework. In the second chapter, findings from previous studies are fully interrogated in order to give a cogent argument about the existing knowledge gap. The third chapter details the description of research design, data collection methods, and method of data analysis. The major findings of the study are presented in chapters four, five and six. The discussion about the results is captured in chapter seven. Finally, chapter eight deals with conclusions and recommendations of the study.

1.8 Conclusion

This chapter clearly provided a solid foundation for the study. The departure point was the research background. This is an important part in any research work. In the current study, the background section outlined a brief analysis on the body of literature about climate change and its coverage in the news media. It also covered a lot of ground on issue attention cycle and agenda-setting theoretical frameworks. The chapter further highlighted existing gaps in the literature and provided rationale for the research. The aim and objectives of the study are also included in this chapter. This is followed by the research questions of interest. The chapter further provided a discussion on selected theoretical frameworks.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter focuses on the previous work regarding the press coverage of climate change. In order to assess the available body of knowledge, the chapter looks at climate change and news media in the global context in Section 2.2. It is fundamental to review literature regarding climate change science in the press from different regions of the world. Newspaper portrayal of climate change science is the first stated objective of the thesis, and the chapter examines issue dimensions and explores drivers of issue attention. The chapter turns to newspaper portrayal of climate change science in Europe and North America (Section 2.3), Oceania (Section 2.4), Africa and Asia (Section 2.5) for the period 1996 to 2016. The objective of public opinions on climate change is discussed in Section 2.6 and finally a conclusion of the chapter is presented in Section 2.7. For the purpose of this review, English peer-reviewed literature (books, journal articles, conference proceedings papers) in climate change and media was searched using academic and media online databases.

2.2 Climate change and news media

With thousands of newspapers, radio stations, and television stations around the world, news media is arguably a key player in disseminating news to the general public. Apart from the print media and broadcast news, the internet is fast becoming a leading source of news. According to Cybercrime Magazine projections, internet users are expected to surpass 6 billion by 2022, which is about 2 billion more than the current online users (Cybercrime Magazine, 2020). Since the advent of smartphones, the role of the internet and social media has grown beyond the expectations of many communication commentators. For example, in the USA, Pew Research found that more than 60% of adults rely on social media as a source of news (Greenwood *et al.*, 2016). However, television, radio, and newspapers remain the trusted sources. They have shown resilience by making news accessible online (Welbers *et al.*, 2018; Aiseng and Akpojivi, 2019; Majó- Vázquez, 2019).

As climate change becomes a leading topic in the scientific community, so has the recognition of the role of news media. Dealing with climate change science representation

in news media, researchers have revealed that simplification of scientific information remains one of the main barriers (Moser, 2014; Knowles and Scott, 2020). However, there is a rising interest in climate change, in critical issue dimensions such as impacts and response measures. It is firmly believed that the basis for a rapid growth of news media coverage of climate change is centred on the issue attention cycle (Saunders *et al*., 2018). A study that was conducted by McComas and Shanahan (1999) shows how far the attention to climate change has advanced in the late 1980's. In the context of cyclical patterns, the progress of the coverage of climate change in news media tells the story of a fluctuating attention during the 1990s and early 2000s. A sizable number of climate change stories were already featured in news media around Europe and North America, though little was published in the developing continents. What is known about the trend in attention to climate change? The most comprehensive overview in trends in general is discussed by Boykoff and Luedecke (2016). They reflected on a range of factors that influence news media coverage of climate change that flowed from the late 1980s and carried over to the early 1990s. There seems to be a consensus that every realm from science to policy shape issue attention. Early research studies pointed out that climate change coverage itself was shaped by many influences in 1988 and 1989, from the multi- year drought in North America to the formation of the IPCC (Ungar, 1992; Boykoff, 2008).

2.2.1 Climate change in news media during the late 1980s to the early 1990s

Drought events are often identified as one of the major causes of environmental changes and socio-economic instability. This claim is supported by the account of Kogan (1995) on the droughts of the late 1980s in the United States of America. With regard to the impacts of the extreme droughts, the study highlighted profound consequences on the economy, water resources, agriculture, wildlife, and human health. Other earlier accounts, including NOAA (1988) stated that it was one of the worst disasters to hit North America during the 20th century. The disaster was perceived as an important story that put the climate change issue into the spotlight across major US broadcast television networks (ABC, CBC, and NBC) and newspapers (*The Los Angeles*, *The New York Times*, and *The Washington Post*).

In the account of Ungar (1999) about national network news coverage of extreme weather events in the US, in addition to a study conducted by Boykoff and Boykoff (2007) on climate change and journalistic norms, it is clearly articulated that drought helped to shape attention to climate change and became fundamental to the discussion of observed

climate trends in news media. According to scientific studies (Trenberth and Guillemot, 1996; Dai *et al*., 1998), it is believed that the Pacific La Niña was responsible for the extreme dry conditions.

Given a wealth of scientific knowledge on climate change issues in the late 1980s and the early 1990s (Moser, 2010), one would have expected factual indicators to be a critical component in news stories. However, a wide range of studies revealed that more attention was devoted to reporting the impacts of drought (Kogan, 1995; Ungar, 1999; Adler, 2010; Craft *et al*., 2015; Kogan *et al*., 2019). Several accounts of climate change coverage indicated that objective facts are poorly reported in mass media (e.g., Romps and Retzinger, 2019). But often the problem is a high control of debate by elite media whose main general function to report impartial stories has been labelled to be biassed.

So why is it easy to manipulate climate change information in the news media? Major media companies are owned by a few influential businessmen, and a single company can control dozens of news media outlets. Thus, the concern is centred on the potential spread of misinformation. McKnight (2010), in the journalism of opinion at News Corporation, concurred with this assertion. The study concluded that framing climate change as a political phenomenon may be a contributory factor in the sceptical coverage of the topic. However, at a political level, the first well-documented climate change testimony by the then director of the NASA Goddard Institute for Space Studies, James Edward Hansen, before the US congress received significant attention in news media (Schneider, 1988; Boykoff and Luedecke, 2016).

Towards the end of 1988, a major breakthrough in bridging the gap between science and policy was reflected through the establishment of the Intergovernmental Panel on Climate Change (IPCC) by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP). According to most accounts (Girod *et al*., 2009; Hulme and Mahony, 2010; Vasileiadou *et al*., 2011; Vardy *et al*., 2017), the creation of the IPCC opened a new era for scientific knowledge on climate change. This is due to the fact that there was an activation of the global assessment to review up to date scientific, technical and socio-economic information required to understand the impacts and risks of climate change.

In the case of effective communication of climate change knowledge, the role of the IPCC has over the years been under scrutiny. It appears to be heavily dependent on physical

scientists. This impression may be a biased one, due to the fact that the mandate of the IPCC was generally thought to have focused on identifying uncertainty regarding the current knowledge on the dynamics of climate change, and possible response strategies that could be taken to reduce the impacts of climate change. For example, some researchers argued that the IPCC ignores social scientists (Shackley and Skodvin, 1995; Yearley, 2009; Hulme and Mahony, 2010). But it is for its role in providing a number of insights into recent anthropogenic emission of greenhouse gases and placing the importance of developing international policies to protect the earth system that the IPCC is most renowned. The emergence of the IPCC was unquestionably vital to the increase in coverage of climate change in news media. As with widespread coverage of other climate change issues, the IPCC tended to be more prolific in the UK and US print media and broadcast media. In the UK, there is good evidence to suggest that the IPCC has increased climate change coverage in *The Guardian*, *The Independent*, and *The Times* (Carvalho and Burgess, 2005).

Even though the establishment of the IPCC coincided with the 1988 US presidential election, its scientific properties made it sought after by international media outlets. Previous studies on media attention to climate change coverage in the late 1980s (Boykoff and Boykoff, 2004; Carvalho and Burgess, 2005; Boykoff and Rajan, 2007), in addition to work done by Boykoff and Boykoff (2007), point to the importance of the IPCC. Generally, observations indicate that the involvement of policymakers and scientists is a feature shown very strikingly in the literature on the IPCC (Hulme and Mahony, 2010; Vardy *et al*., 2017). While Asayama and Ishii (2014) asserted that the IPCC may be pivotal in connecting science and politics, there is often insufficient attention to the role of the general public. Berg and Lidskog (2018) suggest that it is a result of power imbalances in the IPCC. Although the IPCC is dependent on the expert knowledge from the scientific community across the world to give more accurate description of new climate research findings, some observers pointed that it is mostly likely to be infiltrated by both scientific and political interests (Shackley and Skodvin, 1995; Skodvin, 2000b; Hulme and Mahony, 2010; Hughes and Paterson, 2017).

In order to prepare comprehensive assessment reports that are used to provide the global state of knowledge on issues related to climate change, the IPCC relies on three working groups. The first group, Working Group 1, is responsible for scientific assessment of the climate system and climate change. Working Group 2 seeks to improve the dissemination of scientific results on the nature of the climate system through an assessment of the societal and environmental vulnerability and adaptation to potential impacts of climate

change. Lastly, Working Group 3 provides a framework for formulation of response strategies that are linked to effective policies on the reduction of greenhouse gases (Howarth and Painter, 2016).

The earliest explanation for news media coverage of climate change in the early 1990s reflects the contribution of the first scientific report on global climate change by the IPCC, First Assessment Report (FAR). In 1990, the IPCC was recognised to be an essential part of the overall climate change in news media, particularly the release of the First Assessment Report (FAR). Although climate change news stories were highly reported in the UK (Carvalho and Burgess, 2005) and US (Boykoff and Rajan, 2007), coverage progress in Africa was very slow. This is evident in the study of English-language newspaper coverage of climate change from across five continents (Boykoff and Roberts, 2007). South Africa was among the countries with a smaller number of newspaper articles in 1990. One of the major problems in issue attention may be a combination of political unrest and poor availability of accurate data on the extent of print media coverage of climate change.

There are some important, specific topics that were pointed out by the FAR. Working Group 1 produced critical findings on greenhouse gases. This scientific group provided science-based results to validate the fact that anthropogenic activities were primarily contributing to increasing concentration of greenhouse gases in the atmosphere (Houghton *et al*., 1990; Tegart *et al*., 1990). While Working Group 1 indicated that extreme temperatures would be controlled by the rate of greenhouse gas emissions, reported information has shown a greater uncertainty about how physical processes may affect the global climate system (Najam *et al*., 2003; Verheyen, 2005; Duyck *et al*., 2018). In the case of global mean temperature, in particular over the northern hemisphere, scientists found a significant trend in annual minimum temperature rise in the 1980's. Given the scientific evidence that fossil fuel combustion was the main cause of increase in global surface temperature, experts in Working Group 1 suggested that the most rapid periods of greenhouse gas emissions occurred after the mid-1980s. This emphasis may have contributed to the coverage of problem indicators because reporting factual and baseline information requires objective science facts (Romps and Retzinger, 2019).

Although news media outlets were generally concentrating on direct quotations from the FAR without simplifying the message to the public, human-made concentration of greenhouse gas emissions led to a widespread increase in the quantity of coverage of

climate change science. Across France, Germany, UK, and US, where the topic of climate change science was already dominating mass media, major newspapers reported on greenhouse effect (Brossard *et al*., 2004; Grundmann and Krishnamurthy, 2010; Aykut *et al*., 2012; Schmidt *et al*., 2013). They include *Le Monde* (France), *Sud Ouest* (France), *Süddeutsche Zeitung* (Germany), *Frankfurter Allgemeine* (Germany), *The Times* (UK), *The Guardian* (UK), *The New York Times* (US), and *The Washington Post* (US).

Working Group 2 reported that recurring risks of adverse potential impacts of climate change can lead to serious implications in the ecosystems and biodiversity, agriculture, forestry, coastal zones, and water resources. A larger body of evidence outlined that climate change was projected to be the dominant driver affecting agricultural and forestry sectors. This is due to climatic factors, temperature and rainfall being the most critical variables influencing the agricultural sector. Clearly, future changes in mean temperature were projected to alter crop and livestock production due to increasing frequency and distribution of pests and diseases, and soil nutrients reduction, amongst other impacts (e.g., Benhin, 2006; Walker and Schulze, 2008; Blignaut *et al*., 2009; Schulze, 2010; Nesamvuni *et al*., 2012). According to Carvalho and Burgess (2005), *The Guardian* and *The Independent* newspapers in the UK were raising fears in reporting climate change. They cited one of the headlines “The greenhouse time bomb: Authors of UN report say new data shows they have underestimated dangers of global warming.” In *The Sunday Times*, however, news stories were paying more attention to both political and scientific controversy. The politics of climate change was also observed in the US newspapers, including *The New York Times* and *The Washington Post* (Trumbo, 1996; Boykoff and Boykoff, 2004).

News media coverage of climate change was also strongly linked to water scarcity. Scientific observations indicated that changes in climate may result in the decline of water resource availability in certain regions due to greater hydrological system variability. As water is a scarce resource, some studies have noted that global climate change could have exacerbated consequences for availability of drinking water and its use for agricultural purposes (Houghton *et al*., 1990; IPCC, 1992; Kusangaya *et al*., 2014). The assessments of the state of water resources in the late 1980s have suggested that sustainable water resource management is urgently needed in developing countries.

Working Group 3 recommended the development of technological approaches to mitigate emissions of greenhouse gases. Most experts involved in the outcomes of the FAR stated that improving resource efficiency is a scientifically feasible option to ensure excellence

shift from fossil fuels dependency to sustainable energy sources. The discussions captured the attention of news media due to their focus on the comparative advantages of renewable energy technologies that can be implemented to enable efficient energy production (Schneider, 2001; Nordlund, 2008). The development of photovoltaics technologies stands out as an example of innovation, associated particularly with green solutions to address the serious energy challenges facing the planet.

The importance of crop rotations has been clearly recognised by Working Group 3 in an effort to investigate agricultural potentials for mitigation and adaptation (IPCC, 1992; Verheyen, 2005). While the overwhelming majority of the climate experts acknowledged that dealing with the major impacts of global climate change on forests requires an integrated approach, the rate of deforestation had already been highlighted as a problem in tropical forests, which are exceptionally diverse, and species-rich (Lawrence and Vandecar, 2015).

Working Group 3 presented the social, economic and environmental values of forests to humans. One striking ecological service provided by the forests is the carbon sequestration, which plays an important part in climate regulation. News media reported on the proposed approaches by Working Group 3 to reduce the pressure on the forest ecosystems. One approach is to improve the efficiency of wood use. In recommending this approach, the experts took into consideration the assessment made on the high demand for fuelwood in less-developed countries. Overharvesting of wood has been a well-researched cause of decline in forests. A second approach was to strengthen afforestation to sustain forest ecosystems (e.g., IPCC, 1992; Banin *et al*., 2014). Although the process of planting trees in the tropical regions has been fairly estimated, the cost of undertaking afforestation initiatives was far less certain.

For the purpose of assessing the vulnerability of coastal areas to potential impacts of sea level rise, the Coastal Zone Management Sub-group (CZMS) of Working Group 3 recommended adaptation strategies. Across developing countries, where sea level rise was projected to affect coastal ecosystems (including mangroves and coral reefs), it was essential to develop and implement integrated coastal zone management techniques in coastal areas. The most central adaptation strategy was to strengthen sector monitoring and information sharing, particularly in developing countries (IPCC CZMS, 1990; Mimura, 2013; Pedersen *et al*., 2016). In both the UK and US newspapers, climate change adaptation has received less attention. This stands out in the body of work conducted by

Boykoff and Roberts (2007). In their examination of the *Los Angeles Times*, *The New York Times*, *USA Today*, *The Wall Street Journal*, *The Washington Post*, *The Guardian*, *The Sunday Observer*, *The Independent*, *The Sunday Independent*, *The Times*, *The Sunday Times*, and the *Financial Times*, they found that "less than 1% of newspaper reports on climate change or global warming in major U.S. and UK newspapers covered issues of adaptation'' (Boykoff and Roberts, 2007, p.6).

Following a remarkable FAR in 1990, its outcomes had an effect on many negotiations of global climate change in 1992, including the events of the United Nations Framework Convention on Climate Change (UNFCCC), and the first Rio Earth Summit or United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro. However, several scientists have raised their objections on the findings of the FAR. They argued that the IPCC report failed to document accurate climate change science (Lunde, 1991).

Although it is widely recognised that climate change sceptics influenced the rise in media attention during the early 1990s, UNFCCC and Rio Earth Summit are regarded as the two crucial drivers that shaped climate change science coverage in 1992. The fundamental discussions at the Rio Earth Summit were predominantly reported by international media outlets. It is possible that media attention could have been driven by environmental politics. In the study of the Rio Earth Summit coverage by *The New York Times*, Dalby (1996) noted that newspapers had an increasing attention to political figures. Similar patterns have been identified in the major Brazilian newspapers. For example, Reis (1999) found that scientific issues were given less attention by the *Folha de São Paulo*, and *O Globo.* In contrast, government officials were the most favourable features in the newspapers.

Despite many shortcomings in media coverage of objective science facts, some authors argued that it is a combination of a set of five agreements which made the Rio Earth Summit such a striking event to media outlets (Grubb *et al*., 2019). These agreements are likely to have attracted media attention, thus increasing coverage of climate change in the early 1990s. First is a non-binding action plan called Agenda 21. As a guiding document to achieve global sustainable development, Agenda 21 offered significant tools to tackle environmental problems (Xavier *et al*., 2019). Second, the UNFCCC notably suggested urgent actions to deal with the problem of climate change. Probably the most important of all the matters discussed in the UNFCCC is the reduction of greenhouse gas emissions (Hermwille *et al*., 2017). Third is the Convention on Biological Diversity (CBD). With a

specific focus on biodiversity conservation, CBD was established as a legal instrument to address changes in the ecosystems and biodiversity (Agrawal, 2017). The fourth agreement was the Rio Declaration on Environment and Development. Underpinning the Rio Declaration were 27 principles, covering all aspects that are related to development and environment. An interesting characteristic of the Rio Declaration was the recognition of poverty eradication. This is a vital element in sustainable development (Orellana, 2016). The fifth principle categorically stated that "all States and all people shall cooperate in the essential task of eradicating poverty as an indispensable requirement for sustainable development, in order to decrease the disparities in standards of living and better meet the needs of the majority of the people of the world" (United Nations, 2014, p.81). Lastly, the Rio Summit agreed on the principles for the protection and management of forests, the Forests Principles.

2.2.2 Climate change in news media during the mid-1990s

In a global context, a number of studies agreed that there was a sharp decline in news media coverage of climate change between 1993 and 1996 (Brossard *et al*., 2004; Boykoff and Rajan, 2007; Aykut *et al*., 2012). As seen from Boykoff (2008), the decrease in attention was constant in print media from across the continents. This is based on the results from newspapers in Australia, Canada, China, Hong Kong, Israel, Japan, New Zealand, Russia, Thailand, UK, and the US. It is consistent with the findings articulated by Mazur (1998); Carvalho and Burgess (2005); and Boykoff (2009). These authors noted the decline of climate change as a high-level environmental issue in news media.

Apart from the first United Nations climate change conference (Conference of the Parties, COP1) in 1995, the Second Assessment Report (SAR) in 1996 was also influential in the coverage of climate change (Carvalho and Burgess, 2005; Boykoff, 2007). Following the adoption of the UNFCCC by 154 countries at the Rio Earth Summit, the treaty appears to be an important pillar in the development of the Conference of the Parties (COP). During the COP1 in Berlin, many signatories to the UNFCCC were convinced that the convention did not represent a significant conclusion about mitigation of greenhouse gas emissions. It was remarked in the news media that an agreement, Berlin Mandate, was adopted in order to pay serious attention to the mandatory high-level commitment by countries to reduce carbon dioxide emissions by 20% over the period 1996 to 2005. According to Roberts and Huq (2015), the Berlin Mandate was able to present a clear consensus on the basis of improved political commitment in climate negotiations beyond 2005.

As the understanding of the impacts of climate change on the natural and social systems became better understood during the publication of the SAR, it is likely that its outcomes formed the background for climate change coverage in 1996. The report first considered the available data on the science of climate change since 1990. Thereafter, it provided an insight on the scientific basis of the impacts, adaptation and mitigation of climate change. Finally, the report pointed to the explanation of the importance of social and economic components in the case of climate change (Bruce *et al*., 1996; Watson *et al*., 1996; Ravindranath, 2010).

Most findings of Working Group 1 highlighted a steady appreciation of atmospheric concentration of greenhouse gases, including carbon dioxide, methane and nitrous oxide. A series of scientific assessments identified that a deviation to the energy balance of the earth's climate system was greatly influenced by greenhouse gas emissions in the 1980's and early 1990's. Meteorological data have shown good evidence to suggest that global temperature has increased by over 0.5◦C since the late 1890's (Schneider, 2001; Alexander, 2016).

Several analyses of the prediction and projection of future climate change have suggested that there is a continuing need to improve scientific understanding of climate models that are associated with clouds, vegetation and oceanic convection (IPCC, 2007). Other accounts of modelling of climate processes acknowledged the significant importance of clouds in the natural greenhouse effect of the earth. For example, Hansen *et al*. (1984) elaborated in their model analysis results of cloud feedback that clouds played a central role in climate sensitivity. An alternative explanation to the account for the simulated cloud feedback was through conducting General Circulation Models to represent cloud radiative properties (Senior and Mitchell, 1993; Le Treut, 2007).

It was Working Group 2 that significantly emphasised the importance of technology advancement to improve climate change adaptation. In the case of implementing technological options, it emerged that economic pressure is a key challenge in developing countries. Working Group 3 findings stated that the national actions by policymakers could improve the knowledge on climate change mitigation and adaptation measures. Depending on the accessibility of climate change information, research has revealed that society-based techniques are expected to be greater in response to impacts. In developing countries, capacity building is a major hindrance in facilitating mitigation and

adaptation responses due to limited financial resources and lack of education (Watson *et al*., 1996; Fankhauser and Tol, 1997; Siebenhuner, 2002).

Experts in Working Group 3 categorically reported the possibility that usability of knowledge on the climate sensitivity to greenhouse gases might explain the significance of adoption of mitigation and adaptation measures to aid in understanding the essential principles of climate change. It has also been suggested that knowledge on improving energy efficiency may be equally important. It was noted that there is a need to prioritise research in social and economic issues in an interdisciplinary manner to reveal challenges and opportunities of climate change (Stern, 2007; Sriver *et al*., 2018). In particular, sustainable energy and green technology initiatives can inform decisions that will greatly improve the quality of life. However, climate change mitigation measures were not highly visible in the news media in 1996 yet there were talks on political commitment. Furthermore, trends in coverage of climate change did not differ significantly throughout the globe (e.g., Boykoff and Roberts, 2007), suggesting that the issue was not attractive in news media. The fundamental explanation can be found in the issue-cycle attention conceptual model by Downs (1972). Very briefly, the decline of issue interest is driven by agenda setting (Schäfer *et al*., 2014). Boykoff (2011) offers a particularly useful account of the rise and fall of climate change issue attention in the UK and US newspapers.

Although the coverage of climate change remained fairly low in the late 1990s, a slight peak in news media attention was recorded in 1997 (Boykoff and Boykoff, 2007; Schmidt *et al*., 2013). Much of the coverage was associated with the COP3 in Kyoto, Japan. Why was this meeting so special, and how did it differ from the previous conferences? The conference is renowned for the adoption of the first international treaty on climate change, the Kyoto Protocol (Dessai *et al*., 2003; Gupta, 2010). The main interest was on the development of mechanisms that are of particular significance to the reduction of atmospheric concentration of major greenhouse gases, including carbon dioxide, methane and nitrous oxide. During the Kyoto conference, there was a shift of view towards the climate change issue. The focus on global climate policies is therefore thought to have accumulated interest in news media. However, the presence of more than 3000 international journalists was an important part of the conference and may have resulted in increased coverage of the climate negotiations.

Turning to the core principles of the Kyoto Protocol, a considerable number of studies echoed that the agreement was a key developmental stage to inform actions on global

climate change (Michaelowa and Rolfe, 2001; Grubb *et al*., 2018). Sampei and Aoyagi- Usui (2009) wrote at the start of their study on mass media coverage and public awareness of climate change in Japan: “The Kyoto Protocol came into effect in February 2005. It obliges developed countries (Annex I countries) to reduce their greenhouse gas (GHG) emissions by at least 5% below 1990 levels in the first commitment period (2008 to 2012). Japan is required to attain a 6% reduction’’ (Sampei and Aoyagi-Usui, 2009, p.203). Other evidence also attests to the importance of the Kyoto Protocol in media attention to climate change across the globe. Schmidt *et al*. (2013), reflecting on newspaper coverage from 27 countries, acknowledged that the treaty was an important feature in print media between 1996 and 2010. However, the study identified that there was an inequality in newspaper coverage of climate change in 1997. For example, most of the coverage was observed in newspapers from Australia, Canada, UK, and US. Part of the reason for poor coverage in countries like South Africa may be lack of data.

2.2.3 Climate change in news media during the late 1990s to 2005

There seems to be evidence of significantly less attention to climate change for the period 1998 to 2003 (Lyytimäki, 2011; Bohr, 2020). It has been noted that COP and the IPCC remained central in news media coverage of climate change. Following the COP3, the Kyoto Protocol formed a strong foundation for the fourth Conference of Parties (COP4) meeting in Buenos Aires, Argentina. During the conference, the main interest was on the development of mechanisms that are of particular significance to Kyoto Protocol implementation (Gaan, 2008). One striking feature of the COP4 is the adoption of the Buenos Aires Plan of Action. This is known as the action plan that built up on the emissions reduction targets set by the Kyoto Protocol and reflects the need to establish deadlines for various important issues, including financial mechanisms, policy development and transfer of technology (Bodansky *et al*., 2017). As with the widespread global call to increase negotiations on the reduction of the greenhouse gas emissions, during the fifth Conference of the Parties (COP5) which was held in Bonn, Germany, there was a considerable agreement to put the Kyoto Protocol into practice before its enforcement.

In 2000, the sixth Conference of the Parties (COP6) was held in The Hague, Netherlands. The COP6 is thought to have attempted to conclude the Kyoto Protocol negotiations which started in 1997. However, the US requested a special treatment to avoid meeting certain emissions reduction targets. Most countries dismissed the request, including those

from the European Union (Fisher, 2004; Buhr *et al*., 2014). After several different approaches to convince the US, the conference was halted. Meanwhile, in an attempt to revive the failed negotiations in The Hague, another COP6 took place in Bonn. From this second meeting, an agreement, Bonn Agreement, was adopted by all participating nations with the exception of the US (Afionis, 2017). This agreement was aligned with the previous negotiations and informed the ratification of the implementation of the Kyoto Protocol mechanisms.

During the early 2000s, the rising concentrations of greenhouse gas emissions influenced the principles of the Kyoto Protocol. In 2001, the IPCC reported the results of a five-year (1995-2000) research on climate change by an international team of experts. The Third Assessment Report (TAR) provided details on the projection of the future climate change across the globe. Although the Second Assessment Report (SAR) stated that the climate system is changing due to global temperatures that have been increasing over the last century, TAR concentrated specifically on the analysis of paleoclimate to improve the knowledge of climate change projections so that policymakers have prerequisite understanding of the future changes in the climate (Kutney, 2014; Orrego *et al*., 2016).

The experts in Working Group 1 found that the global surface temperature has increased at an average rate of 0.6◦C per year during the latter years of the 20th century. This surpassed the SAR estimation by over 0.1◦C. It is likely to have significantly contributed to the warmest year (1998) during the period of data collection (IPCC, 2001; DeLeo, 2015).

The findings of Working Group 1 emphasised the important aspects of the primary role of burning fossil fuels and clearing of forests in carbon dioxide emission. The TAR has estimated that the concentration of carbon dioxide increased by approximately 0.4% per year since the 1980s. Tracking the annual trends in the concentration of carbon dioxide in the 1990s, TAR indicated a variability of about 0.2% to 0.8%. With respect to atmospheric concentration of methane, estimates revealed a growing body of evidence that suggests that there was an increase of more than 50% in the 1990s in comparison to the 1980s. This gas has been introduced in the atmosphere over the years, especially from agriculture and landfill activities (IPCC, 2001; Green and Armstrong, 2007).

Working Group 2 presented major findings on how current and future changes of climate extremes could affect social and natural systems. It reported the mounting evidence which suggests that climate variability and change can influence the frequency of extreme

events such as droughts, floods, storms and heatwaves. The report noted that extreme weather events during the 21st century are projected to bring potential impacts in sectors such as water resource, agriculture, terrestrial and freshwater ecosystems, amongst others (IPCC, 2001; Mishra, 2016).

As part of its commitment to ensuring assessment of the scientific technical, environmental, economic and social aspects of the measures taken to reduce the impacts of climate change, Working Group 3 presented its results of the recent knowledge, in comparison to the findings outlined in the previous assessment report, SAR. Several other important issues of energy development were discussed in an attempt to create a cogent approach to reduce cumulative greenhouse gas emissions. For example, the main factors that will facilitate energy efficiency in any particular region or country are innovative and green solutions. The striking outcome of the TAR findings is that there is no significant difference compared to the SAR (IPCC, 2001; Corbera *et al*., 2017). During the same year (2001), the UNFCCC held its seventh session of Conference of the Parties (COP7) in the Moroccan city of Marrakech. To better understand the legal implications for the implementation of the Kyoto Protocol, the COP7 reached an agreement known as the Marrakech Accords (Hovi *et al*., 2016). This agreement demonstrated a clear need to move towards an integrated framework for capacity building to meet the emissions reduction targets.

Following the Marrakech Accords in the COP7, Delhi hosted the COP8 in 2002. While the delegates concurred that new technologies are significantly influential in the quest for solutions to reduce greenhouse gas emissions, an important step of the COP8 was the adoption of the Delhi Ministerial Declaration on Climate Change and Sustainable Development (Afionis, 2017). The declaration hypothesised that a key issue for effective reduction of greenhouse gas emissions is the need to strengthen the transfer of innovative technologies in developing countries. Agreements by the delegates indicated that developed countries should provide technical and financial resources to support the implementation of sustainable technologies, especially in developing countries (Warner and Zakieldeen, 2012).

In December 2003, COP9 was held in Milan, Italy. Despite recent increases in political commitment towards ratification of the Kyoto Protocol, there was an unclear framework on the issues associated with funding developing countries (Castro, 2014). Before discussing the financial issues, the European Union requested that countries should abide by the

National Adaptation Programmes of Action (NAPA), which is regarded as a working programme that was adopted at the COP8 to support Least Developed Country Parties (LDCs). As the COP7 has demonstrated that afforestation and reforestation are important sinks to achieve Clean Development Mechanism (CDM), participating countries in the COP9 agreed that a standard baseline is essential for all CDM activities (e.g., Castro, 2014; Roberts and Huq, 2015).

With increasing global temperatures, 2003 was the third hottest year on record. The health impacts of the European heatwave of 2003 were reported across the most affected countries, including France (Vandentorren and Empereur-Bissonnet, 2005). However, the climate change issue was outcompeted by politics and sports news in the media. This is likely to be due to an increase in the frequency of political and sporting events. It can be argued that the decrease in climate change coverage may be attributed to the media attention on the war in Iraq and Rugby World Cup in Australia.

Global climate change-related stories started to rise in 2004 (Grundmann and Krishnamurthy, 2010; Boykoff, 2011; Schmidt *et al*., 2013). It is important to note that COP10 in Buenos Aires, helped to shape the preparation for the Kyoto Protocol enforcement in 2005. This has been attributed to the suggestion of a policy-based climate change adaptation framework that goes beyond 2012. Adaptation options were recognised to be the essential part of the overall global climate negotiations during COP10.

After the Kyoto Protocol enforcement in February 2005, the eleventh Conference of the Parties (COP11) in Montreal, Canada, became the cornerstone of the agreement. The COP11 meeting was held in conjunction with the first Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (CMP1). For many years the US, although reluctant to accept the Kyoto Protocol, continued to be part of negotiations as an observer (Zolin and Rodrigues, 2016). The Kyoto Protocol gained more visibility in news media probably because the COP11/CMP1 renewed greater global-wide focus on the reduction of greenhouse gas emissions. For example, the delegates adopted major actions to deal with all the interlinked issues that were discussed over the past seven years. These include development of functional mechanisms to aid the operation of the agreement. The parties to the Kyoto Protocol agreed that financial resources are urgently needed from the Global Environment Facility (GEF) to fund operationalisation of the projects which are aimed at addressing the adverse effects of climate change.

2.2.4 Climate change in news media in the mid-2000s to 2008

The release of the film, An Inconvenient Truth, by the former US vice president, Al Gore, together with the publication of the report on the economics of climate change by the British government or the Stern Review, and COP12 in Nairobi, received significant attention in 2006 (Boykoff and Roberts, 2007; Sampei and Aoyagi-Usui, 2009). The causes, impacts and projections of climate change were combined by the film to highlight the global crisis. Central to the message of the film was the affirmation that human activities were contributing to the global temperature rise. The film was not the first to note human-induced concentrations of greenhouse gases. It benefited from scientific consensus which strongly suggested that temperature has increased due to carbon dioxide emissions from combustion of fossil fuels (IPCC, 2001). The content of the film was not significantly different from prior reports by the IPCC. On the issue of the Stern Review, the 700-page report was the largest and most important work by economists, which provided compelling evidence on the costs of addressing global climate change. It should be noted that the report was able to present climate change as an economic issue. The report showed an improved understanding of the connection between science and economics. According to the outcomes of COP12, more than eight decisions were made to present an elaborated resolution that will assist countries to adapt to the effects of climate change. The Nairobi Work Programme (NWP) on the impacts, vulnerability and adaptation of climate change is amongst the commonest initiatives adopted during COP12 and is probably of the greatest importance for adaptation actions in the developing countries (Markandya *et al*., 2014). One of the critical issues that NWP was meant to address, and one that is crucial to other meetings, is the distribution of climate change adaptation knowledge.

In their study on newspaper coverage of climate change in 50 newspapers from 25 countries across 6 continents for the period 2004 to 2015, Boykoff *et al*. (2015) found that there was a general sharp increase in the coverage of climate change between 2007 and 2008. However, their results revealed that this significant rise was in Oceania, Europe and North America. A previous study by Schmidt *et al*. (2013) presented similar findings, based on a combination of newspapers from 27 countries.

Knowing the nature of issue attention by news media, it is essential to determine international events that may be attributed to climate change issue coverage. In its Fourth Assessment Report (AR4) published in 2007, six years after the TAR, the IPCC through its three working groups gave an integrated description of the observed changes in

climate and their effects, climate change impacts vulnerability, and mitigation and adaptation options (IPCC, 2007; Gleditsch and Nordas, 2014).

Although the warming of the earth system has been outlined by the TAR, observed long-term changes from 1995 to 2006 have continued to give evidence on the warming trends at both regional and global scales. Working Group 1 data indicated that the greatest warming trend was recorded in the Arctic region. It further revealed that there was a positive correlation between warming and sea level rise. The latter increased at a global average rate of over 3mm from the early 1990s to 2003 (IPCC, 2007; Nouaceur and Murarescu, 2016).

Between 1900 and 2005, variability in precipitation has been observed in some major regions across the globe. Scientists reported a significant decrease of precipitation in southern Africa over the period 1955 to 2005. The immediate explanation of many scientists was associated with changes in extreme weather events (IPCC, 2007).

Many of the climate change impacts that affect human and natural systems, and various sectors were reported in the findings of Working Group 2 (Li *et al*., 2015; Alves *et al*., 2017). In this report, it was noted that the increasing global temperature of about 2°C is projected to be linked to extinction of some endemic plant and animal species during the 21st century. However, some scientists warned that estimating future extinction rates is a lengthy and tedious process. It has been further demonstrated that climate change is projected to have consequences for food production (Abera *et al*., 2018). It is critically important to emphasise that the potential health risks are particularly high for millions of people in developing countries. This is largely because of poor infrastructure to deal with vector diseases such as malaria. Cardio-respiratory diseases were described by Working Group 2 as the most health risks in urban populations due to increasing frequency of extreme weather events, including heatwaves (Paz *et al*., 2016; Davis-Reddy and Vincent, 2017).

Working Group 2 experts have projected that climate change is likely to have an increasing impact on human and natural systems in all major global continents. In Africa, climate change research suggested that more than 300 million people will experience severe water shortages by 2020 (Kusangaya *et al*., 2014; Davis-Reddy and Vincent, 2017). One projection was of a 50% decline in agricultural productivity. Further insight

illustrated that food security was also expected to be significantly affected by climate change (Masipa, 2017).

For the purpose of responding to climate change, Working Group 3 experts reported that effective implementation of mitigation and adaptation options will reduce both short and long-term vulnerability to climate change (IPCC, 2007; Pattberg and Zelli, 2015). Changes in consumption and production patterns are probably of the greatest importance to climate change mitigation. Although it is difficult to change lifestyle patterns, individuals and communities' commitment is necessary to influence effective mitigation strategies. However, there may, in addition, be a critical role played by principles of action that primarily focus on adoption of activities which reduce the quantities of greenhouse gases in the atmosphere. For example, investment in new technologies with low greenhouse gas emissions can contribute to climate change mitigation across a range of sectors and industries (Hart, 2015). Analysis of climate policies and instruments demonstrated that mitigation actions require an integrated approach because they vary widely between countries. Because of the complex interrelationships between a number of factors such as social and economic, most adaptation options are difficult to implement (Davis, 2011; Minx *et al*., 2017).

In the TAR, one of the fundamental issues in society has always been their adaptive capacity to impacts of climate change. This is similar to the findings of Working Group 3 in the AR4. To explain the relationship between mitigation and adaptation options, some vital results were presented to validate the point that sustainable development is critical to address aspects of societal, economic and environmental vulnerability to climate change (Zhou *et al*., 2014).

To contribute to solving the climate change problem, basic understanding of the phenomenon has been acknowledged as a first step. The IPCC and Al Gore were recognised by the Nobel Peace Prize 2007 for their role in disseminating climate change knowledge. This award tends to have given rise in attention to the climate change issue in news media. Another important event is the Bali climate change conference (COP13). The conference was a fertile ground for exploring the idea of defining a clear pathway on greenhouse gas emissions mitigation actions, in response to the realisation that the targets of the Kyoto Protocol were effectively focussing on the period 2008 to 2012 (Aldy and Stavins, 2010; Roberts and Huq, 2015). Many participating nations agreed that the ultimate goal should be to achieve emissions reduction targets beyond 2012. What

followed was adoption of an agreement, the Bali Action Plan, which was a roadmap aimed at working towards building effective mitigation negotiations post-2012 (Nanda, 2017).

Since the enforcement of the Kyoto Protocol in 2005, significant progress was made in climate change visibility in the media. The presence of climate change issues in the speeches of American politicians cannot be underestimated as a driver of news media attention. Despite the global financial crisis in 2008, it was common to read messages that acknowledged the existence of climate change. In May, former presidential candidate, John McCain, started to encourage actions to reduce greenhouse gas emissions, and was later joined by his opponent, Barack Obama, in August. The UK Climate Change Act 2008 also led to a steady increase in the coverage of climate change. The act outlined specific information concerning the carbon targets, impact and adaptation to climate change (Lorenzoni and Benson, 2014). With this context, it is unsurprising that this piece of legislation became a valuable feature in different types of news media outlets in the UK.

The 14th climate change conference in Poland (COP14) caused further rise in climate change stories. It involved an attempt to find a substitute for the Kyoto Protocol. The global financial crisis and recession in 2008 constituted an additional burden in the financial resource's instability for the realisation of the Kyoto Protocol replacement (Rashid and Paul, 2014; Singh *et al*., 2016). For this reason, there is a wide acceptance that COP14 made little progress in global climate negotiations.

2.2.5 Climate change in news media in 2009

Through reflection of coverage in 2009, it was established that the year had a dwindling number of climate change stories during the first quarter. With the rapid increase in attention to the newly elected first African-American president, Barack Obama, since January 2009, climate change has gone from being a leading topic to a sporadic feature in a wide range of international news media outlets. Although the issue-attention rapidly declined in the early months of 2009, it skyrocketed in December. In their global monitoring of media coverage of climate change from more than 100 sources across 7 continents by the Media and Climate Change Observatory (MECCO) at the University of Colorado, Boykoff *et al*. (2018) were in agreement with the trend. With regard to the world newspaper coverage of climate change, MECCO is an interesting source of datasets. It is arguably one of the largest sources that have been providing reliable data on global newspaper coverage since 2004.

During the last months of 2009, some focusing events were critical in the coverage of climate change. In November 2009, there was an acrimonious argument over the leaked emails of climate scientists from the Climatic Research Unit (CRU) at the University of the East Anglia, England. This controversial event, “Climategate,” has claimed that scientists colluded in climate data manipulation (Maibach *et al*., 2012; Grundmann, 2013). A number of climate science sceptics used hundreds of the published emails to oppose scientific evidence on man-made climate change. Consequently, the “Climategate” is without its climate negotiations consequences and there has been considerable disagreements during COP15 in Copenhagen, Denmark.

Greenhouse gas emissions and the Kyoto Protocol continued to be the critical issues of the climate talks. In an effort to explore an integrated agreement to replace the Kyoto Protocol, the COP15 delegates orchestrated a political agreement, Copenhagen Accord. The aim of this framework was to strengthen reduction targets by countries which constitute more than 80% of the global greenhouse gas emissions. Reduction targets were selected to be achieved by 2020 in comparison to the past emission levels of 1990, 2000, and 2005, respectively (Falkner, 2016). A number of the parties to the conference objected to the adoption of the Copenhagen Accord because it failed to outline a legal binding mandate for future commitment.

2.2.6 Climate change in news media after COP15

Some evidence suggests that attention to climate change was at its low over the period 2010 to 2015. However, observations have shown an increase in December 2015. How does the story of COP fit in this period? Towards the end of 2010, COP16 meeting in Cancun was a consistent presence in news media (Arcila-Calderón *et al*., 2015). The conference stressed that commitments for reduced emissions can be achieved by strengthening climate finance and facilitating multilateral climate frameworks. The delegates agreed on a set of decisions, Cancun Agreements, to develop appropriate actions of mitigating the impact of global climate change.

The establishment of a new legally binding agreement was a central theme during COP17 in Durban, South Africa. One striking feature of the conference was an emphasis on the achievement of the emissions reduction targets (Parker and Karlsson, 2018; Chan *et al*., 2018). The commitment to the second phase of the Kyoto Protocol was a key point in

climate talks at the 18th climate change conference (COP18) in Doha, Qatar. In this session mention was made of the importance of extending the Kyoto Protocol by another seven years (2013-2020). During COP19 in Warsaw, a plan of action was drawn up to point the way forward for the adoption of a new global agreement in 2015. But it was with the Warsaw International Mechanism for Loss and Damage linked to the impacts of climate change, established by the COP19, that the subject of an integrated approach to address adverse effects of climate change was incorporated into the discussion on adaptation strategies (Gewirtzman *et al*., 2018).

The fundamental question concerns the impact of the IPCC report on news media coverage of climate change in 2014. While previous work has shown the influence of the AR4 in climate change coverage (Fernández-Reyes *et al*., 2015), the Fifth Assessment Report (AR5) was not significantly effective in accelerating issue attention in news media. Surprisingly, the points the report brings out were the importance of understanding climate change risks and uncertainties (Mach *et al*., 2016; O'Neill *et al*., 2017).

In the AR5, Working Group 1 offered an outstanding assessment of the state of warming atmosphere and ocean from 1880 to 2012. The rapid decrease in snow and ice proved that global sea level should be expected to rise over long time periods. The findings and recommendations of Working Group 1 had a broad impact in climate science because they have shown how land and ocean surface warming is a consequence of rising global temperature of almost 0.9°C (Pearce *et al*., 2014; Mayer, 2015). It is through a range of multiple studies conducted by Working Group 1 that the decrease of ice sheets has been strongly elaborated between 1992 and 2011. The major region of interest to climate scientists was the northern Antarctic Peninsula. The loss of the ice sheet was recorded to be larger from 2002 to 2011. With details of the ice sheets losing mass and retreating glaciers outlined, evidence attests that they accounted for a significant global mean sea level of 0.19 metres over the period 1993 to 2010 (IPCC, 2014; Orrego *et al*., 2016). As population and economy continued to grow, human-induced greenhouse gas emissions have been accelerated between 2000 and 2010. The level of concentrations of three major greenhouse gases (carbon dioxide, methane and nitrous oxide) appears to have been increasing at an alarming rate from 2002 to 2011. Much of carbon dioxide emissions were from burning of fossil fuels and other industrial activities. Total annual anthropogenic greenhouse gas emissions data revealed a contribution of almost 80% between 2000 and 2010 (Marotzke *et al*., 2017).

In the accounts of scientists in Working Group 2, a steady increase in anthropogenic emissions of greenhouse gases is the principal driver of projected long-term climatic changes. It is more important to emphasise the fact that understanding the nature of projected changes is essential to determine the level of risks of adverse impacts from climate change (Barros *et al*., 2017).

In previous reports, climate models that reliably project changes in temperature, including General Circulation Models (GCM), have appeared to be useful tools in assessing future climate change. Some evidence suggests that the use of Representative Concentration Pathways (RCPs), a set of scenarios that have been produced with the aid of Integrated Assessment Models (IAMs), provided an insight on the pathways of greenhouse gas emissions in the 21st century (IPCC, 2014). In both terrestrial and marine ecosystems, species were projected to face irreversible change throughout the 21st century (Davis-Reddy and Vincent, 2017). Critically endangered marine species in low-lying coastal areas were highly likely to be affected by the large impacts of climate change. Due to changes in ecosystems and biodiversity, fisheries productivity was expected to decrease (IPCC, 2014). Working Group 2 concluded that water and food security will be threatened by climate change.

Since the publication of the AR4, most scientists who assessed the adverse impacts of climate change on food production and water availability concurred that major risks in the developing countries include decreasing crop yield, and deteriorating water availability and supply (O'Neill *et al*., 2017). This was likely to adversely affect efforts to reduce poverty. Water-borne diseases generally increase when people are exposed to increasing temperature and change in rainfall patterns. A number of regions were already experiencing the changes and Working Group 2 projected a rapid spread of diseases beyond the 21st century (IPCC, 2014; Paz *et al*., 2016).

As studies on reducing and managing risks of climate change have demonstrated, mitigation and adaptation strategies require effective approaches to limit greenhouse gas emissions and abate impacts of climate change (Davis, 2011; Minx *et al*., 2017). According to Working Group 3 (IPCC, 2014), the mitigation and adaptation options considered so far, as well as most of the initiatives for addressing climate change, need to be strengthened to avoid irrevocable impacts. In addition to the projection of continued warming beyond the 21st century, it should be noted that Working Group 3 outlined that lack of cross-sectored mitigation approaches will significantly lead to further difficulties of

dealing with estimated warming of over 4◦C in 2100 (Princiotta and Loughlin, 2014). Many examples of mitigation pathways to limit warming have been elaborated. Arguably one of the most appropriate pathways of mitigating greenhouse gas emissions is afforestation. The introduction of Carbon Dioxide Removal technologies was considered to be a growing pathway for climate change mitigation (IPCC, 2014). The ways of adapting to climate change can be traced to several paths. First, it is essential to start with the reduction of vulnerability to climate change and variability. It is worth remembering that adaptation responses have to be integrated into policy implementation. Second, the promotion of sustainable development should be undertaken by connecting a wide range of social, environmental, economic, and technological factors that are framed to enhance adaptation implementation. The close links between mitigation and adaptation are of primary importance for policymakers. Despite the apparent supplementary degree of mitigation and adaptation strategies, a greater challenge is dealing with complex conflict of interests (Millar *et al*., 2017; Vardy *et al*., 2017).

As the 2014 COP20 began in Lima, Peru, the question of progress in pledging financial resources in the Green Climate Fund (GCF) had become a prominent feature (Leal Fihlo, 2015). Compared with many of the climate change conferences held over the past decade, the Lima conference was identified as a key session that is vital for giving a logical framework towards a global climate agreement in Paris, France. From the point of view of the delegates to highlight key negotiation areas in which attention is needed ahead of the Kyoto Protocol replacement in 2015, a decision, Lima Call to Climate Action, was set up to lead the process (Harris, 2016). The most ambitious point outlined by the Lima Call to Climate Action was an attempt to establish synergies among previous emission reduction targets (Cherian, 2015). The priorities listed in the Lima Call to Climate Action cannot be called a step towards achieving emission reduction – they were just plans which do not provide any legal background for the introduction of a new global climate agreement. It can be safely stated that the conference had no significant influence in increasing climate change issue attention. However, it is likely that COP21 in Paris, in particular the Paris Agreement, attempted to catalyse a growth of climate change stories in news media. Most, if not all, of those who participated in the meeting agreed on achieving a target of limiting warming below 2◦C. Despite the fact that the COP21 meeting appeared to have provided an opportunity for international news media to report the information on climate change knowledge, the level of coverage continued to be generally low across the globe (Boykoff *et al*., 2018).

Media coverage of climate change stayed low between February and October 2016. Although there was a slight improvement in the number of climate change stories during the last two months of 2016, issue attention dropped compared to the previous period in 2015. There is little evidence to support the claim that COP22 played a critical role in sustaining coverage of the climate change issue. This is contrary to the basic fact that previous studies have suggested that media coverage was directly dependent on climate change events (Liu *et al*, 2008; Schmidt *et al*., 2013; Fernández-Reyes *et al*., 2015; Metag, 2016; Eskjær, 2017). But what happened during the COP22? While it is necessary to consider the importance of financing climate action, discussions in COP22 showed very little progress on the financial commitments made by developed countries in the previous meetings.

The conclusion that a shift to a green economy requires a system approach to sustainability has led to a new high-level political endorsement known as the Marrakech Action of Proclamation (Scavenius and Rayner, 2018). It was generally agreed that linking global climate agreements with existing initiatives will increase Sustainable Development Goals implementation possibilities. The conference may therefore turn out to be repeating the storyline on climate change that was already known by news media outlets.

2.3 Newspaper portrayal of climate change science in Europe and North America

This section aims to describe gaps in existing research between 1996 and 2016. The period was chosen to achieve the objectives of the study. Since the early 1990s, Europe and North America were acknowledged as the leading continents in climate change coverage (Boykoff *et al*, 2020). Although a number of studies have outlined different perspectives in newspaper portrayal of climate change science, there is limited body of work thus far that provides an authoritative account of objective facts of climate change in the press. The section is delving into scholarly work on broadsheet newspaper coverage of climate change. It is worth mentioning that the section looks at key studies regarding newspaper attention to climate change science in Europe and North America.

2.3.1 European press coverage of climate change

Scholarly research highlights that key work by Carvalho and Burgess (2005) was influential among scholars in Europe. A central issue in their study involves the

understanding of the attention that was paid by the UK newspapers from the mid-1980s to the early 2000s. The aim of the study, from which data was collected from a total of 5913 articles published in three major broadsheet newspapers (*The Guardian*, *The Independent*, *The Times*) for the period 1985 to 2003, was to provide an analysis of climate change representation in the UK press. Their results show an overall poor attention in 1996 across all the newspapers. In 1997, a rise in the number of climate change articles was recorded. Generally, the articles were based on the political dimension of the Kyoto Protocol or COP3. In an earlier study on press coverage of climate change in France and USA from 1987 to 1997, Brossard *et al*. (2004) demonstrated similar findings in the leading French newspaper, *Le Monde*. COP3 was also a major feature for most of the newspapers in Germany (*Der Spiegel*, *Die Tageszeitung*, *Frankfurter Allgemeine Zeitung*) and Switzerland (*Neue Zürcher Zeitung*) during the late 1990s and early 2000s. For instance, Grundmann (2006) noted a significant rise in coverage of climate change in 1997. Newspapers typically focus on event-based reporting. According to Carvalho and Burgess (2005), UK press coverage of climate change reached its peak in 2001 (it is thought to have been influenced by the TAR). A key message is clear: increased attention has been directed toward political and economic frames. The coverage of climate change impacts was closely linked to the floods of 2000 and the 2003 European heatwave.

Evidently, newspapers in other European countries have shown a similar issue attention pattern. In an authoritative study on the controversies of climate change coverage in French press over the period 1990 to 2010, Aykut *et al*. (2012) found that attention of three major newspapers (*Le Monde*, *Sud Ouest*, and *L'Express*) was arguably influenced by the impacts of a strong winter storm in 1999 and a heatwave in 2003. COP3 continued to dominate news stories in French newspapers. The role of the first French climate plan, COP6, COP7, and TAR in shaping climate change coverage was pointed out.

With an increasing recognition of the importance of the climate change issue in newspapers, widespread attention in Europe has been increasingly putting a strong emphasis on political and social agenda. Across Scandinavia, a number of studies found that newspaper coverage of climate change started to show significant growth between 2006 and 2007 (Lyytimäki and Tapio, 2009; Lyytimäki, 2011; Shehata and Hopmann, 2012; Schmidt *et al*., 2013). This may be due to the fact that COP12 and COP13 were increasingly being recognised in the Danish, Finnish, and Swedish newspapers. For example, a study conducted in Finland on newspaper coverage of the UN climate change

conference found that issue attention reached two major peaks in 2007 and 2009 (Kumpu, 2016).

The publication of the AR4, Climategate scandal, and COP15 certainly helped to shape the coverage of climate change. This is consistent with other studies in the UK and Spain. However, politics dominated the news stories. Indeed, the failure of newspapers to pay attention to in-depth analysis of observed climate trends, climate change impacts and projections, leads to the conclusion that insufficient objective facts are disseminated. For at least a decade, COP meetings have been a prominent part of climate change reporting in most European news outlets and received the highest peak in 2009. It is the period of heightened political agenda and negligence of the actual science of climate change. During COP15 in Copenhagen, politics received more attention in the European newspapers. By this time news stories quoting climate scientists and experts had become rare. This has exposed the extent to which newspapers were covering climate change science. It is factually sensible to state that news outlets were highly interested in political frames (Shaw, 2013). Whilst climate action remains a major objective for COP meetings, Shaw (2013), in a study of 12 UK national newspapers and BBC News online, expressed that few newspapers shifted away from political and social agenda in their approach to reporting climate change. Although they were still grappling with fear-based communication, broadsheet newspapers frequently cited scientific analysis. For example, *The Guardian* used a neutral to positive tone in the coverage of climate change by drawing attention to scientific results and implications of the changing climate. However, there was considerable exaggeration of climate change threats in tabloid newspapers. For instance, *The Sun* attempted to take further action by warning readers of a threatening climate catastrophe beyond 2°C. Tabloids have been demonstrated to pay less attention to climate change, including observed climate trends (e.g., Carvalho and Burgess, 2005). However, the topic became the dominant headline across European broadsheets and tabloids during COP15. Climate controversies paved the way for a greatly improved coverage of climate change in news outlets. Why was climate change an issue of interest in Europe? Compared to the previous year of 2008, there are two fundamental reasons in favour of rising attention in Europe in 2009. First, the climate science scandal involving UK scientists from the University of East Anglia's Climate Research Unit garnered significant coverage in the leading newspapers *(*Bowe *et al*., 2014). So where did the story end? The scientists were cleared by a six-month inquiry which examined the allegations. The Muir Russell Report was released in July 2010 (Garud *et al*., 2014).

Second is the Copenhagen conference (COP15) in December 2009. According to Mulaudzi and Kioko (2020), COP15 was critical to newspaper attention devoted to climate change issue in leading European newspapers – including *The Times* in the UK, *Le Monde* in France, *Süddeutsche Zeitung* in Germany, *The Irish Times* in Ireland, *Helsngin Sanomat* in Finland, and *El Pais* in Spain (Schmidt *et al*., 2013; Kumpu, 2016; Saunders *et al*., 2018). Similar accounts have also been observed in the Scandinavian major newspapers including the *Berlingske Tidende*, and *Politiken* in Denmark (Eskjær, 2017), and *Helsingin Sanomat*, in Finland (Kumpu, 2016).

The disagreements between political actors received much more attention than the scientific aspect of climate change. COP15 gained more prominence in the European press because the meeting was criticized for its insufficient progress during the negotiations to strengthen climate actions. Furthermore, comprehensive coverage of climate change science objective facts was again neglected in the press. Although in the UK some factual and baseline information was reported, for example in *The Guardian*, continental and global progress was very slow (Saunders *et al*., 2018). Political and social agenda persisted in spite of available scientific knowledge on observed climate trends and climate change impacts between 2010 and 2016. Some studies reported that a handful of objective facts appeared in the UK newspapers. The main downfall is offered by Shaw (2013), who argued that newspapers focussed primarily on the use of unnamed scientists and experts in their coverage of greenhouse emission reduction targets. Despite some growing number of scientific publications between 2000 and 2012, the study suggests that politics and economic dimensions continued to prevail.

Although there was a global decrease in climate change coverage after the first quarter of 2010, there seems to be a general consensus among scholars that scientific dimension was not persistent in newspapers across Europe. Several factors have been mentioned to play a role in poor attention to objective facts, including lack of correspondents who are specialists in climate change, and general domination of politics in news outlets. Politicians have for decades been the most cited key actors in news stories pertaining to climate change. However, studies have found that the COP meeting is considered an important catalyst for driving the issue of climate change (Schmidt *et al*., 2013; Kumpu, 2016). In the context of coverage of observed climate trends, climate change impacts and projections, it has been illustrated that their attention has been pushed into a stagnation state. It is no surprise to witness that between February 2010 and November 2015 European newspapers coverage was at its lowest point (Boykoff *et al*., 2020). It is still unclear how the publication of AR5 in 2014 failed to boost climate change issue attention

in the press. The portrayal around climate change in the European press was, from the very beginning, a political-driven agenda. Although it is difficult for news outlets to simplify science findings, coverage of climate change is also powerfully influenced by their worldviews. Given that COP15 increased attention of climate change in Europe, it was not expected that a sharp decline would take place during COP16 in Cancun, COP17 in Durban, COP18 in Doha, COP19 in Warsaw, COP20 in Lima, COP21 in Paris and COP22 in Marrakech. Despite a resuscitation of coverage of the climate change issue during COP21, a meeting which was held on European soil, Lidberg (2018) argued that news stories about basic objective facts were underreported. Some improvement was, however, made by a few broadsheet newspapers, including *The Guardian* (Hulme, 2016). This shows that with sufficient effort climate change science objective facts can be significantly reported.

2.3.2 North American press coverage of climate change

North American press coverage of climate change has already increased during the period 1996 to 2016. Given that political actors received more attention in major US newspapers, it was perhaps unsurprising that in 1997 the politicisation of climate change was sustained. During the Kyoto conference (COP3), climate change became a common issue in the press. Because of COP3 having pioneered the first climate change treaty, it dominated news stories. And how did it impact newspaper coverage? In the examination of climate change issue attention by *The New York Times* for the period 1987 to 1997, Brossard *et al*. (2004) demonstrated a significant peak in 1997. A similar trend appeared in *The Washington Post* and *The Wall Street Journal* (Grundmann, 2006). A study by Boykoff and Boykoff (2007) exploring print and broadcast media attention from 1988 to 2004 found that climate change coverage has increased markedly in a number of news outlets in 1997. They include *The New York Times*, *The Los Angeles Times*, *The Washington Post*, *The Wall Street Journal*, ABC, CBS, and NBC. Slow progress in the representation of scientific findings was, however, being made: the political, social, cultural and economic dimensions significantly shaped climate change news. For example, their results hinted at the effects of "personalization and dramatization" as the limiting factors that constrained dominance of science news stories. There have been many studies which provided evidence that politics was being given a special treatment over observed climate trends and climate change impacts in the press (Boykoff and Roberts, 2007; Liu *et al*., 2008; Boykoff, 2011; Bohr, 2020). The results of these studies,

consistent with research in the UK (e.g., Carvalho and Burgess, 2005), suggest that science was not dominating the coverage of climate change in the early 2000's.

Combined with the TAR, and G-8 Summit in Italy, the Kyoto Protocol continued to garner political status between 2001 and 2002. However, one promising year was 2005. In August, a Category 5 storm, Hurricane Katrina, hit the US. It attempted to increase the presence of observed climate trends in news stories. For instance, five major broadsheets (*The Washington Post*, *The New York Times*, *The Wall Street Journal*, *The Los Angeles Times*, and *USA Today*) improved coverage in September 2005 (Boykoff *et al*., 2020). The newspapers had the highest proportion (42%) of articles compared to the same period in 2004. It could be argued, however, that this shows that reportage of climate change was based on extreme weather events. Another critical event for climate change coverage was the release of *An Inconvenient Truth* documentary in 2006. This is especially important considering a key figure in the documentary was a politician. Unlike other documentaries, scientific findings were generally the core drivers. Newspapers gave the documentary more attention in stories that dealt with the impacts of climate change.

Although *An Inconvenient Truth* documentary was vital to the advancement of climate change science in news media, an overall significant peak in issue coverage was in 2007. A recent study which examined the coverage of climate change from 52 newspapers for the period 1997 to 2017 offers a useful overview (Bohr, 2020). One area of interest in the findings is the influence of AR4, the Nobel Peace Prize (awarded to Al Gore and the IPCC), and COP13. A similar trend in the US newspapers was shown by Nerlich *et al*. (2012). Moreover, other studies showed that a surge in climate change attention across major broadsheets was based on current events (Boykoff, 2011; Painter and Ashe, 2012; Schmidt *et al*., 2013; Romps and Retzinger, 2019).

In terms of scientific viewpoint, several accounts appear to agree that newspapers ignored climate change science objective facts between 2007 and 2016. However, 2009 was a particularly important year in the coverage of climate change. Climate change policy commitments by Barack Obama, Climategate and COP15 proved to be popular across major newspapers. As it has already been highlighted in the previous research, politics has always dominated news stories (Boykoff and Luedecke, 2016). For example, press attention devoted to political agenda remained high in five major broadsheets. Previous studies provide evidence that in the absence of politics or political figures, climate change fails to get more recognition in the press. In other words, the failure to recognise the role

of climate science experts could lead to poor coverage of climate change scientific dimension (Lyytimäki, 2011; Kumpu, 2016).

Did the attention to the scientific agenda improve in 2009? Certainly, the US newspapers continued to put more emphasis on political agenda in reporting climate change, but they still viewed greenhouse gas emission as the main driver of the changing climate (Bohr, 2020). It is worth remembering that five major newspapers have reported more climate change stories in 2009 than any year for the period 2000 to 2015. Ultimately, the spike in the number of news stories pointed to politics and climate controversies. For example, Boykoff and Luedecke (2016) argued that Barack Obama and COP15 were pivotal in the rise of climate change politics in the US press. Their findings do not differ from previous media studies by other researchers (Boykoff, 2011; Boykoff, 2012; Grundmann and Scott, 2014; Schmidt *et al*., 2013).

About two months after COP15, in the account of Boykoff *et al*. (2020), climate change news stories plummeted from a peak of more than 500 in December 2009 to less than 250 stories in February 2010 – across five major newspapers. After at least 34 months, a large proportion of climate change stories rose in November 2012. One major driving factor of increasing attention is the build-up to COP18. Yet, the number of stories were drastically reduced. The re-election of Barack Obama as the president of the country cannot be underestimated as the constraint to climate change issue attention. The period December 2012 to October 2014 was characterised by unstable coverage. However, attention rose in November 2014 and declined the following month. In 2015, the months of September, November and December showed substantially higher attention. Although the AR5 was widely published in 2014, it failed to shape climate change coverage in the press. This significantly impacted the visibility of reports on extreme weather events and climate change impacts as topical issues. A climate pledge by the US and China to limit greenhouse gas emissions made headlines across US press (Pan *et al*., 2019).

Both COP20, COP21, and COP22 appeared to have been vital in accelerating newspaper attention. Nevertheless, news stories were unable to capture sufficient scientific findings, which were available through the publication of the AR5. There appears to be a negative relationship between rise in climate change news stories and objective climate science facts coverage. Overall, the greatest attention was recorded in November and December 2016. Generally, studies conducted between 1996 and 2016 indicate that attention to

extreme weather events, climate change impacts and projections was overshadowed by political agenda.

2.4 Newspaper portrayal of climate change science in Oceania

As seen in Europe and North America, climate change coverage upward trends have been extensively documented over the period 2006 to 2009. In Oceania, coverage reached its peak in December 2009. What followed was a considerable downward trend between 2010 and 2016. In July and August 2010, attempts were made to increase attention. Furthermore, newspapers have shown similar interest in July 2011 (Boykoff *et al*., 2020). Most of the news stories often associated climate change with policy and political leaders and were reported by major Australian broadsheets. They were widely available in *The Australian* and *The Age*. In New Zealand, climate change stories were significantly confined to the *New Zealand Herald*. What contribution COP meetings made in newspaper portrayal of climate change? Climate change reporting was always of less interest to newspapers in Oceania between 1996 and 2005 but previous studies strongly suggest that COP3 played a pivotal role (Schmidt *et al*., 2013; Schäfer *et al*., 2014).

There is no doubt that a prevalent argument is that climate change issue attention was largely due to the Kyoto Protocol. This is consistent with other studies in the UK and US (Boykoff, 2011; Bohr, 2020). In an issue attention study, Eide and Kunelius (2010) concluded that COP meetings are fundamental to climate change coverage. Schäfer *et al*. (2014) also attributed climate change attention to COP.

While newspapers often use climate scientists and scientific findings as the main sources (Billet 2010; Schäfer *et al*., 2014), the striking factor about the press in Oceania in the late 1990's and early 2000's is politics outweighing science stories. Despite the publication of TAR, major broadsheets had little interest in the detailed scientific findings, making the trend similar to that observed in the UK and US. This proved to support evidence that climate change was constantly on the low for almost a decade (Boykoff and Roberts, 2007). In 2006, Oceania started to see a significant increase in newspaper coverage of climate change. It has been demonstrated that researchers attribute this rise to the Climate Change Action Bill in Australia and New Zealand's Fourth National Communication under the United Nations Framework Convention on Climate Change. It would be appropriate to suggest that the attention was on climate change policy across major newspapers. It relates to the findings in the UK. COP12 seemed to have been one of

the important climate change events in 2006. Although the overall increasing attention was recorded in 2007 and 2009, coverage reached its highest peak in December 2009. Determining whether COP15 was an essential component to an increase in issue attention requires understanding of the appearance of such an event in newspapers. From an Australian perspective, there is evidence that COP15 contributed importantly to climate change coverage in the press (Lidberg, 2018), but climate science expert voices constituted low percentage in the news stories.

Political agenda, particularly voices from national and foreign political systems had a majority stake in the press, which resulted in scientific agenda being undermined. Schäfer *et al*. (2014) showed that COP15 strongly influenced climate change issue coverage in two Australian broadsheets (*The Australian* and *Sydney Morning Herald*). Their findings give an indication that COP was a consistent driver across the continents.

Despite an impressive attention in 2009, it has been observed that climate trends, climate change impacts and projections had a limited influence in shaping issue attention in Oceania (Chetty *et al*., 2015). It was only in Fiji, in a recent study, where it was found that climate change impact sufficiently contributed to the rise of climate change news stories between 2004 and 2010 (Chand 2017). Comparison of the results of this study with findings from a similar study in Australia during the same period suggests that newspapers put more emphasis on politics, social and economic dimensions (Chetty *et al*. 2015).

While scientific reports from the IPCC were readily available to the media, scientific findings and climate science experts failed to dominate discussion in the broadsheets across Oceania. Similarly, previous studies in the UK and US have shown the glimpse of the way climate change is given attention in newspapers – as a major environmental issue but detailed scientific agenda poorly reported.

What followed after a more visible improved attention in December 2009? It is important to take the big-picture observation, such as a sharp decline in 2010, which ushered a new era of low attention. The effectiveness of the COP meetings (COP16, COP17, COP18, COP19, COP20, COP21 and COP22) and AR5 have been called into question, largely due to a substantial poor coverage of climate change in the broadsheets. In the previous research work of media attention, climate change events were all it takes to boost issue attention (Boykoff and Boykoff, 2007; Doulton and Brown, 2009; Bohr, 2020). However,

AR5 struggled to maintain this reputation which was epitomised by AR4 in 2007. Additionally, press attention devoted to climate change has remained significantly low for a five-year period (2012 to 2016). Thus, it can be concluded that this was part of a continuous shift away from valuing climate change science. In Australia, recent studies confirm a convincing biasness by news outlets to be crucial in the drive to reduce climate change coverage, a fact that is widely credited with the huge growth of scepticism by the owners of the influential newspapers (e.g., McKnight, 2010; Manne, 2011). For example, News Corp, owned by a prominent climate sceptic Rupert Murdoch, has been associating climate science with conspiracy (Cadorette *et al*., 2018). During the 2019-2020 Australian bushfires which burned an area of more than 10 million hectares, News Corp's leading newspapers (*The Australian, The Daily Telegraph*, *Herald Sun* and *Courier Mail*) openly rejected the scientific consensus about the link of the devastating fires to climate change (Schweinsberg *et al*., 2020). The sceptical views have also been observed in newspapers and broadcast media owned by News Corp in several countries, especially the US (Bacon and Jegan, 2020).

2.5 Newspaper portrayal of climate change science in Africa and Asia

The coverage of climate change in Africa and Asia showed similar trends to Oceania, owing significantly to poor availability of data. Despite the influential Kyoto Protocol, African and Asian newspapers appear to have begun to give more attention to the climate change issue in 2006 (Boykoff and Rajan, 2007). Although Aoyagi (2017) stated that COP3 was pivotal in Japanese press coverage of climate change, the study listed the following among the most significant drivers of rise in issue attention: the release of the AR4 in 2007 and COP15 in 2009. The study concluded, among other things, that political bias has dominated news stories. This corroborates a standpoint that climate change has increasingly been politicised in the press (Sampei and Aoyagi-Usui, 2009). It resulted in a significantly low coverage of the scientific findings and a very limited effect on the coverage of observed climate trends, climate change impacts and projections. There has long been poor attention to these objective facts and, despite evidence from the climate science community, very little interest was observed in the broadsheets.

Provided the vulnerability of Africa and Asia to climate change risks, the assumption was that this would lead to a broader attention in newspapers and play a role in improving public understanding. However, for broadsheets it is politics and economy that were of particular interest. It is fundamentally important to note that climate change coverage in

relation to the COP meetings varies in Africa and Asia. In South Africa, coverage of climate change reached its peak in November 2011. The South African press demonstrated interest on climate change towards the end of 2006, being established in the Business Day (Boykoff *et al*., 2020). This could be because COP12 was held on African soil. Previous studies showed that European newspapers reported more stories during a COP event in Europe. The assumption that news outlets report climate change based on events is satisfied in this regard.

While availability of data was a challenge, Schmidt *et al*. (2013) reported that *The Sunday Times* made a valuable contribution towards increasing coverage of climate change during COP events. However, the findings do not provide a further exploration to establish the effects of science – probably due to the dominance of political figures and civil society in news stories. South Africa had a limited coverage of climate change for the period 2012 to 2016. Similarly, when observations were made in Oceania, the trend identified was poor coverage during the same period. Apart from their major peak in November and December 2009, Asian newspapers showed a fluctuating trend between July 2010 and October 2015 (Comfort *et al*., 2020).

Regardless of the agenda reported, Boykoff *et al.* (2020) found that three important newspapers associated with the rise of climate change in attention during the highest peak are Japanese broadsheets (*Asahi Shimbun, Mainichi Shimbun and Yomiuri Shimbun*). For the story of the influence of COP, there was a notable rise during COP15. Evidence indicates that COP21 has shown a positive effect in India, Philippine and Japan (Pandey and Kurian, 2017; Boykoff *et al*., 2020; Das, 2020). This can be traced to leading newspapers such as *Manilla Bulletin*, *Times of India*, *Hindustan*, *Asahi Shimbun*, *Mainichi Shimbun* and *Yomiuri Shimbun*. Like in the developed world, scientific agenda was usually secondary to politics and economy. Over the years, as documented in the literature elsewhere, many broadsheet newspaper articles contained significant numbers of political figures (Lyytimäki, 2011; Kumpu, 2016; Boykoff and Luedecke, 2016). One of the most important observations is poor visibility of climate scientists in news articles. Perhaps most significant in the context of Africa and Asia, the importance of COP meetings for the climate change agenda was widespread. But probably the greatest media attention discussion centres around COP. Schmidt *et al*. (2013) examined the grounds for connecting COP and media attention and found substantial evidence to suggest that a surge in issue attention is recorded in news outlets at the time of COP event. This is consistent with the findings in study by Gurwitt *et al.* (2017). The results reveal that "COP21 generated substantial media coverage around the world, but much of this

coverage was based on a limited range of issues and did not fully reflect the depth, range, and complexities of the debates within and around the conference" (p. 291).

2.6 Public and climate change information

Over the past two decades, the lay public in many developed countries have been exposed to climate change science information. In contrast, news outlets in developing countries have shown little progress in terms of framing climate change science into issues of relevance to broader society (Kahan, 2015; Davis-Reddy and Vincent, 2017). There is evidence to suggest that ambiguous coverage of climate change science in mass media influences how the lay public receive and interpret scientific outcomes. Since media framing can help to highlight the significance of a story, the uncertainty in climate change science is the main driver of misinterpretation (Boykoff, 2013).

Previous studies in the UK and US have frequently highlighted that climate change is not perceived as the most important threat in society. This is evident in two studies (Leiserowitz, 2005; Lorenzoni and Pidgeon, 2006), all of which point to the explanations for poor appetite for climate change science. This may have stemmed from limited awareness and climate change understanding. A study by Pidgeon (2012) found that climate change was not an issue of central importance across the UK for the period 2006 to 2010. It is strongly supported by a more recent comprehensive review focussing on international trends in public perceptions of climate change by Capstick *et al*. (2015). The study examined changes in public perceptions for a period of 25 years (1989 to 2014). In the study, findings have shown that climate change remained a distant issue for the American public. Despite the rise of news media coverage of climate change in 2007 and 2009, many Americans were not concerned about the impacts of climate change. According to Smith and Leiserowitz (2012), the public expressed the notion of scepticism. This is consistent with other studies in the UK (Corner *et al*., 2011; Whitmarsh, 2011), Australia (Connor and Higginbotham, 2013) and Germany (Ratter *et al*., 2012). However, the exceptional dominance of the political agenda was clear. The implication is that climate change failed to become an issue of major importance to the public. However, according to recent studies (e.g., Bergquist and Warshaw, 2019; Howe *et al*., 2019), there was a slight increase in public concern about climate change over the last decade. But this was markedly different from the findings in China. Liu *et al*. (2020) demonstrated that the Chinese have been consistently not highly concerned about climate change.

Observed climate trends influence public perceptions and opinions on climate change. There is evidence to suggest that extreme weather events have a beneficial effect on public opinion relating to climate change science (Spence *et al*., 2011; Borick and Rabe, 2014; Konisky *et al*., 2016; Demski *et al*., 2017). Additionally, previous studies have shown the association between rising temperatures and public opinions (Brooks *et al*. 2014; Zaval *et al*., 2014). Could these fix the level of public trust on climate change science in news media outlets? It is now over 10 years since the Climategate scandal was revealed, and during that period a study found that there was a significant loss of trust in climate change science (Leiserowitz *et al*., 2013). However, recent years have witnessed advances in the ability of scientists to instil confidence in the public.

As the main source of information, newspapers are often identified as a major contributor to public opinions and perceptions. Previous research has indicated that it is its manner of generating textual information from a wide range of voices which makes newspapers such a striking source of climate change news stories. It is worth mentioning that as a scientific issue, climate change offers significant challenges to news media outlets. Therefore, if the textual information is misreported it may be subjected to misinterpretation by the lay public. The fact that there is a weak linkage between climate scientists and media adds a further complication in the level of public trust. An example of this disconnection between climate change science and the public is usefully discussed by Kiem and Austin (2013).

Public perceptions and opinions are undoubtedly activated by impacts which are related to extreme weather events. They are often seen as the most significant contributory factor in public interpretation of climate change science. The impacts of heatwaves, droughts and floods have helped to capture public attention regarding climate change. The support for this claim is given by Howe *et al.* (2019). Their review of more than 70 studies found that there was a positive relationship between extreme weather events and public opinion. Other similar studies have corroborated the account of Howe and colleagues. In the US, a study of short-term belief in anthropogenic climate change has illustrated that changing temperature was the reason climate change received public attention (Hamilton and Stampone, 2013). Equally striking is that the findings are consistent with previous studies of temperature trends and public interpretation of climate change science (Li *et al*., 2011; Egan and Mullin, 2012; Shao and Goidel, 2016). While evidence about consensus around the influence of temperature trends has been widely presented, Zaval *et al*. (2014) cautioned that attention to temperature abnormalities can be overvalued.

Despite the notable effects of observed climate trends on the public opinion about climate change (Lorenzoni and Pidgeon, 2006; Li *et al*., 2011; Weber and Stern, 2011; Hamilton and Stampone, 2013; Shao and Goidel, 2016), the influence with specific focus on press readers in rural South Africa remains unknown. While climate change science studies provided evidence about changing temperature and rainfall patterns over Africa (Osborn and Jones, 2014; Roxy *et al*., 2015; Sutcliffe *et al*., 2016), there has not been an answer to resolve a longstanding question about how newspaper readers interpret textual information of climate change in the rural communities of South Africa. One great argument in the area of public opinion of climate change is over the influence of significant or focussing events. COP events, release of the IPCC reports and screening of documentaries strongly influence public interpretation. They also play a tremendous role in encouraging climate action (Leiserowitz, 2004; McCright and Dunlap, 2011; Brewer, 2012; Anderegg and Goldsmith, 2014; Garud *et al*., 2014; Capstick *et al*., 2015). However, as argued by Hamilton and Stampone (2013), political events are not the only factors underpinning public beliefs. They noted that short-term weather changes lead to the development of climate beliefs. Existing studies often neglect newspaper readers residing in rural areas. It is not simply a matter of understanding public opinions and perceptions that is fundamental, but the exploration of the connections between newspaper portrayal of observed climate trends, climate change impacts and projections, and response measures with public interpretation of the textual information.

2.7 Conclusion

Available literature clearly outlined that the issue of climate change received less attention during the mid-1990's and mid-2000's. However, COP3 was an important feature in newspapers across European countries and the US. Globally, a first notable peak was recorded in 2007, with many studies having similar viewpoints about the influential roles of the AR4 publication, *An Inconvenient Truth* documentary and COP13. Political agenda dominated the news stories and was captured in all major newspapers in Europe and the US, whereas scientific agenda was generally reported during extreme weather events. For instance, coverage of observed climate trends and climate change impacts was strongly influenced by the European floods of 2000, European heatwave of 2003, US Hurricane Katrina in 2005. The politicisation of the climate change issue was also observed in newspapers across Oceania, Africa and Asia. COP15 appeared to have been the turning point in newspaper coverage of climate change. With the exclusion of Africa, a number of

newspapers in other continents have shown a considerable peak in November and December 2009.

There is evidence to suggest that the spike in news stories was positively driven by the climate change controversy, Climategate. However, more emphasis was put on climate change policy commitments by political figures. European newspapers have demonstrated a sharp decline for the period 2010 to 2015, but coverage was slightly resuscitated in December 2015. It has been highlighted that COP21 was crucial in newspaper attention to climate change. This is consistent with evidence in some of the major Asian broadsheets. The publication of AR5 was a failure in terms of increasing attention. In the US, climate change coverage was at its low for nearly three years after COP15 because of the political affairs that were happening, including election campaigns.

It has been noted that COP20, COP21 and COP22 were important in climate change coverage. However, despite the fact that AR5 was readily available, insufficient scientific findings were reported. Contrary to the findings in Europe, US, Oceania and Asia, African newspapers have shown a coverage peak in 2011 – for one main reason. South Africa was hosting the 17th COP meeting in the city of Durban. Poor availability of data may be another explanation.

With respect to the specific objectives of the current study, this literature review has found that broadsheet newspapers across the world tend to focus largely on political agenda, while neglecting basic objective facts. Available evidence suggests that COP events generally helped to ensure issue attention. Poor coverage of observed climate trends, climate change impacts and projections can influence public interpretation. Indeed, previous studies in the UK and US revealed that public attention was captured because of extreme weather events. Acknowledging that media outlets are central in the distribution of climate change information to the public, reporting simplified textual information can play a significant role in public opinion.

Scholars have shown that the major cause of the dearth of climate change science in news outlets is the complexity of climate change and acute shortages of specialist reporters (e.g., Chadha, 2017; Painter, 2019). The boundaries between climate scientists and media outlets can add more complications. There is an urgent need to align climate change science messages with the lay public's worldviews. It is well-established that

studies on public opinions and perceptions are concentrated in the UK and US. However, it has been observed that climate change is not considered a major threat.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

Over recent decades, literature indicated that research methodology is central in understanding the manner in which the research is executed (Kothari, 2004; Kumar, 2019). Clarification of research questions, method of data collection, method of data analysis, contentious issue (i.e., design and ethics): these four points are typically the main focus for many studies. The research methodology chapter is traditionally concerned with how the selected methods answer the research questions (Berger, 2018).

In the first section (Section 3.2), research design is described in more detail. Section 3.3 provides an overview of quantitative content analysis. The quantitative questionnaire survey method is discussed in Section 3.4. The sampling procedures in Section 3.4 represent a fundamental stage in the chapter since it is here that the study population and sample size are elaborated. Section 3.6 is concerned with data collection. Data analysis for the study is captured in Section 3.7. Thereafter, Section 3.8 discusses ethical considerations that were taken into account.

3.2 Research design

The selected procedures for data collection and analysis are regarded as the vital prerequisites for conducting research. Many accounts in the literature make note of the importance of rigorous research designs (Gorard, 2013; Ridzuan *et al*., 2018). The decision making in terms of methods that are employed to carry out a study has generally accumulated distinct attention. In particular, selected methods have been identified as contributors to the development of the interpretation stage. This is the stage that represents the core of the study since it is here that the logic of research occurs (e.g., Berger, 2018; Hansen and Machin, 2018). Appropriate research design is thus essential for producing a logical conclusion of the study. As such, the current study has selected a multi-method approach that represents a significant strength in addressing the main research question.

3.2.1 Multi-method design

For the purposes of the current study, the focus of this section is multi-method design, which involves two quantitative research approaches for collecting, analysing and interpreting data (Seawright, 2016; Schoonenboom and Johnson, 2017). One of the observations made by Benoit and Holbert (2008), in their study of multiple quantitative methods, is that there is a compatibility advantage in using a combination of two or more methods. In terms of accuracy and precision, the suggestion is that multiple methods outperform a single method. Multiple methods are considerable across communication studies (Ivankova *et al*., 2006; Clark and Creswell, 2008; Carlson *et al*., 2016). This is especially the case when dealing with studies that include content analysis and survey.

For decades, researchers have been studying the dynamics of using two different qualitative methods within the field of communication (Jensen and Jankowski, 2002; Tsene, 2016). While qualitative research has always been recognised as an important component of the intersection in participant observation and surveys, the need for performing statistical analysis has led to the development of an approach that combines three quantitative methods. By following the standard process and procedures for quantitative media system analysis, scholars have increasingly focussed on the important components of media dissemination of message and its impact to the public. When a survey is combined with content analysis techniques in terms of media exposure and interpretation of the message, the results can provide useful information regarding media influence on public interpretation of media genres (DiStaso and Bortree, 2012; Dvir- Gvirsman *et al*., 2016; Wells and Thorson, 2017).

An important detail about multiple methods research is that because extracting data from one source does not yield vigorous results, the effect of multiple data sources and types of analysis may be highly significant. It is notable that it is in the use of two or more quantitative methods, and two or more qualitative methods that multiple-methods research is clearly defined (Brewer and Hunter, 2006). The most striking aspect that advanced multiple-methods research is the establishment of multitrait-multimethod. Most typically it is concerned with the fact that variances not only depend on the method employed, but also on the traits under study (Bodie *et al*., 2014). It is this factor that has highly contributed to the use of multiple methods in this study.

One of the most common methods used in climate change communication studies is content analysis, which has been widely applied in the last few decades (Boykoff and Boykoff, 2004; Mayring, 2004; Neuendorf, 2016; Lidberg, 2018; Riffe *et al*., 2019; Wonneberger *et al*., 2020). The study conducted a content analysis of climate change articles published in three leading Sunday newspapers from 1996 to 2016: *City Press*, *The Sunday Independent*, and *Sunday Times*. Content analysis in mass media is generally more appropriate for the investigation of media portrayals of climate change (e.g., Liu *et al*., 2008). The current study, for example, is particularly interested in the following: the way in which climate change science is presented in print media; the drivers of climate change coverage in the leading Sunday newspapers; and interpretation of the science information by the lay public.

The role of questionnaire survey is important in the study because it provides different insights about the phenomenon in question. This is significant because to understand the impact of the message communicated by mass media, the fundamental aspect to be considered is public interpretation. Based on available literature, the vital part of this study is that it is amongst a few studies that implemented quantitative multiple research methods in the field of climate change communication. Sections 3.2.1 and 3.2.2 discuss multiple research methods (quantitative content analysis and quantitative questionnaire survey) that have been executed for the purpose of the study.

3.3 Quantitative content analysis

Quantitative content analysis is a research method that has its roots in media studies. It seeks to give objective and systematic description of textual content. Leading scholars in climate change communication have shown that the application of quantitative content analysis is based on its competitive edge for statistical analysis (Metag, 2016; Neuendorf, 2016; Krippendorf, 2011). Because qualitative content analysis follows an interpretative approach, there is often a problem of reducing and analysing large data samples. Quantitative content analysis includes not only trends and patterns, but also portrayal of issues. The basic steps of quantitative content analysis are captured by Neuendorf (2002) and Rössler (2005) in the following flowchart:

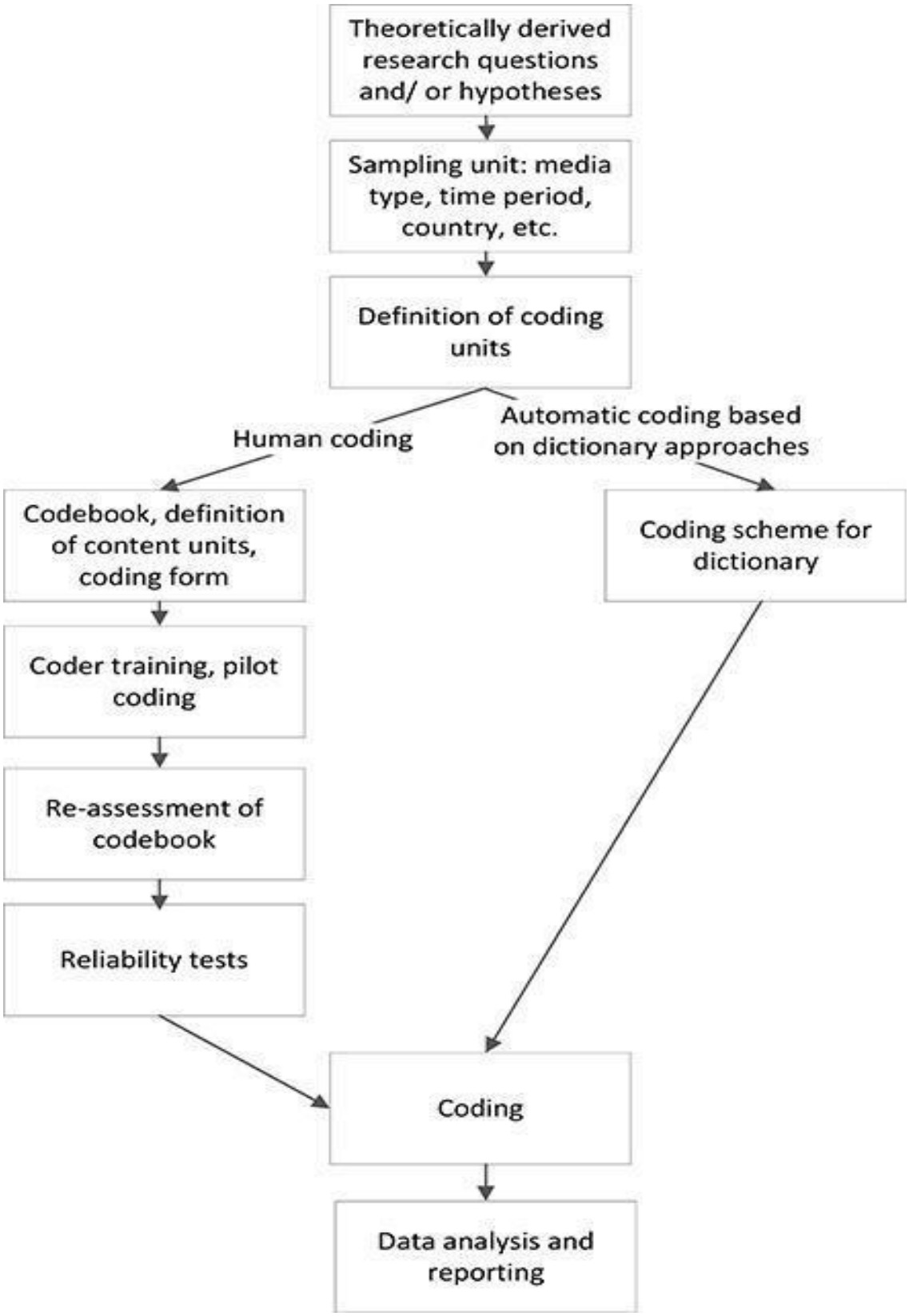

Figure 3.1: Basic procedures of quantitative content analysis.

Source: Neuendorf (2002), and Rössler (2005)

Two approaches of content analysis are presented in Figure 3.1. First, manual coding, although it requires human coders, is the most common approach in climate change communication. To examine the message of the content, one needs a codebook, which is a fundamental tool for human coding. Second, as noted in Figure 3.1, the opposite to manual coding is automated content analysis. This approach does not essentially require human coders. Of most significance is the use of a computer-based software for the identification of word frequency and pattern. Thus, large samples are often analysed using automated content analysis, which is highlighted by Kirilenko and Stepchenkova (2014). In the case of description of frames, it has been demonstrated that automated content analysis does not give any indication of how major topics should be constructed (Metag, 2016). Success in quantitative content analysis depends on the reliability and replicability of the procedures. As for manual coding, it has been identified as more reliable than automatic coding. Climate change communication studies confirm that manual coding is a distinct approach for a specified replication. With respect to print media coverage of climate change, quantitative assessment has been undertaken using manual coding in many studies (Ahchong and Dodds, 2012; Asplund *et al*., 2013; Metag, 2016). On this basis, the significance of manual coding to the field is clear. This gives reason for the current study to consider it in conducting quantitative content analysis.

As many of the previous studies have shown (Neuendorf, 2002; Rössler, 2005), the first step is to select the content to be analysed. Research question is an important component of this step, particularly in making decisions on sampling procedures, and there is evidence to suggest that it is responsible for the selection of media types, criteria of inclusion, time period and location, amongst others (Figure 3.1). In this study, the focus is on news articles published in three major weekly South African newspapers over a period of two decades. Research confirms that newspapers are widely used in studying media representation of climate change for a range of purposes but are believed to be the most reliable source of textual data (Whitmarsh, 2009; Painter and Gavin, 2016; Gurwitt *et al*., 2017; Stecula and Merkley, 2019). Step two is centred on the definition of the coding units. The unit of analysis in the study is news articles in the South African Sunday press. These are determined by the explicit appearance of climate change or global warming, and a reference to climate change conferences. The study recorded the frequency of the major topics that appeared in the articles. Climate change objective facts were defined by the presence of three issue dimensions: a) observed climate trends (e.g., greenhouse gas concentrations, temperature change, rainfall change, climate extremes); b) climate change impacts (i.e., impacts on natural and social systems); and c) climate change projections (e.g., global temperatures, rainfall events). A clear distinction was made

between three basic facts and an important issue dimension, response measures (i.e., climate change adaptation and mitigation strategies). Climate change conferences were defined as all the yearly United Nations conference of the parties (COP) meetings. The coding units were categorised based on issue dimensions and focusing events, including other categories such as the geographic scope, public key issues, and issue participants. The third step is to describe the rules for coding. However, as illustrated in Figure 3.1, it is worth noting that human coders are required to have prerequisite knowledge in order to conduct pilot coding. While it is possible to continue with coding after refining the codebook, it is paramount to perform reliability tests (Wozniak *et al*., 2015; Krippendorff, 2011). To ensure consistent coding, observed climate trends, climate change impacts, climate change projections, and response measures were central to the "issue dimensions" category. COP2 to COP22 meetings were recognised for the "focussing events" category. These ranged from the Kyoto Protocol agreement in Japan to the Paris agreement in France. The "geographic scope" category was characterised by domestic news, regional news, international news, and mixed news. With respect to "public key issues," six sectors were considered – agriculture, biodiversity, energy, fossil fuels, coastal zone, and water resources. The last category, "issue participants," was composed of the main actors that were referenced in the articles. These were divided into ten key participants: *scientis*t, *research agency*, *government representative*, *government department*, *non-governmental organisation*, *non-governmental organisation representative*, *United Nations agency*, *United Nations agency representative*, *foreign news agency*, and *member of the public*. It should come as no surprise that this step plays a key role in coding. And more important is that rules are the fundamental aspects of transparency and reliability. Although there is a considerable debate over whether automated coding is superior to human coding, in step four, the study followed the procedures of manual coding to examine each article in the sample. There are written records confirming that data analysis and reporting is the last step in conducting content analysis (Neuendorf, 2002; Rössler, 2005; Metag, 2016). In this study, examination of the collected data occurred in the fifth step. This step not only helped in identifying the trends and drawing conclusions, but by answering the overall research question.

3.4 Quantitative questionnaire survey

One of the common research methods in the field of climate change communication is survey. This method is popularly used to assess public understanding and perceptions on climate change (Taylor *et al*., 2014; Capstick *et al*., 2015; Knight, 2016; Elum *et al*., 2017;

Sullivan and White, 2019). There are grounds to believe that the popularity may be attributed to sociology. The research methods specialist Anol Bhattacherjee's *Social Science Research: Principles Methods, and Practices*, published in 2012, reflected on the powerful influence of an Austrian-American sociologist, Paul Lazarsfeld (1901-1976), in the use of survey method for quantitative research (Bhattacherjee, 2012). For example, his work on public opinion and mass communications in the late 1940s is usually taken as a reference in survey analysis. Recent authors, including Jeřábek (2017) and Centola (2019), have shown a consensus on the matter. Compared to other research methods, the great strength of surveys in collecting data on a large population is undeniable. To further appreciate the advantage of the survey method, it is most important for its cost- effectiveness characteristics (e.g., Ilieva *et al*, 2002). This can be judged by the ability of an online survey to successfully collect data from thousands of participants. Although it is the common method utilised by researchers, two main biases have been identified – sampling bias, and non-response bias (Jones *et al*., 2013).

Fundamental to the current study is the use of questionnaire surveys. In research of public opinion about climate change, a survey has been demonstrated to be a useful tool to gather different perspectives on public concern over climate change (Brulle *et al*., 2012; McCright et al., 2013). Several authors have discussed how "public opinion on climate change is multidimensional, dynamic, and differentiated" (e.g., Dunlap and Brulle, 2015, p. 269). Here, the focus is on gaining insight into patterns and trends in newspaper reader opinions about climate change science in the context of the content produced by Sunday newspapers. By definition, it is recognised as a research instrument comprising standardised questions in order to acquire information from respondents. The types of questionnaire surveys have been extensively documented (Bhattacherjee, 2012). It is worth noting that there are three vital types of questionnaire surveys. The first type involves mailing self-administered surveys to the respondents. One of the disadvantages of this type is how inefficient they are at gathering responses. In fact, this inefficiency is particularly noticeable in delay of responses by respondents because, one way or another, the request may be simply ignored (Dalati and Gómez, 2018). A second type consists of a group-administered survey that needs to be independently completed by respondents at one place. Although group-administered questionnaires can successfully yield more responses, the researcher needs to be physically present (Du Plooy, 2009). Web survey is a third type of questionnaire that is vital in gathering information. Although it is not expensive to send a link or email to respondents, the questionnaire survey is accessible to people with internet and technological devices such as computers or smartphones (Bhattacherjee, 2012; Callegaro *et al*., 2015). However, online surveys not

only bring automation in data collection, but it gives a combination of convenience and flexibility to the respondents. Therefore, the current study preferred online surveys over other types of questionnaires.

If the questionnaire is to be of a high quality, it is known that one of the most important elements is the format of questions. From this perspective, the current study was tailored to obtain closed dichotomous response, closed nominal response, closed ordinal response, and closed interval-level response. Generally, it seems clear that one of the main drivers of a quality questionnaire is the content of questions (Bhattacherjee, 2012). The starting point for the online questionnaire in this study is to frame questions in a simplified language. Apart from the personal detail (socio-demographic) questions, it is no exaggeration to mention that the questions in the questionnaire were not too general. The questions vary widely, with the beginning paying attention to the confidence of respondents in dealing with climate-related issues in newspaper articles, and the end being concerned with summarising the stance of Sunday newspapers towards projected changes. Between these questions are a number of important questions covering public interpretation of newspaper attention to observed climate trends, climate change impacts, climate change projections, and response measures. This provides a perspective which has much relevance in the literature.

There is a large body of work in content question and wording, a good overview which is provided by Bhattacherjee (2012). Among some qualities of a good questionnaire is question sequence. While beginning with easy questions, the questionnaire in this study logically asks respondents about the fascinating factual topics in the field of climate change science. The principles of question sequence are summarised thoroughly in Dalati and Gómez (2018). How does this study fit into this picture? The reflection on the closed- ended response was a consistent presence in the discussion. The work by Dalati and Gómez (2018) focuses not only on question sequence but also on wording.

3.5 Sampling procedures

It is frequently stated that the process of selecting a representative fraction of a population is known as sampling. Population is a necessary pillar that the researcher needs to strongly prioritise to produce the intended outcomes of the study. It is more appropriate, however, to consider a sample. The dominant views seem to have a unanimous position in defining a sample as a subset of a population. In general, two techniques are used to select a

sample, namely probability and non-probability sampling. Babbie (2010) provides an interesting account of probability sampling. The work suggested that probability theory is the determinant in the selection of samples. With the correct application, probability sampling technique explains that each population element has the same known likelihood of inclusion in a sample. One of the principles is that the selection is done randomly. Meanwhile, because non-probability sampling requires personal judgement, it does not cover the randomisation process. Baker *et al*. (2013) offer a good summary of recent advances in non-probability sampling. This technique embraces a range of types, including convenience sampling and purposive sampling. If elements of a target population meet specific criteria (e.g., geographical location), it is considered to fall under convenience sampling.

Due to the nature of this study, purposive sampling is ideal. According to Etikan *et al*. (2016), purposive sampling is based on researcher's choice of the participants, indicating their usefulness. In the next section, the study populations are described in more detail.

3.5.1 Study populations

The focus of the study was on the coverage of objective climate change science facts and the United Nations climate change conferences in the South African national press. Three most widely read Sunday broadsheet newspapers were recognised: *City Press*, *Sunday Times*, and *The Sunday Independent*. For establishing the public opinion on climate change science content in rural South Africa, data were collected on newspaper readers at Mvelaphanda in Lwamondo, Limpopo. The study area was purposively selected on the basis that the researcher has identified that most of the residents are regular readers of hardcopy newspapers. In addition, most of the inhabitants can read and write in English. Recent research has shown that literacy can strongly influence reading newspapers (Rentería *et al*., 2019). The selected area was an ideal choice to gain more understanding about the opinion of newspaper readers on climate change in rural communities. It is important to note that the findings from the study area might not be representative of all rural areas in South Africa. This study was limited to data from 30 individuals (active Sunday newspaper readers) across a selected village in the northern part of South Africa.

South African weeklies, especially Sunday newspapers, are good at providing an overview of the most important stories that happened during the week. Much more important is that people have ample time to read over the weekend. The recent practical

example is given in the findings of the Pew Research Center's 2016 State of the News Media report. It has been shown that people devote more than one hour on reading the Sunday newspaper (Greenwood *et al*., 2016).

The interests of the weeklies involved in this study range from business news to political news. The South African Sunday press is dominated by three media companies, namely Arena Holdings, Media24, and Sekunjalo Independent Media Consortium. Of the three weeklies, the oldest weekly, *Sunday Times*, is owned by Arena Holdings. The *Sunday Times*, which was founded in 1906, holds several credits: it is probably one of the few broadsheet newspapers to be published before and after apartheid, and by far the largest weekend newspaper (Marschall, 2010). The *City Press* is under the ownership of Media24, and it was first published as the *Golden City Press* during the apartheid year of 1982. By 1983, the newspaper changed its name to the *City Press*. The post-apartheid period marked the emergence of a new competitor in the South African Sunday press. Independent News & Media SA, just months after the end of apartheid, established *The Sunday Independent* in 1995. The ownership of the newspaper was acquired by the Sekunjalo Independent Media Consortium in 2013 (South African Media, 2020).

So why is the focus on the *Sunday Times*, *City Press*, and *The Sunday Independent*? There are several factors that were taken into consideration. First, historical accounts: *Sunday Times*, *City Press* and *The Sunday Independent* accurately reflect three periods in South African history. These include the formation of the Union of South Africa in 1910, apartheid era (1948 to 1994), and democratic era (1994 to present). A second factor is related to national circulation of the newspapers. Circulation of the *Sunday Times*, which in 1910 was 35 000, to over 520 000 by early 1990s. Of most significance is an estimated readership figure of 3.7 million readers in 2015. Although the *City Press* and *Sunday Times* were established 76 years apart from each other, they occupied a large proportion of weekend press in the apartheid era (Marschall, 2010; South African Media, 2020). From the 1980s to the 1990s, the *City Press* became a significant source of news for black South Africans during apartheid. For example, throughout 1991, more than 134 000 copies were distributed (Jackson, 2019). *The Sunday Independent*, in contrast, was founded in the democratic era. Despite the growing dependence of the South Africans on newspapers after the first democratic elections, the circulation of *The Sunday Independent* remained low in the late 1990s, with an average distribution of less than 45 000 (South African Media, 2020). However, it was recognised as one of the key players in the Sunday press. In recent years, more than two decades after the end of apartheid, the three weeklies had a remarkable presence in the news media. And yet, the circulation of

newspapers in South Africa has been reported to be declining. This threat to the distribution of newspapers can be attributed to a rapid growth in consumption of news from digital technology.

3.6 Data collection

3.6.1 Weeklies portrayal of climate change science

In the context of the coverage of climate change science objective facts and focussing events, the study collected data from news articles published in the *City Press*, *The Sunday* Independent, and *Sunday Times*. Relevant articles were searched using two keywords (climate change, and global warming) in the Sabinet-SA Media newspaper archive. This online newspaper database has a collection of almost 5 million searchable articles from over 30 South African newspapers, including the *City Press*, *The Sunday Independent*, and *Sunday Times*. SA Media provides original articles that were published in the 1970s to the present (Botma, 2019).

The search period for the study covers a 20-year period, from November 1996 to November 2016. The primary reason for the selection of this period was the considerable availability of comprehensive climate change science information. Scientific reports of the IPCC are good sources regarding the basic understanding of climate change. Since the early 1990s, a joint assessment by leading experts detailed how impacts of climate change are threatening society (Smith *et al*., 2009; Hulme and Mahony, 2010; Minx *et al*., 2017; O'Neill *et al*., 2017).

In South Africa, environmental issues started to receive slight media attention after 1996, a fact that is widely credited to the promulgation of the democratic constitution. The country ratified the UNFCCC in 1997, and climate change strategies were in the spotlight. The 1997 Kyoto climate change conference has been linked with a climate change strategy shift in South Africa (Sebitosi, 2006; Luiz and Muller, 2008; Ziervogel and Taylor, 2008).
What explains the study focus beyond the first decade of post-apartheid era? The latest IPCC report, AR5 (Fifth Assessment Report) was published in 2014. The 2015 Paris climate change conference was perceived as an important meeting in the history of climate negotiations. The Paris Agreement, which was adopted in the conference, became effective in November 2016. It remains a crucial climate agreement to the

present. South Africa has signed both the Kyoto Protocol and Paris Agreement. These affect how newspapers report climate change information. Thus, it is important to take into account the timeline of assessment reports of IPCC and UN climate change meetings.

From the Sabinet-SA Media, 1,648 articles were generated. One particularly important interest of the study is news articles. When excluding articles which focus on other genres (e.g., editorials, commentary, etc.), the dataset was left with 266 articles. It is through the use of standard procedures that the extraction of articles was made possible. It is important therefore, to understand the criteria that were followed in extracting the articles. These were categorised in the following: (1) searching *City Press*, *The Sunday Independent*, and *Sunday Times* articles on climate change science in the Sabinet-SA Media database; (2) scanning and retaining articles which addressed news stories; (3) retrieving the articles in PDF format. Coding newspaper articles is crucial in this study, as the sample articles provide important and specific data regarding climate change science. In order to address the first and second objectives of the study, articles were coded based on specific variables (see Table 3.1), including: (1) science dimension of climate change;
(2) science (i.e., scientists and research agencies) and non-science (i.e., government, non-governmental organisation, member of public) sources; and (3) references to Conference of the Parties (COP) events.

It then becomes befitting that detailed steps of coding are conducted in a sequence that acquires precise information from each article. This was indeed what has been followed by the current study. In view of the above, the study took a six-step approach. First step involves the characteristics of an article (i.e., newspaper name, newspaper title, and date of publication). Second, each article was coded in terms of geographical issue scope, specifically four news categories: domestic news, regional news, international news, and mixed news. The third step addresses the issue dimension of the story in the article. The focus of coding was on four main themes: observed climate trends, climate change impacts, climate change projections, and climate change response measures. The key issues related to the public were coded in the fourth step. In the fifth step, the researcher coded references to the COP events. For example, mentioning the agreements such as the Kyoto Protocol, Copenhagen Accord, Cancun Agreements, and Paris Agreement. Finally, the main actors in the articles were coded using issues participants in the article.

Table 3.1. Coding sheet

A. Basic Information
v1. Newspaper name
v2. Newspaper title
v3. Story date (day, month and year)
B. General Coding
v4. Geographical issue scope
1=domestic news 2=regional news
3=international news 4=mixed news
v5. Story theme
1=observed climate trends 2=climate change impacts
3=climate change projections 4=climate change response measures
v6. Public key issues
1=agriculture 2=biodiversity
3=energy 4=fossil fuels
5=coastal zone 6=water resources
7=other
v7. Reference to COP
1=COP1 2=COP2 3=COP3 4=COP4 5=COP5 6=COP6
7=COP7 8=COP8 9=COP9 10=COP10 11=COP11 12=COP12
13=COP13 14=COP14 15=COP15 16=COP16 17=COP17 18=COP18
19=COP19 20=COP20 21=COP21 22=COP22
v8. Main issue participant
1=scientist 2=research agency 3=government representative
4=government department 5=non-governmental organisation representative
6=non-governmental organisation 7=United Nations agency
8=United Nations agency representative 9=foreign news agency
10=member of public

Note. v stands for variable

3.6.2 Newspaper readers' opinion about climate change science information

The data was gathered with the help of a quantitative online questionnaire survey (https://docs.google.com/spreadsheets/d/1_aCDzBlQIxsAceLw7Ga-AMVXC-sCzuvHXqUPqYDMvds/edit#gid=2085776166), which was made available to the newspaper readers at Mvelaphanda for three months (October to December 2019). Globally, recent studies have broadly collected data about public opinions on climate change through online surveys (Doran *et al*., 2019; Sullivan and White, 2019, Douenne and Fabre, 2020), and the current study is no different. An online survey was created using Google Forms. It is an essential tool that has a long history of collecting data in a wide range of disciplines. Of particular interest has been the fact that a survey is created for free. Furthermore, the properties of Google Forms application platforms are user-friendly. The researcher is knowledgeable about the use of the application in the field of environmental sciences.

In this study, the process of collecting data from newspaper readers involves three key steps: creation of questions in Google Forms, invitation of the participants, and gathering of responses. The major study interest is in the way in which newspaper readers interpret climate change science textual information they encounter in the South African Sunday press. Taking into account the third objective, a list of questions created was related to the first and second objectives of the study.

Does interconnection of questions matter in gathering relevant data from participants? The reason interconnectedness of questions is of significance in questionnaire surveys has essentially to do with assessing local knowledge of climate change science. Collecting data on reader understanding of basic climate change science facts was a fundamental aspect for the study. For example, there were questions looking at newspaper attention to observed trends (Question 10), newspaper attention to climate change projections (Question 11), newspaper attention to climate change impacts (Questions 12 to 15). Newspaper readers at Mvelaphanda were invited to participate in the online survey. The researcher distributed a survey link via an email and WhatsApp tool. Responses were automatically captured and stored in Google Drive.

3.7 Data analysis

It is important to analyse collected data, as the results depend on data analysis. The way in which researchers analyse their data typically plays a central role in producing results in a representative manner. This study used a range of software packages and versions to analyse how three main South African Sunday newspapers have portrayed basic climate change science objective facts and related focussing events (COP meetings), and the influence of this portrayal on reader interpretation of the press coverage of climate change. In an effort to quantify the data, the study conducted analysis using Microsoft Excel (2016), and WordStat 8.0.26.

One of the most basic tools that researchers around the world use is Microsoft Excel. It is used for a variety of purposes such as sorting and analysing data. This programme, which was developed by Microsoft Corporation, belongs to a generation of electronic spreadsheet of the 1980's. Due to its distinct features (e.g., Pivot tables, sorting, filtering, conditional formatting, basic mathematical operation, mixed type charts), the programme plays a critical role in maintaining large amounts of data. Compared with many of the programmes, Excel is particularly attractive. This attraction has become noticeable because the programme has grown in importance during the past decade. As the major share of Excel usage is on the organisation of data, sorting and filtering are the features which receive considerable attention as they are quick and efficient approaches for arranging data systematically (Burns and Bush, 2007; Abbott, 2014).

Excel was used by the study based on its scientific strengths. The most impressive aspect is the way in which data can be exported into another application. In this respect, import of data was undertaken through WordStat8 (Allen *et al*., 2019; Fagan, 2019; Provalis Research, 2020). It is a text analysis software with well-defined data extraction and analysis features including link analysis, which pays special attention to the association between concepts. For example, the study explored the relationships among climate change objective facts. While the root of WordStat has long been associated with content analysis of documents, it can also be used for analysis of data extracted from online surveys and social media (Ćurlin *et al*., 2019; Provalis Research, 2020).

As the current study concentrated on data from content analysis of news articles, and online questionnaire survey data, it was appropriate to use WordStat8. The analysis largely considered newspaper attention to climate change facts (OCT, CCI, and CCP),

and climate change focussing events (COP meetings). Prevalence of attention over the months and years was attained using a maximum chi-squared (Max Chi^2) test with significant differences at $P<0.05$.

3.8 Ethical considerations

Principles of ethical conduct have been extensively published in studies which use human data (Mathy *et al*., 2003; Kapp, 2006; Vanclay *et al*., 2013; Connelly, 2014). As one of the most important pillars of the research, no study using online questionnaires can avoid ethical considerations. Respondents have to be provided not only with sufficient information in terms of informed consent (Sloan *et al*., 2020), but also transparency in relation to the core focus of the study. It is helpful to the participants to know from the outset that their privacies are protected (e.g., Bryman and Bell, 2007). They were also informed that they could withdraw from participating at any time without explanation. As part of the ethics approval requirements, the researcher requested permission from the Lwamondo Traditional Authority to collect data for the study at Mvelaphanda in the greater Lwamondo village. Permission was given on October 11, 2018. This study was approved by the Ethics Committee of the Faculty of Applied Sciences, Cape Peninsula University of Technology. The Faculty Research Committee, in consultation with the Chair of the Ethics Committee, issued an ethical clearance letter (Reference number: 217293697/1/2019) on January 28, 2019.

CHAPTER FOUR: PORTRAYAL OF OBJECTIVE FACTS

4.1 Introduction

It is well-documented that basic scientific facts are generally essential in understanding climate change science. When studying changing climate, one of the fundamental factors is to know how climate has changed in the past and how it may change in the future (Davis-Reddy and Vincent, 2017). Although there is an increasing uncertainty on climate patterns, recent climate extremes provide a good direction of the future impacts associated with changes in climate, which have serious implications on agriculture (Ado *et al*., 2019; Apraku *et al*., 2019; Zwane, 2019; Gebreegziabher *et al*., 2020); biodiversity (Krause and Farina, 2016; Hoffmann *et al*., 2019; Nunez *et al*., 2019; Yu *et al*., 2019; Trisos *et al*., 2020) water resources (Zwane, 2019; Alemaw and Matondo, 2020; Makondo and Thomas, 2020); and human health (Godsmark *et al*., 2019; Godsmark and Irlam, 2020; Orimoloye *et al*., 2019). For these reasons, there is an important need to provide a context with regard to the portrayal of the objective facts in news media. This chapter aims to provide a description of the progress made by the South African newspapers in the coverage of climate change science. The results are divided into the following sections: changes in the overall newspaper coverage over time (Section 4.2), trends in the coverage of objective facts, including level of association (Section 4.3), geographic scope (Section 4.4), public key issues (Section 4.5), and issue participants (Section 4.6). The chapter concludes with a discussion on the portrayal of objective facts in Section 4.7.

4.2 Results

4.2.1 Changes in the overall newspaper coverage over time

The newspaper data set consisted of 266 articles that reported climate change science across three weekly newspapers between November 1996 and November 2016. *The Sunday Independent* covered 54% of the total articles. The newspaper with the second most coverage was the *Sunday Times* (26%). The remaining articles (20%) were in the *City Press* (Figure 1). This section is devoted to presenting the results on the overview of changes in the coverage of climate change science over time.

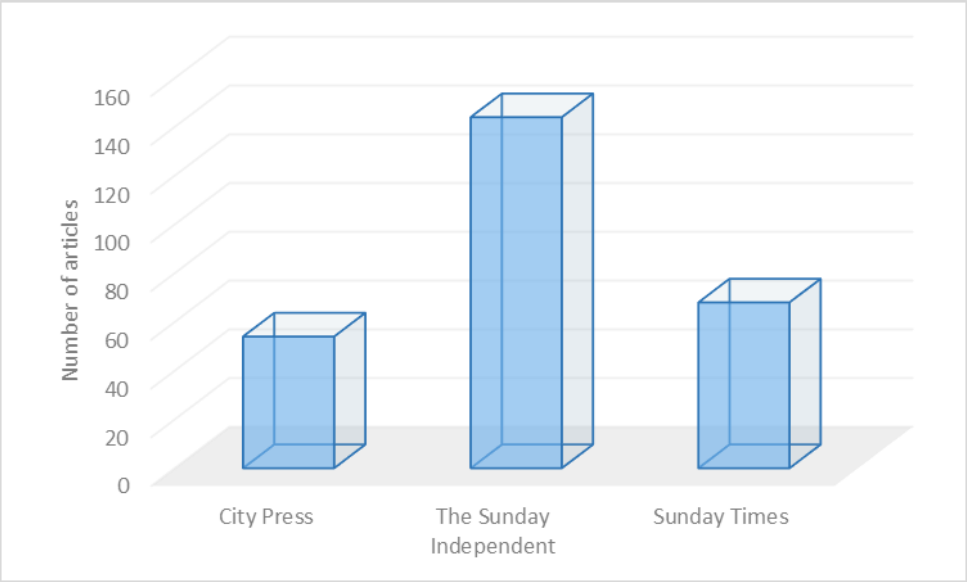

Figure 4.1: Total number of articles across newspapers.

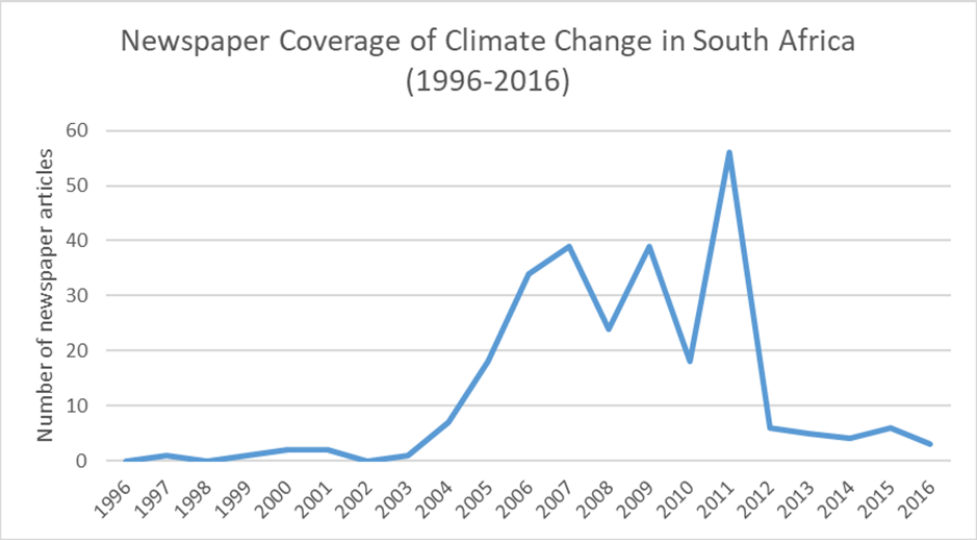

Figure 4.2: South African newspaper coverage of climate change in the *City Press*, *The Sunday Independent*, and the *Sunday Times* from November 1996 to December 2016 (X-axis represents the years, and the Y-axis represents the number of articles).

The first objective of the thesis was about trends in the coverage of the three main climate change science objective facts. To provide the occurrences of the facts in the newspapers, the starting point is to give an overview of changes in coverage of climate change over the years. Figure 4.2 shows that the annual newspaper coverage of climate change was at its lowest point during the period 1996 to 2003 (no records were obtained in 1996, 1998 and 2002). Newspaper attention to climate change increased for the next four years, 2004 to 2007. While the attention declined in 2008 (24 articles), the following year, 2009, witnessed a considerable growth in the coverage of climate change, with a

total of 39 articles. An interesting result is that 2010 recorded a drop of more than 50% (21 articles) in the coverage of the issue. After the 2010 FIFA World Cup South Africa, attention to climate change increased significantly in 2011 (56 articles). Between 2012 and 2016, a sharp decline was observed in the proportion of the articles that paid attention to climate change.

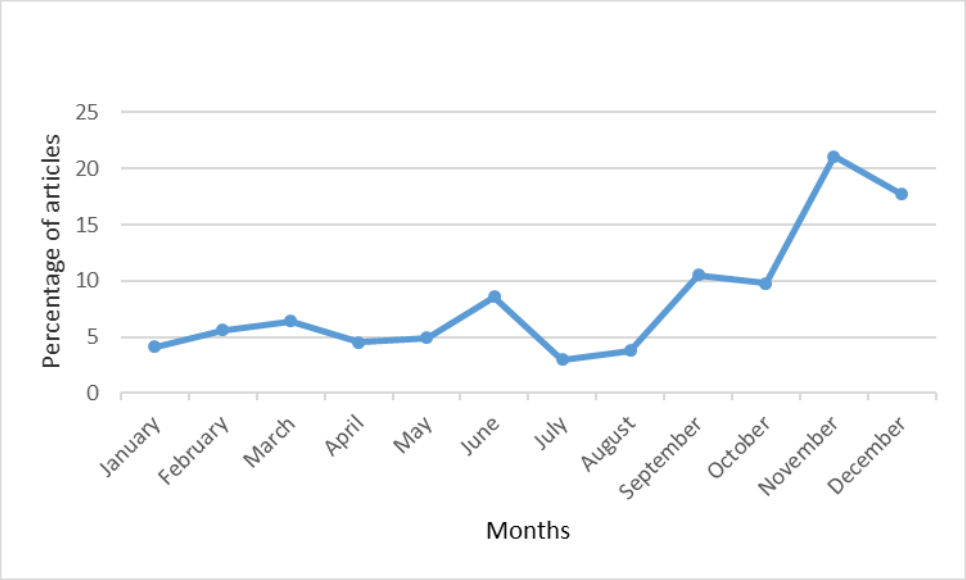

Figure 4.3: Trend in the monthly coverage of climate change science in the *City Press*, *The Sunday Independent*, and *Sunday Times.*

As with previous studies in news media coverage of climate change, newspaper attention is at its highest peak in November and December (e.g., Gunster, 2011; Lyytimäki, 2011; Fernández-Reyes *et al.*, 2015; Robbins, 2018). Similar findings were revealed by the current study (Figure 4.3). Results showed that the growing number of articles were published in November (21.1%) and December (17.7%). Newspaper coverage of climate change was lowest for July (3%). Figure 4.3 illustrates an observed fluctuation of monthly coverage between January and October. For example, the number of articles increased to 9.8% and 10.5% (October and September) from 4.1% and 5.6% (January and February). The main conclusions are drawn from the results: an identified first increasing phase in March followed by the first decreasing phase in April and May, second increasing phase in June followed by the second decreasing phase in July and August, third increasing phase in September and October followed by a significant fourth increasing phase in November, and the third decreasing phase in December.

4.2.2 Trends in the coverage of objective facts

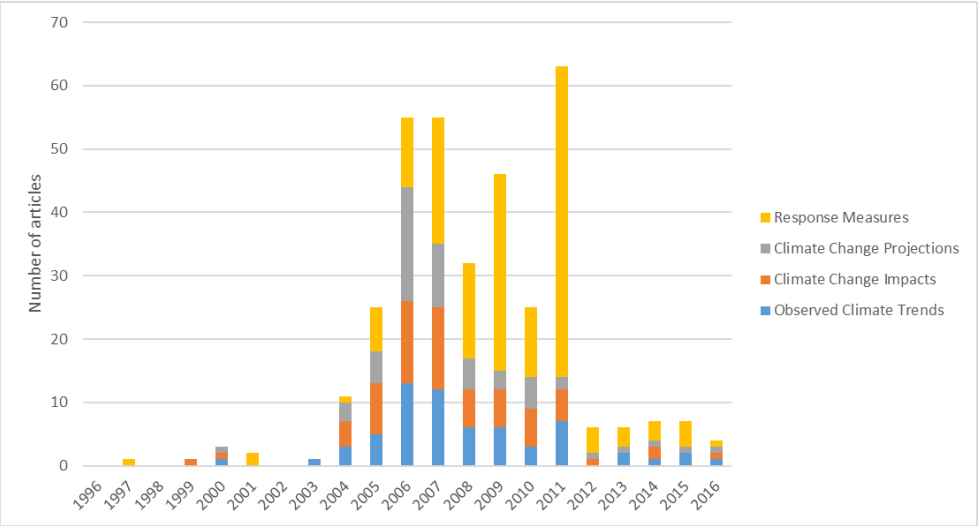

Figure 4.4: Newspaper article codes over the timeframe of this study (n = 350). The number is greater than the sampled size (n = 266) because some articles consisted of more than one coding theme (X-axis represents the years, and Y-axis represents the number of articles).

Overall, this study revealed that *climate change impacts* dominated the scientific dimension. However, climate change *response measures* were the dominant topics during the timeframe of the study. Figure 4.4 illustrates that *response measures* had the highest peak in 2011. It is not surprising that climate politics took the centre stage in the news articles during that period. While *response measures* remained at the top of other themes, a decrease in newspaper attention was observed post-2011 (from 2012 to 2016).

Factual indicators of climate change are, in scientific terms, vital in understanding how physical processes may affect the global climate system. The South African press arguably started to devote unprecedented attention to *climate change projections* (18 news articles), *climate change impacts* (13 news articles), and *observed climate trends* (13 news articles) in 2006. Despite *climate change projections* dominating news articles in 2006, a decline of eight new articles was recorded in 2007. This was nearly half the amount of coverage in 2006. It was also revealed that attention to *observed climate trends* in 2007 declined by one article from 2006. This study found that coverage of *climate change impacts* was consistent in 2006 (13 news articles) and 2007 (13 news articles). Coinciding with the decline in the overall climate change coverage across the newspapers, attention to the scientific dimension decreased by 50% from 2008 to 2010 (Figure 4.4). A slight recovery in attention to *observed climate trends* was recorded in 2011 (seven articles

compared to three articles in 2010). This study found that coverage of all objective facts significantly declined from the beginning of 2012 until 2016.

Changing attention to *observed climate trends* over the years, which may indicate the extent of newspaper coverage of baseline information, was not significant (Max Chi^2 = 0.0700, P>0.05). However, monthly coverage results reveal a significant change in attention contrary to the yearly prevalence (Max Chi^2 = 0.0200, P<0.05). An increase in attention was observed during the first four months of the year (Figure 4.5), January (45.5%), February (46.7%), March (47.1%) and April (41.7%). Results show a rapid decline in newspaper attention to *observed climate trends* in December (8.7%).

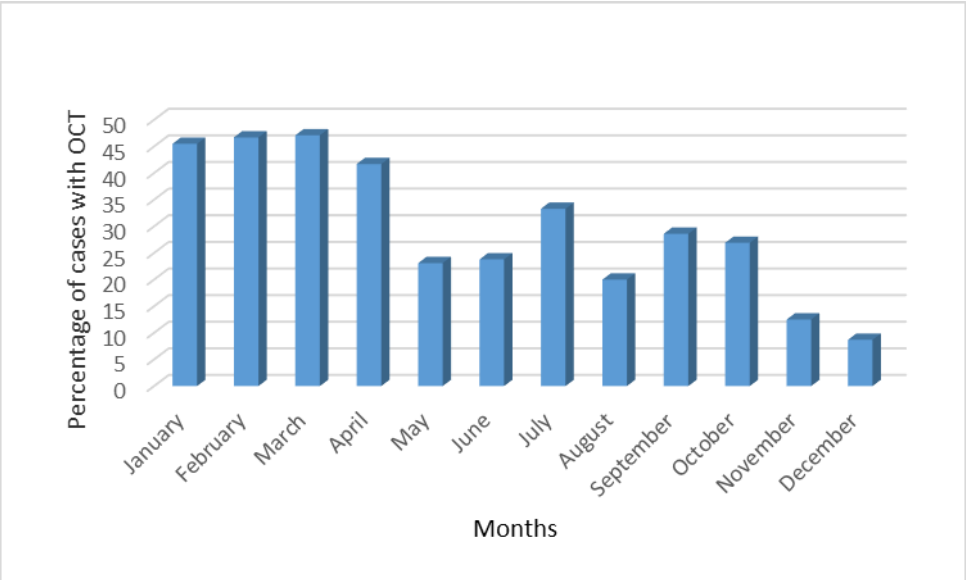

Figure 4.5: Changing attention to *observed climate trend*s over the months.

Results in Figure 4.6 show that attention to *climate change impacts* increased considerably over the month of July (66.7%). An ignorance in the coverage of climate change science objective facts is illustrated by a declining attention to *climate change impacts* in November (8.9%). Over the months, however, change in attention to *climate change impacts* was significant (Max Chi^2 = 0.0200, P<0.05).

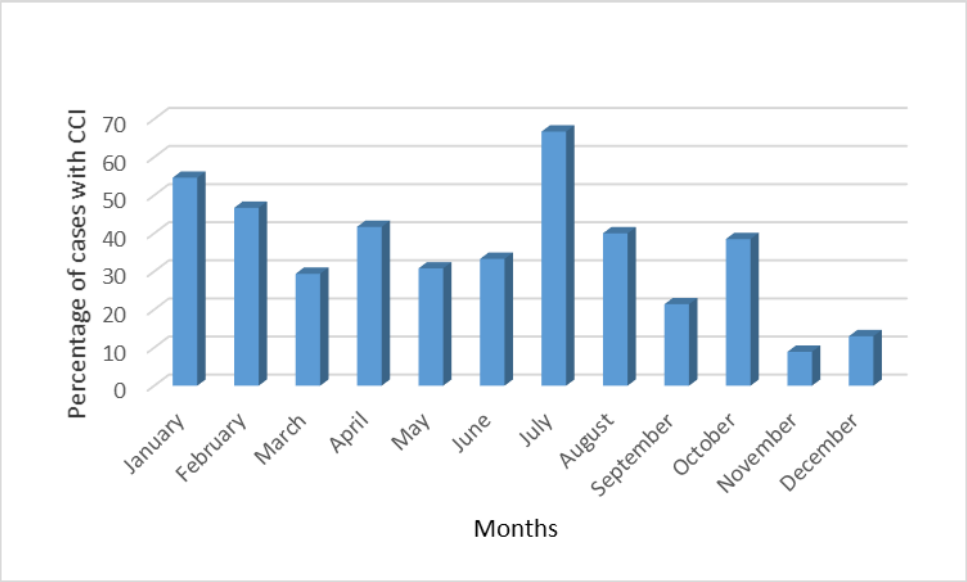

Figure 4.6: Changing attention to *climate change impacts* over the months.

There was sufficient evidence to suggest that change in attention to *climate change projections* was significant between 1996 and 2016 (Max Chi^2 = 0.0000, P<0.05) (Figure 4.4). Although newspapers paid more attention to *climate change projections* in July (50%), its coverage plummeted in December (8.7%) (Figure 4.7).

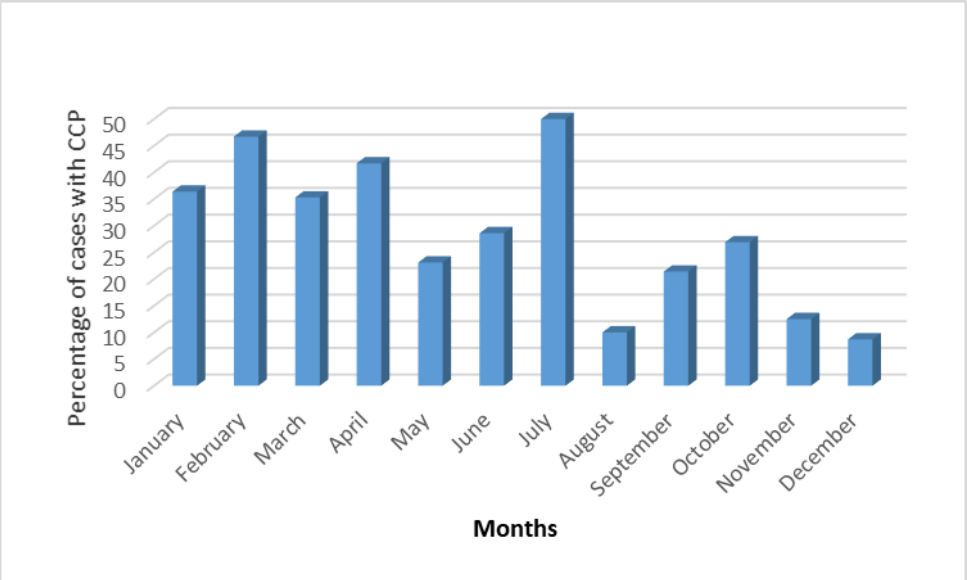

Figure 4.7: Changing attention to *climate change projections* over the months.

A striking finding was the decline in attention to both *climate change projections* and *observed climate trends* in December. Furthermore, July was an important month for newspaper attention to *climate change impacts* and *climate change projections*.

Nevertheless, statistical analysis revealed an overall lower prevalence of attention over the months (Max Chi^2 = 0.3200, P>0.05).

4.2.3 Linkages between three main objective facts

In order to understand the extent of newspaper attention to climate change facts, it was impossible to ignore the connection between *observed climate trends*, *climate change impacts*, and *climate change projections*. The results on the linkages between the three objective facts are presented in Figure 4.8 and the strengths of association are shown in Table 4.1. The most common linkage was between *observed climate trends* and *climate change impacts* (0.274) followed by *climate change projections* and *climate change impacts* (0.164). It is clearly demonstrated (Figure 4.8) that the connection between *observed climate trends* and *climate change projections* was moderately low (0.147). As such, the observed pairing of these objective facts can be related to uncertainty in projected climate change futures (Kundzewicz *et al*., 2018; Bornemann *et al*., 2019; Girvetz *et al*., 2019).

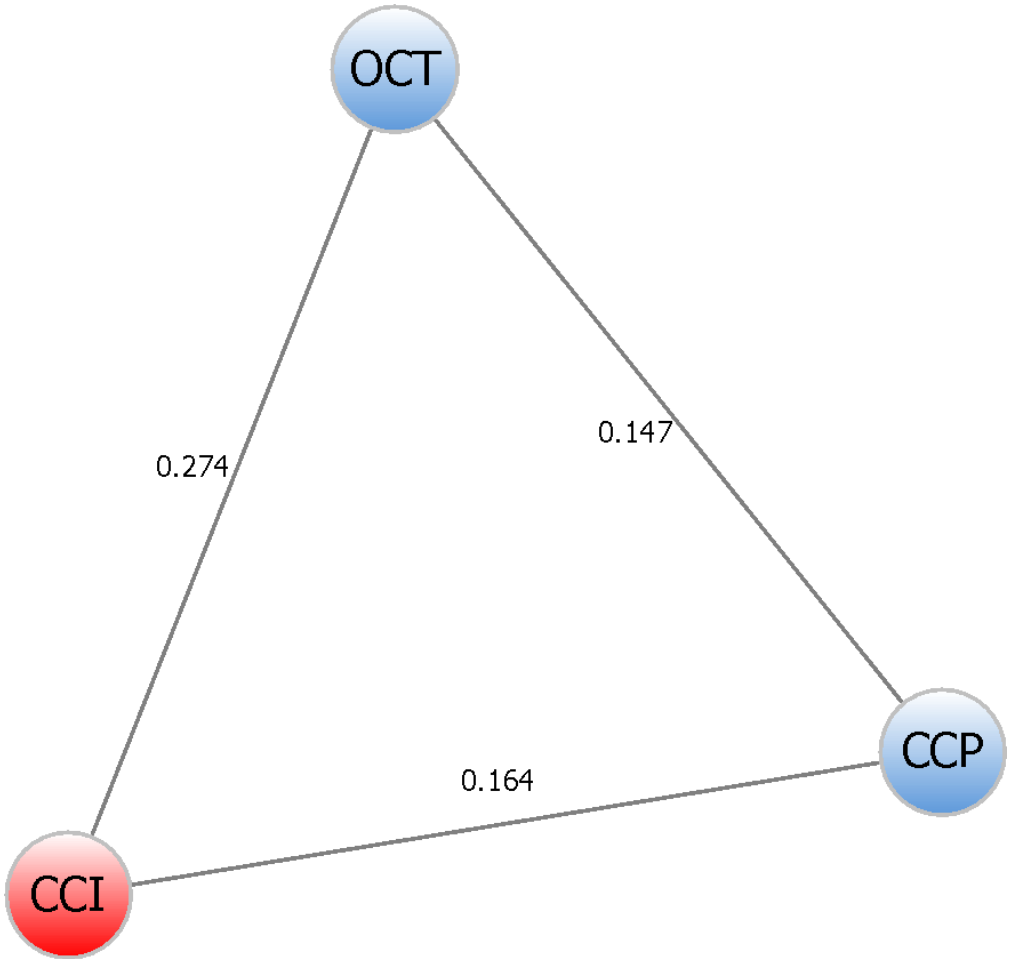

Figure 4.8: Linkages identified in the newspaper coverage of *observed climate trends* (OCT); *climate change impacts* (CCI); and *climate change projections* (CCP).

Although CCP may seem to be an important part in determining future climate, OCT, which deals with climate extremes, held a strong association with CCI (Table 4.1).

Table 4.1: Strength of association between objective facts

TARGET	KEYWORD	CO-OCCURS	DO NOT	IS ABSENT	Association	
OCT	CCI	34	33	29	0.274	
OCT	CCP	23	34	40	0.147	
OCT	RM	10	152	53	0.010	
TARGET	**KEYWORD**	**CO-OCCURS**	**DO NOT**	**IS ABSENT**	**Association**	
CCI	OCT	34	29	33	0.274	
CCI	CCP	25	32	42	0.164	
CCI	RM	8	154	59	0.006	

OCT objective fact appeared along with CCI objective fact 34 times, and without 29 times. The recorded appearances of CCI without OCT were 33. The results have shown an observed association between newspaper attention to the impacts of climate change and projected changes in climate extremes. First, CCI appeared with CCP in 25 cases, and without in 32 cases. Second, the number of appearances of CCI without CCP were 2 times higher than that of OCT and CCP.

4.2.4 Geographic scope

One of the greatest challenges that news media faces is the relevance of issue scope (Bolsen and Shapiro, 2018; Van Aelst *et al*., 2020). In the case of the current study, Figure 4.9 demonstrates four types of geographic scope in the articles. Firstly, domestic news which results from the articles that exclusively covered South Africa. Secondly, regional news drawn from articles in which attention is paid to South Africa and other countries in Africa. Thirdly, international news in which the articles were predominantly focussing on the western world and South Africa was hardly mentioned. Lastly, mixed news type consisted of the articles featuring a combination of domestic, regional, and international news.

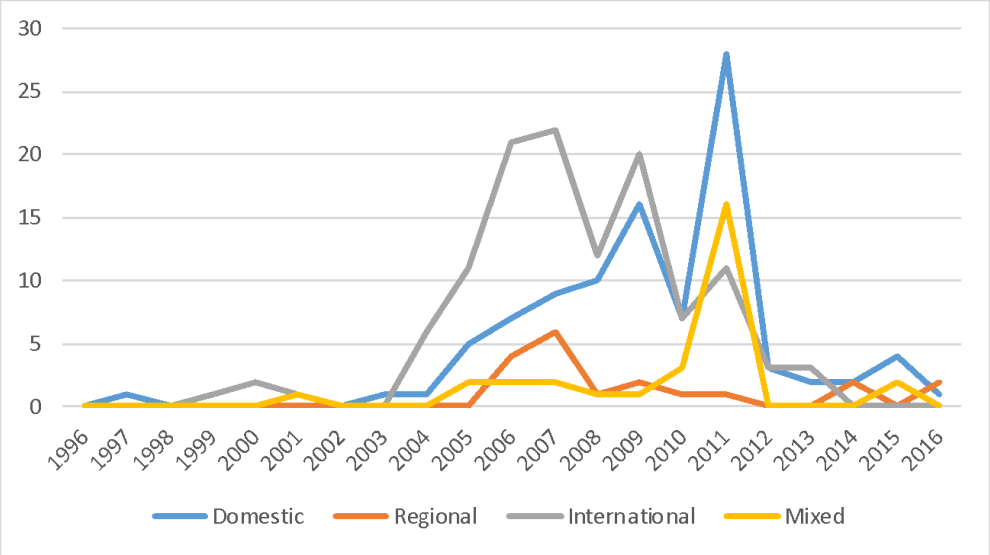

Figure 4.9: Number of articles on issue scope (X-axis represents years, Y-axis represents number of articles).

Overall newspaper coverage of international news (45.1%) has been generally higher than those of other types. The results show a total of 36.5% articles on domestic news. The newspaper attention to regional news constituted 11.3%. With this general view, a low 7.1% was devoted to mixed news. Since 2004, international news dominated the coverage for six years (2004-2009). It is illustrated in Figure 4.9 that an attention to international news increased rapidly in 2006 and 2007. Although there was a decline in 2008, coverage gained momentum in 2009. After an observed variation between 2010 and 2011, there was a sudden drop of coverage in 2012. Between 2005 and 2009, newspaper attention to domestic news gradually increased from 5 to 16 articles. But it was in 2010 that the coverage of domestic news decreased by over half (56%) of the articles recorded in 2009. However, Figure 4.9 shows that a significant increase in attention to domestic news was observed in 2011. The coverage surpassed that of international news by 60%. Mixed news coverage was also at its peak during the same year. The peak coincides with a significant international climate-related occurrence. Results noted a slight increase in coverage of regional news in 2006 and 2007, and the overall attention was limited over the years.

4.2.5 Public key issues

To understand more about the linkage of climate change to public issues in the articles, the study analysed six categories (Figure 4.10). One of the observations made was that more than 100 articles had reported on the burning of fossil fuels, which was followed by *coastal zone* (43 articles), energy (33 articles), *water resources* (30 articles) and *biodiversity* (29 articles). *Agriculture*, including food security, was poorly

covered by the newspapers. A particularly clear example was shown by the fact that only 18 articles linked climate change to agriculture. Fossil fuels had the highest number of articles likely because they are widely regarded as the primary drivers of climate change.

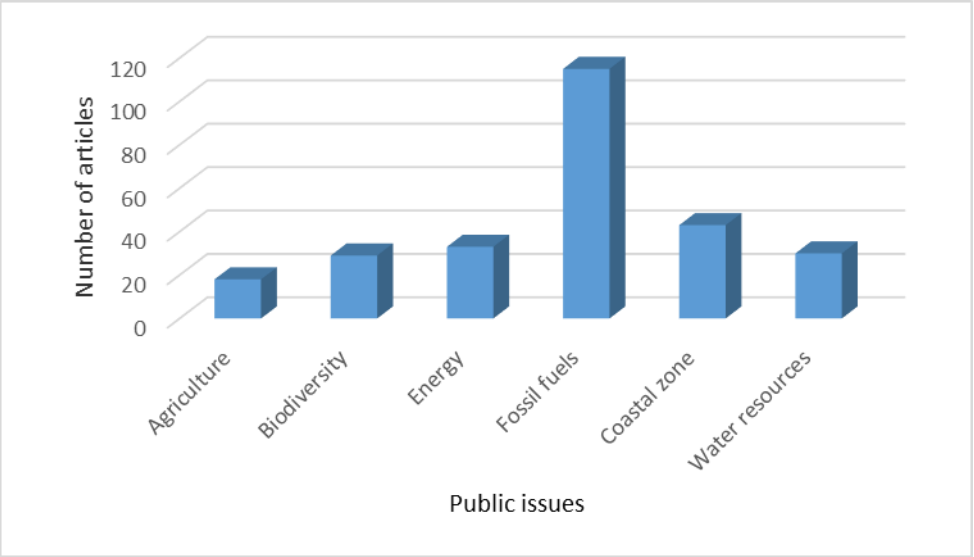

Figure 4.10: Number of articles on key issues related to the public.

4.2.6 Issue participants

The sources cited in the articles covered a broad range of actors - from scientists and research agencies to United Nations agencies and members of the public (Figure 4.11). Scientists were referenced in a total of 126 articles. They are widely regarded as the primary sources where news outlets obtain scientific information. The results noted the importance of policymakers' voice in the news articles, appearing in 95 articles. Compared with other key actors (Figure 4.11), the voices of members of the public were less dominant in the news articles.

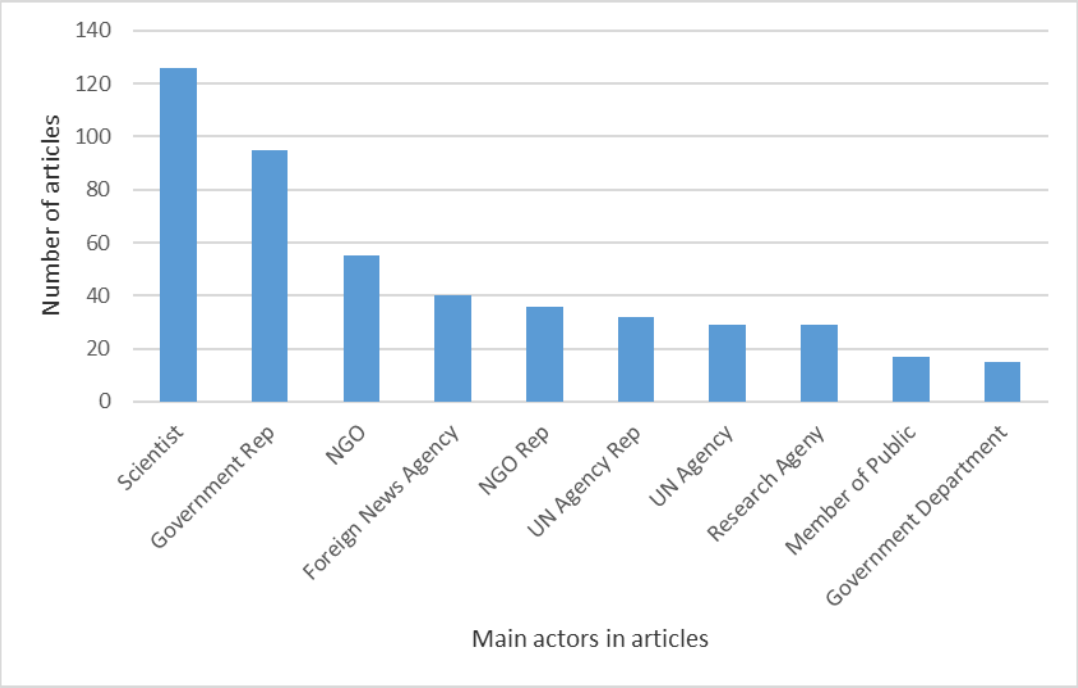

Figure 4.11: Frequency of the main actors in the articles.

4.3 Discussion

This section discusses the major findings pertaining to the first objective and illustrates the range of factors that answer the question about how South African national newspapers portray climate change science objective facts. As a scientific phenomenon, climate change offers a significant challenge to newspapers.

Although *The Sunday Independent* had the highest volume of coverage during the study period, attention to objective facts was not significant. In general, the late 1990s and early 2000s had the least coverage of climate change. This supports the findings of previous studies from other regions that suggest that climate change issues received less attention during that period. For example, several authors have indicated that stories on climate change were poorly reported in newspapers across the globe. In fact, Boykoff and Roberts (2007) noted that there has always been poor newspaper coverage in both developed and developing countries for the period 1996 to 2004.

Studies of Europe and US newspapers have shown evidence in agreement with the results of the current study. Examples of such studies include those by Carvalho and Burgess (2005) UK broadsheet newspapers and Aykut *et al*. (2012) on French

newspapers. The study of Bohr (2020) in US newspapers corroborates the findings of earlier studies (Boykoff and Rajan, 2007; Boykoff, 2011). This evidence may explain why climate change was not an issue of importance in South African newspapers. Most generally, newspapers in South Africa heavily rely on content published by European and American press.

The period 2004 to 2007 in the study revealed an evolution in the coverage of climate change issues. Newspaper attention to climate change was particularly high in 2007. This study showed that major broadsheet newspapers in South Africa were significantly following the coverage trends observed in the US and UK. There is evidence elsewhere in the literature of a major peak in 2007. As reported by Bohr (2020), growing issue attention seems to have been informed by the publication of AR4, and the Nobel Peace Prize that was awarded to Al Gore and the IPCC. Earlier observations concurred that these events, including the Bali conference, were integral in the rising coverage of climate change. Thus, taking into consideration the findings of this study there was no doubt that news stories related to the IPCC played a major role in newspaper attention to the issue of climate change. It was also observed that several articles were published in the context of the IPCC report. For example, on November 18, 2007, *The Sunday Independent* carried the following headline and subheading: “Climate change deal needed to avert disaster. Scientific report reinforces the need for a new carbon reduction agreement to replace the Kyoto Protocol at next month's intergovernmental meeting in Bali.”

An important question to consider was how the South African press kept its climate change coverage momentum post-2007. In general, news media coverage of climate change issues dropped across the globe, and South African newspapers exhibited a similar trend. In accordance with the issue attention cycle and agenda-setting theories, the global economic crisis may be the reason why news outlets devoted less attention to the climate change issue. The period 2007 to 2009 exhibited one of the worst global economic recessions in history. However, it was in 2008, when the world felt the greatest economic impact. This could have prompted a significant dominance of economic issues in newspapers. There is clear evidence that climate change coverage changed during this period. In the US and UK, most leading newspapers have shown consistency in terms of a declining overall newspaper coverage of climate change in 2008. Based on the findings of the current study, the year 2009 matched the number of articles that were published in 2007. According to several authors (e.g., Schmidt *et al*., 2013; Boykoff *et al*., 2020), 2009 showed a significant upturn in the coverage of climate change. The coverage during this period surpassed the first major global peak of 2007. Therefore, the results observed for

the *City Press*, *The Sunday Independent* and the *Sunday Times* were following the global trend.

According to Schmidt *et al*. (2013), during the year 2009, climate change received much-needed attention in leading newspapers across Europe. Similar observations are made in the US newspapers (Bohr, 2020; Boykoff *et al*., 2020). It is a known fact that climate change coverage was boosted by the Climategate scandal and COP15 (e.g., Kumpu, 2016; Saunders *et al*., 2018; Bohr, 2020). Although there was a significant decline in 2010, the coverage of Climate Change issues in the South African press bounced back in 2011 and reached an all-time peak. At a global level, news media showed a sharp decline in climate change coverage during this period. There was no doubt that increasing attention in South Africa is attributed to COP17. It is important to note that a significant proportion of news stories was centred around the event. The following were among the leading headlines in 2011: “COP17: Hope for SA to pave way” (*City Press*); “COP17 dithers as earth withers” (*City Press*); “Gloom and doom hang in the air at climate talks” (*The Sunday Independent*); “Green Fund may be only positive to come from COP17” (*The Sunday Independent*); “Smaller nations despair as agreement eludes summit” (*The Sunday Independent*); “Half-baked forecast for climate talks” (*Sunday Times*); and “COP17 deal unlikely amid uncertainty” (*Sunday Times*).

For a clearer corroboration about the influence of climate change events elsewhere, Eskjær (2017) concurs with the results of the current research through the findings of a study about Danish newspaper coverage of climate change. That study found that two leading newspapers (*Berlingske Tidende*, and *Politiken*) devoted much more attention to climate change news stories during the COP15 in Copenhagen. This was also shown in the French newspapers during COP21 (Gurwitt *et al*., 2017). The current study found that newspaper attention in South Africa sharply declined post-COP17. These findings showed that the coverage of climate change remained low from 2012 to 2016.

Perhaps it is essential to interrogate the drivers of poor coverage for the period 2012 to 2016. As reported elsewhere, socio-economic and political issues control newspaper attention and agenda setting across the globe. In the context of this study, it was common to read more articles that focussed solely on politics. Due to the nature of news media space in the country, any socio-economic and political events were expected to affect the coverage of science-related news stories. Generally, climate change failed to garner during the following events: Marikana Massacre in August 2012 (nearly 50 people died

during a mining strike in Marikana platinum mine), formation of the Economic Freedom Fighters (third largest political party in the country) in July 2013, the publication of the provisional Nkandlagate report (irregular renovations of Jacob Zuma's home in Nkandla) in November 2013 and the death of Nelson Mandela in December 2013, the trial of Oscar Pistorius in March 2014, national and provincial elections in May 2014, the emergence of #FeesMustFall (student movement) in October 2015, the reaction of the investors after the axing of finance minister Nhlanhla Nene in December 2015, municipal elections in August 2016, and the United States presidential election in 2016. The low coverage of climate change could mean that the issue was not of great importance in the agenda of newspapers, or it was overshadowed by the prevalence of political news.

It was revealed that when there were domestic political or social events, COP18 (2012), COP19 (2013), COP20 (2014), COP21 (2015), and COP22 (2016) meetings did not influence newspaper attention to climate change in South Africa. The months of November and December are often known to generate more coverage of climate change due to COP events. That is according to a study by Fernández-Reyes *et al*. (2015). Based on the analysis of three Spanish newspapers (*El País*, *El Mundo* and *La Vanguardia*) for the period January 2000 to November 2014, the study found that the Spanish press achieved significant coverage in December 2009 (nearly 600 articles were recorded). With a total of 436 articles, the study also highlighted that December 2007 was the second- highest peak. Given the influence of COP events, the authors outlined that November 2007 was the period which has shown an overall third-highest peak across the newspapers.

When the monthly newspaper coverage of the issue of climate change was considered, the South African press recorded a peak in November. Despite a more rapid rise of climate change news stories in December 2009 elsewhere, results showed that attention declined by 3% in South African leading newspapers. This means that while the global coverage peaked in December 2009, it was not the case for weeklies in South Africa.

There was one main reason why the climate change science issue failed to dominate news media in the country in 2009. Looking at some of the non-science events that happened in December 2009, it was certainly possible that they overshadowed the climate change issue. For example, the sentencing of Ananias Mathe (a serial murderer, rapist and robber), Miss World 2009 pageant, Miss South Africa 2009 pageant, the death of Manto Tshabalala-Msimang (former minister of health) were among the notable top stories (R Mulaudzi

2018, 20 November). The findings validated the fourth stage of issue-attention cycle theory by Downs (1972) - there is a gradual decline in media attention due to the direct impact of an emerging issue. Although exceptions are known (Fernández-Reyes *et al*., 2015), a trend of low coverage of climate change is generally known two months after COP event (Boykoff *et al*., 2020). The findings of the current study were not surprising.

Overall, the results clearly pointed to the months of January to October being the period of less importance of the year in terms of the number of news stories reported. It is important to note that few climate change news stories were recorded in July over the timeframe of this study. The month of July coincided with a number of social and political events in South Africa, which may be an opportunity for newspapers to pay more attention to them over the climate change issues. In the literature of newspaper coverage of climate change, there was observation in the past that economic and political factors dictate coverage of news stories (Lyytimäki, 2011; Bohr, 2020). Having found that trend in monthly coverage exhibited distinct increasing and decreasing phases, it was possible that COP had an effect on the maximum number of climate change news stories that were covered by both the *City Press*, *The Sunday Independent*, and the *Sunday Times* between November 1996 and November 2016. As reported in a recent study, Boykoff *et al*. (2020) outline that newspapers have always depended on climate change events. Schmidt *et al.* (2013) also indicated that COP events are the main significant propellers of newspaper attention to climate change in the developed world. An overwhelming body of evidence, as detailed by Doulton and Brown (2009), has already shown the powerful influence of climate change events.

At the centre of reporting during climate change events was that political actions can constrain or enable newspaper attention. This is perhaps problematic because it shows not only that politics control the coverage of climate change, but the reliance of newspapers on major climate change events can further limit the reportage of basic factual information throughout the year. This study maintained a view that news media outlets should be involved in multi-level and multi-stakeholder engagement with relevant stakeholders in order to avoid biassed event-based reporting. A new approach, which is more focussed on educating journalists about the basics of climate science and international climate negotiations, could greatly improve news media reporting of climate change.

Many researchers, particularly social scientists, have analysed newspaper coverage of climate change risk and uncertainty (Smith, 2005; Collins and Nerlich, 2016). For South

African broadsheets, there has been a longstanding concern about negligence of basic climate facts (R Mulaudzi 2017, personal communication, 25 November). This study found that observed climate trends (OCT); climate change impacts (CCI); and climate change projections (CCP) were constantly overlooked for the period 1996 to 2016. Surprisingly, climate change response measures (RM) dominated news stories. This was a worrying trend, considering that substantial scientific evidence about climate risk and vulnerability appeared in southern Africa during the early 2000s (e.g., Magadza, 2000; Dixon *et al*., 2003; Erasmus *et al*., 2003; Fauchereau *et al*., 2003; Ziervogel and Calder, 2003).

With the publication of the AR4 in 2007 and AR5 in 2014, an increasing proportion of studies covered factual and baseline information on climate change in South Africa (Engelbrecht *et al*., 2015; Davis-Reddy and Vincent, 2017). This study showed that, while scientific information about climate change science was available in South Africa, newspapers were not paying more attention to *observed climate trends*, *climate change impacts*, and *climate change projections*. While the findings explicitly highlight a widening newspaper-objective fact gap, newspapers became slightly interested in *climate change projections* during the mid-2000s. Although climate change was highly visible in 2007 across the globe, the coverage of basic facts in South African newspapers was not a top priority. The same newspaper-objective fact gap was present over the years. With the rapid decrease of the global coverage of the climate change issue in 2008, it was not likely that basic objective facts would be given attention. Newspapers have made the economic issue a priority during this period. While there was a positive recovery in newspaper coverage of climate change elsewhere due to the Climategate and COP15, this study demonstrated that objective basic facts remained scarce in South African newspapers. Even after recording a peak in the overall attention from the UK and US newspapers, studies suggested that press devote ample time on reporting political agenda (Bohr, 2020).

The question of why South African news media constantly ignored *observed climate trends*, *climate change impacts*, and *climate change projections* may be explained by several reasons. For example, coverage of climate change in other parts of the world was not entirely dedicated to basic objective facts. Politics pertaining to climate change was massively reported. It is often cited that climate change events have been central in stimulating the attention of print media. However, quantification of objective facts is pushed to the bottom of the list in the news media. This was a major challenge that South African newspapers faced because they depend largely on foreign press. A similar trend was noted in the French press (Brossard *et al*., 2004). The authors provided evidence

to suggest that US broadsheet newspapers had long been playing a major role in shaping climate change issue attention.

This study identified three remarkable phases of objective facts coverage in the South African press. The first phase took place from 1996 to 2003. There was extremely poor coverage of the objective facts. In comparison to the overall coverage of climate change in the Global North, the results suggest that South African newspapers were following a global trend. The second phase was when the coverage of objective facts was at its peak in 2006 and 2007. There is evidence to suggest that the global news outlets started to increase their coverage of climate change during this period (McAllister *et al*., 2021). The third phase was a declining period of coverage, with some fluctuations, from 2008 to 2016. The political dimension of climate change was arguably the central topic in the news articles during this period (Mulaudzi and Kioko 2022).

In examining the overall monthly changes in the coverage of objective facts, this study sheds insight into the dominance of *observed climate trends* in the news articles between January and April. This means that observed climate trends coverage may not be entirely related to climate change events. Based on the findings of the study, it was difficult to show definitively that newspapers took advantage of COP events in reporting *observed climate trends*. A number of studies have argued that the coverage of climate change had more to do with focussing events (Schmidt *et al*., 2013). At close scrutiny, *observed climate trends* attention was unstable over the months of May and December. Because the overall monthly *observed climate trends* attention was so low in November and December, the study can strongly argue that this objective fact was neglected in broadsheet newspapers. Along with *climate change projections*, *climate change impacts* coverage exhibited a similar pattern. In fact, the results confirmed that decreasing *climate change impacts* attention was rife in November. It has also became clear that the decline of *observed climate trends* and *climate change projections* attention was highly visible in December. *Climate change impacts* and *climate change projections*, however, were predominantly reported in July. This was probably an example of the relationship between climate change impacts and projections.

It is important to note that COP events are not the only influential drivers of coverage. Most accounts have shown that extreme weather events have an effect on how newspapers report climate change issues (Craft *et al*., 2015; Kogan *et al*., 2019). Because the findings contain strong evidence that the coverage of objective facts was dissimilar to the overall attention of climate change, their visibility was diluted by non-science agenda. As a

basis for corroborating this argument, other studies have pointed out a known dominance of politics and economics in news stories, and it was suggested as the main reason why objective facts were not given sufficient attention in news media. While it was certainly possible that newspapers were avoiding objective facts because of the complexity of climate change science, the general view of the news media outlets in this study was the politicisation of the issue. This may be a result of one barrier. This study argued that the absence of collaborative capacity between media and scientists can make it particularly difficult to integrate scientific information into existing agenda setting of news media outlets. Although the overall changes in attention of *observed climate trends* and *climate change impacts* were highly significant over the months, the opposite was the case for *climate change projections*. It was possible that projecting future changes in temperatures and rainfall could have been the explanation of the findings. Of significant importance was the extent to which observed changes in global temperatures attract media and public attention (e.g. Hase *et al*., 2021).

Results of the linkages between *observed climate trends*, *climate change impacts*, and *climate change projections* suggest that coverage of *observed climate trends* were strongly linked to newspaper attention to *climate change impacts*. Another observation with respect to the *observed climate trends* was that this objective fact showed a pattern that exhibited a weak link with *climate change projections*. However, because the association between *observed climate trends* and *climate change projections* was not strong, it can be partly considered as the explanation for a slight increasing strength of association between *climate change impacts* and *climate change projections*. The findings revealed that there had not been a consistent association between the objective facts of climate change in the South African press. Unfortunately, lack of a clear solid association between objective facts might be reflecting a scary picture about the standpoint of the South African newspapers around the issue of climate change science. To explain this point, it is paramount to note that the findings showed that newspapers failed to strike a balance between observed changes in global climate, projected climate change, and impacts of climate change. A consequence of this failure can be a distorted climate change science message.

Although it may seem that climate change science objective facts were reported in a disjointed manner, specifically for *observed climate trends-climate change projections* and *climate change projections-climate change impacts* associations, it did not imply that newspapers are entirely showing disconnection. For instance, the *observed climate trends-climate change impacts* association showed that newspaper attention was based on

extreme events and impacts. The findings from this study validated evidence that extreme weather events may influence issue attention (Barkemeyer *et al*., 2017; Hase *et al*., 2021). The combination of changes in temperature and rainfall may have contributed to a positive association between *observed climate trends* and *climate change impact*s. In addition, risks of adverse impacts of extreme weather events were also equally important.

The study revealed that geographical issue scope contributed to newspaper portrayal of climate change. The primary explanation is that the South African newspapers put more emphasis on international news than local news. While international news dominated climate change stories for the period 2004 to 2009, there was strong evidence that domestic news nearly surpassed international news in 2009. Trend analysis across all geographic scope in the articles revealed that domestic news was at its peak in 2011. The findings of this study further revealed that the period of significant attention to mixed news on climate change also occurred in 2011. This was the period that relegated international news to a third spot. It was possible that this finding resulted from the fact that South Africa was hosting COP17. Existing evidence indicated that domestic newspapers increase their coverage of climate change during COP events. Although domestic news type is strongly associated with regional news type, it was surprising that the findings of this study demonstrated that the latter did not feature in 2011. Only a single article was recorded during this period. A slight contribution was visible in 2007.

What was more obvious from this study was that four phases have emerged from the findings. First, climate change issue coverage in the South African press was fuelled by international news between 2004 and 2009. Thus, when the issue was becoming a persistent feature in newspapers, it was made possible by a major influence of foreign news outlets on the dynamics of science coverage in South Africa. It is thus likely, that while domestic news attempted to dominate the space in 2009, international news persisted as a result of the Climategate scandal and COP15. Second, both news types (domestic news, regional news, international news, and mixed news) followed a global declining trend in 2010. Third, domestic news was given significant attention in 2011. While acknowledging the general significance of other factors, the explanation of increasing attention to local news was more reasonably located in the leading role of South Africa in the Durban climate talks. Fourth, consistent with the sharp decline of coverage in 2012, all news types have shown a similar trend. In the face of these phases, the study can argue that the effects of COP17 were shown to be greater on attention to domestic news than on international news. However, it did not impact the overall dominance of international news in the South African press.

How did newspapers portray key issues related to the public? Analysis of the distribution of issues that were highly associated to the public shows that a large proportion of coverage was devoted to fossil fuels. To understand why the issue of fossil fuels was attracting more attention across the newspapers, it was important to look at the history of the relationship between climate change and fossil fuel. More than 60 years ago, scientific evidence about the impact of industrial gases on climate emerged. The blame fell on the emissions of carbon dioxide from fossil fuel combustion. Keeling (1958), who made a number of measurements from Mauna Loa Observatory in Hawaii (see e.g., Keeling 1998), argued that annual carbon dioxide concentration in the atmosphere was growing at an alarming rate (Keeling 1961; Pataki *et al*., 2003). It must be noted that Keeling's findings were among the useful starting points in the understanding of current state and historical changes of global climate. Although an increase in atmospheric carbon dioxide produced by humans was considered to be the main culprit, methane and nitrous oxide were also contending gases. Today's discussion about climate change is still centred around anthropogenic emissions of greenhouse gases. In the face of mounting calls to dump fossil fuels, the world is consistently divided about the future of energy production. The burning of fossil fuels may therefore turn out to be the most attractive public related issue in news media. However, even though fossil fuel is closely linked to energy production, it must be noted that the findings of this study showed that the energy issue was not given a high priority. This was a major concern, taking into account that South Africa's electricity generation is still heavily reliant upon coal to meet its growing energy demand. The finding was in disagreement with previous research on attention to climate change issues related to the public (Liu *et al*., 2008), which indicated that the energy issue was one of the valuable components in climate change news stories. It seemed likely that newspapers failed to reflect the interrelationship between fossil fuel and energy. The disconnection, therefore, of these issues was seen as an interesting finding because it raised a question about the viewpoints of the South African press regarding the energy issue and its practical value to climate change story.

In discussing issues related to the public it is important to understand the vulnerability of various sectors to climate change. The findings of this study, however, showed that the South African newspapers did not significantly report about the risks of climate change on agriculture, biodiversity, coastal zones, and water resources. This was a worrying picture because the country is already impacted by climate change. Despite evidence from studies which showed that South Africa had been paralysed by climate change over the past few decades, this study clearly illustrated that the emphasis of newspapers remained

pointed to response measures, rather than observed climate trends and impacts of climate change. This notion confirmed the argument that as long as political agenda is able to dominate news stories about climate change, objective facts will find it hard to garner attention. The fact that there was insufficient coverage of climate change impacts indicated that the public was receiving incomplete messages. Therefore, this presents limitations in terms of possible actions to deal with the impacts of climate change.

This study found that scientists played an integral part as the main source in the articles. It is widely recognised that journalists get their information from scientific experts. In many cases, scientific voices are often cited sporadically. Compounding the infrequent appearance of scientists in the articles is that more attention is given to political figures. On the contrary, this study has shown that scientists featured in almost 50% of the articles. It was thought that this would give rise to coverage of objective facts. However, climate change news stories clearly showed a lack of scientific dimension. This highlights some of the challenges that news outlets might be encountering when they report scientific information. Although the gap between policymakers and climate scientists is among the chief factors that are highly documented regarding inconsistent communication of climate change, this study revealed that government representatives attempted to show resilience. This may hold an explanation that climate change reporting is not only rooted in objective fact, but also in the voices of policymakers. Furthermore, non-governmental organisations were among the top three main actors in the articles. It was highly likely that the finding was widely credited with the huge growth of climate organisations in the country over the last decade, and that they were also an essential component of climate talks.

South African newspapers seem to mainly rely on foreign news agencies rather than United Nations agencies, and research agencies. This could explain why international news dominated news stories. Observing that non-governmental organisation representatives and members of the public were significantly underrepresented, the study argued that the public was not given attention. The imbalance between scientists, government representatives and members of the public in news stories could, at least in part, mean that newspapers focused on reporting about what they view as selling points from scientists and policymakers, rather than having a balanced message from both actors. Although public voices have been taken fairly seriously elsewhere, climate scientist voice was by far the least cited in the articles. The findings of this study suggested the opposite, but newspapers poorly reported objective facts.

4.4 Conclusion

In this chapter, the results on the first objective of the study were provided. First, the chapter looked at the changes in the overall newspaper coverage of climate change over time. Second, the focus turned to the trends in the coverage of objective facts on climate change science. Third, the chapter demonstrated results on the types of geographic scope in the newspaper articles. Fourth, the results on key issues related to the public (agriculture, biodiversity, energy, fossil fuels, coastal zone, water resources) were shown in this chapter. Lastly, the chapter provided results on the issue participants – sources cited in the newspaper articles.

This chapter has also provided a comprehensive discussion on the findings of the study. Guided by the issue cycle and agenda-setting theories, it has attempted to answer the question around how broadsheet newspapers are reporting objective facts of climate change. Based on the findings, it was shown that there is less attention given to the scientific dimension of climate change. This chapter is based on the following research paper: Mulaudzi, R and Kioko, J. 2022. Understanding broadsheet newspaper attention to climate change objective facts in South Africa. *Environmental Research Communications*, 4(12), 125001. https://doi.org/10.1088/2515-7620/aca1fd

CHAPTER FIVE: INFLUENCE OF CLIMATE CHANGE FOCUSSING EVENTS

5.1 Introduction

The decisions originating from climate change focussing events under the United Nations are critical in increasing newspaper coverage of climate change. Conference of the Parties (COP) meetings are known for driving discussions centred around equitable reduction of greenhouse gas emissions (Kahn, 2016; Kinley, 2017; Seo, 2017).

In general, the climate change conference that received more attention is COP3 in Japan. In the conference, the 1997 Kyoto Protocol represented a major development in international agreement to reduce greenhouse gas emissions (Batalha and Reynolds, 2012; Depledge, 2013; Grunewald and Martinez-Zarzoso, 2016; Almer and Winkler, 2017; Maamoun, 2019). Dealing with the active role of South Africa during the climate change conferences, results show how newspapers had an almost consistent coverage of both COP15 in Denmark (Copenhagen conference) and COP17 in South Africa (Durban conference).

This chapter explores the appearance of climate change conferences in the articles (Figure 5.1). Section 5.2 presents findings relating to the coverage of the third conference on climate change. The results of the attention to the Copenhagen conference (COP15) over the years are captured in Section 5.3. The average monthly coverage of the conference is also presented. Section 5.4 is concerned with the coverage of the Cancun conference (COP16). The Durban conference (COP17) is covered in Section 5.5. The section focuses on both yearly and average monthly trends in the coverage of COP17. Then Section 5.6 looks at the coverage of the landmark meeting in France, Paris conference (COP21). Lastly, Section 5.7 discusses the association amongst the conferences and its impact on the coverage of climate change science objective facts.

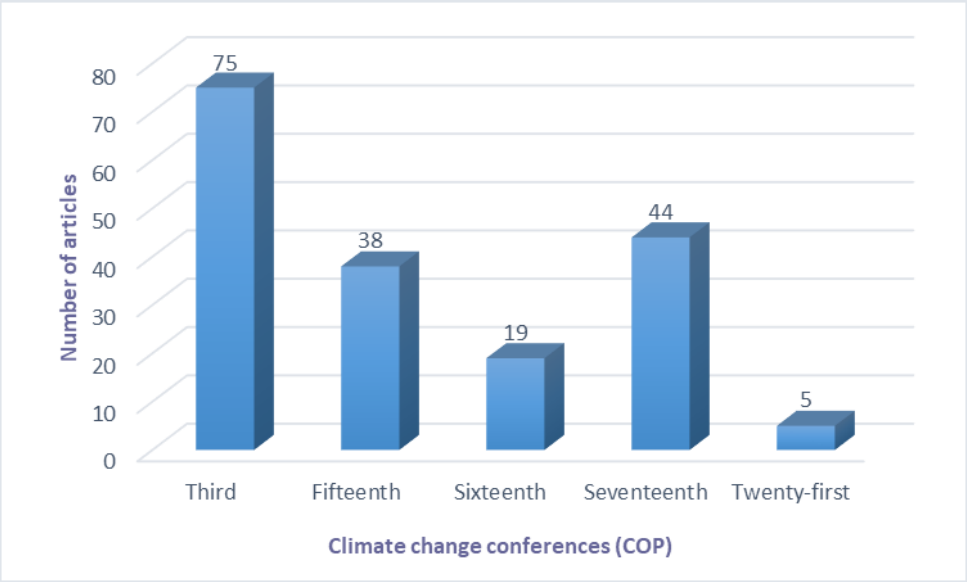

Figure 5.1: Climate change conferences covered in the articles.

5.2 Results

5.2.1 Kyoto Conference (COP3)

The results shown in Figure 5.1 illustrate that COP3 was cited in more than 70 articles. The conference was characterised by the adoption of an international agreement, the Kyoto Protocol. The majority view in science and policymaking realms emphasised that the agreement was the world's strongest tool, in terms of binding commitments on reduction of the main greenhouse gases such as carbon dioxide, methane, and nitrous oxide (Depledge, 2013; Grunewald and Martinez-Zarzoso, 2016).

Clean Development Mechanism (CDM) was one of the important mechanisms that emerged in the Kyoto Protocol, and Article 12 contained vital elements. These include achieving sustainable development through emission reduction projects in developing countries (Shishlov *et al*., 2016; Grubb *et al*., 2019).

This study found that news media attention to the COP3, particularly the Kyoto Protocol, increased in 2009 and 2011. The increase in coverage appears to be largely driven by the politics of climate change during the Copenhagen Climate Summit and Durban Climate Summit negotiations (Schmidt *et al*., 2013; Mulaudzi and Kioko, 2020). After the expiration date (31 December 2012) of the Kyoto Protocol, COP3 was cited in a single article between 2012 and 2016. This is the period of the overall decrease in climate change.

5.2.2 Copenhagen Conference (COP15)

In 2009, at COP15 held in Copenhagen, Denmark, negotiations continued to search for an integrated replacement for the Kyoto Protocol. “The solution is complex, but we know what needs to be done. We know that the future of our planet depends on a global commitment to permanently reduce greenhouse gas emissions.” This statement was made by Lars Løkke Rasmussen, Prime Minister of Denmark, during his official opening address to the delegates at COP15 on the 18th of December 2009 (International Institute for Sustainable Development, 2020). During the negotiations, delegates adopted a framework agreement, the Copenhagen Accord, to inform and strengthen greenhouse gas emissions reduction targets. There was a firm standpoint that developed countries have an obligation to finance climate change mitigation and adaptation projects in developing countries (Bodansky, 2010; Christoff, 2010; Parker and Karlsson, 2018).

Long before COP15 was held, the conference started to get recognition in the *City Press*, *The Sunday Independent*, and *Sunday Times* in 2007 (Figure 5.2). While the details about the conference were limited, acknowledgement rose by 3.2% in 2008. Nonetheless, it is likely that newspapers were continuing with the coverage of the great recession that lasted for 18 months (December 2007 to June 2009). Following the end of the global crisis, attention began to be focussed on climate negotiations. The trends in newspaper attention to COP15 are highlighted in Figure 5.2, the key point being a notable increase of coverage in 2009. Over 60% of the articles reported on COP15. Most striking is a significant fall in attention during the post-conference years, 2010 (11.1%) and 2011 (12.5%). Results revealed that there was a statistical significance of COP15 coverage from 2007 to 2011 ($\text{Max Chi}^2 = 0.0000$, $P<0.05$).

The average monthly coverage trend identified in the data sets indicated that COP15 received no attention in April and October (Figure 5.3). During the first three months (January, February, and March), the attention was constant, with a slight decrease in May, July, and October. COP15 dominated newspaper coverage in September, November, and December. In general, news stories on climate talks are traditionally at peak during the last two months of the year.

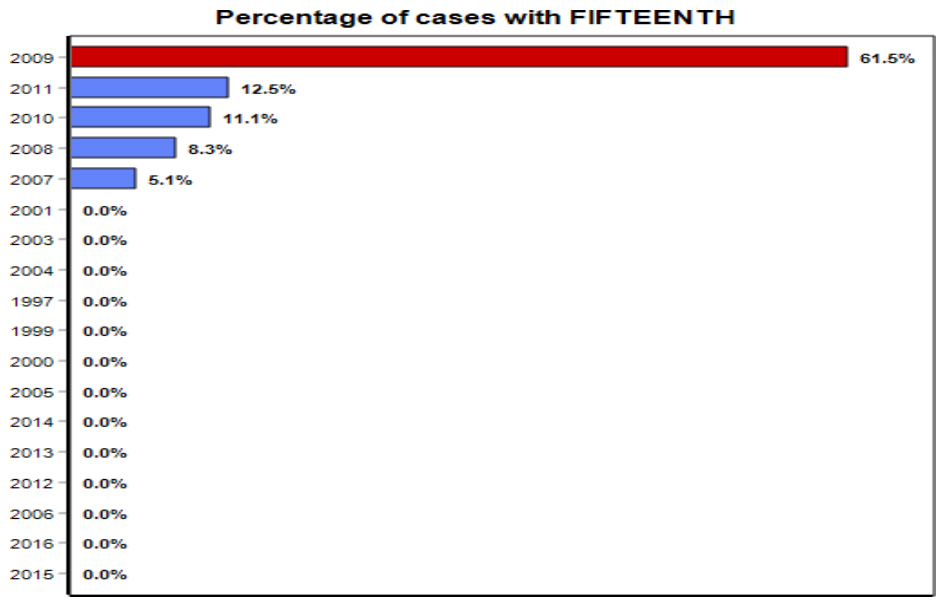

Figure 5.2: Attention to COP15.

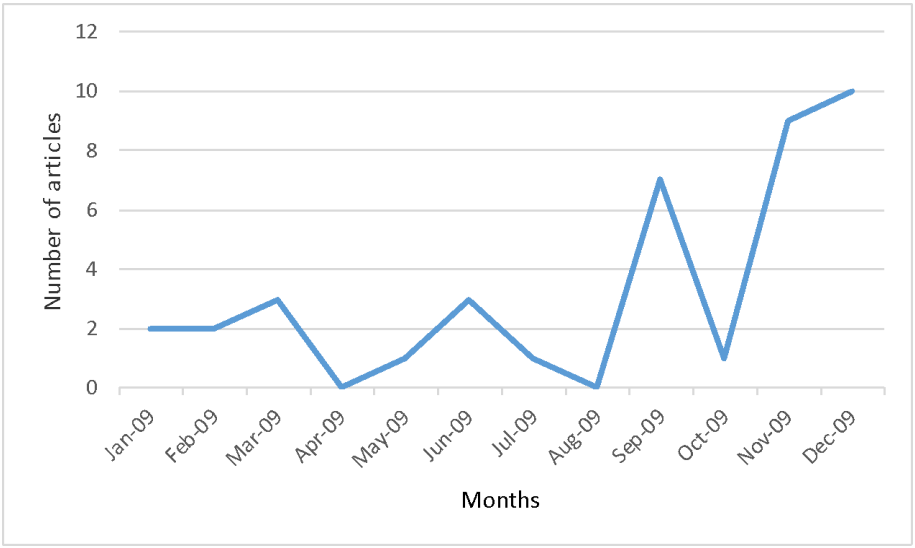

Figure 5.3: Monthly coverage of COP15.

5.2.3 Cancun Conference (COP16)

Commitments for reduced emissions have always been at the centre of the United Nations climate change meetings, but there is a long history of empty pledges made by the developed countries. Essential in cutting carbon emissions were strengthening climate

finance and facilitating multilateral climate frameworks. A remarkable issue of the discussion is that the delegates agreed on a set of decisions, Cancun Agreements, to develop appropriate actions of mitigating the impact of global climate change. Although the Cancun Agreements were seen as the extension of the unsuccessful Copenhagen Accord, it appears that they have been identified as the contributors in the progress towards effective implementation of transparent actions in climate change mitigation and adaptation (Keohane and Victor, 2011; Rajamani, 2011; Boykoff, 2012; Paolo, 2020).

In an effort to shift towards low carbon and climate resilience, the delegates agreed on a Green Climate Fund (GCF). The fund entails that rich countries agree to support developing countries with finance to address the impacts of climate change and at the same time mainstream adaptation and mitigation activities across sectors. In general, accounts of the Cancun Agreements emphasise a call for a clear binding agreement to keep global warming below 2°C. For this reason, if progress was to be made, it was necessary to review long-term mitigation and adaptation actions. COP16 recognised the need to establish operational mechanisms for the implementation of clean technologies and GCF in developing countries (Recio, 2019; Seo, 2019; Cui *et al*., 2020).

Within the context of South African Sunday newspapers, COP16 first appeared in 2009 (Figure 5.4). Further observation, notably in 2010, showed that attention to COP16 was under 30%. There is a remarkable degree of decline of over 33% from the previous conference, COP15. It is highly likely that the coverage decreased due to focus on a current sporting event, 19th FIFA World Cup in South Africa. This was arguably an event that received more attention in news media in the country and across the globe in 2010. Post-COP16, the coverage declined in 2011 (down 6.4%) and 2012 (down 11.1%). During these years, South African news media had undergone several shifts. First, press media interest was on the 17th climate change conference held in Durban, from 28 November to 11 December 2011. Second, the 2012 shift was characterised by the coverage of the Marikana massacre which took place in August. This is likely to have attracted media attention because 34 protesting mine workers were killed by police at the Lonmin platinum mine (Marinovich, 2016; Bernard, 2016). In October, the Marikana Commission of Inquiry started with its first seating. This study suggests that the Marikana massacre took prominence over the COP16 in the South African press (R Mulaudzi 2017, personal communication, 25 May). Overall, results revealed that attention to climate change science in the *City Press*, *The Sunday Independent*, and *Sunday Times* had little to do with the Cancun conference.

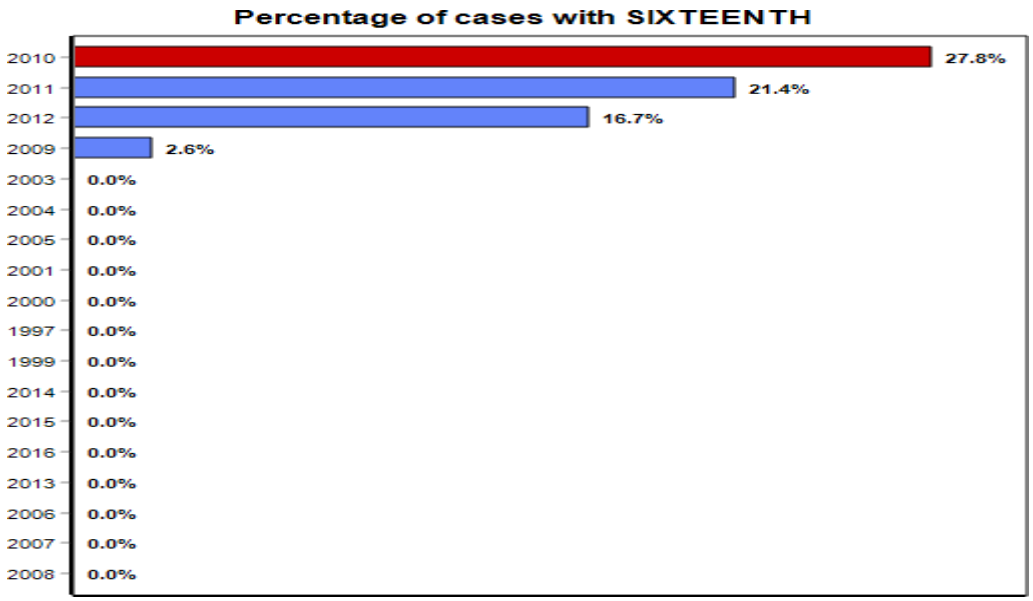

Figure 5.4: Attention to COP16.

5.2.4 Durban Conference (COP17)

Like in any international summit on climate change, the previous host nation is given the opportunity to brief the delegates. Prior to the discussions of the agenda of the Durban conference (COP17), one member of the delegates from Mexico, Patricia Espinosa, president of COP16, proposed that the implementation of the Cancun Agreements is a significant starting point for COP17 (International Institute for Sustainable Development, 2020).

In the case of an issue that has significant importance in negotiations, the delegates suggested a more elaborative mechanism with clear guidelines for actions aimed at increasing mitigation measures. The suggestion was, therefore, that the COP17 mandate is to bridge the negotiation-action gap since the adoption of the Bali Action Plan in the Bali conference (COP13) in 2007. The roadmap aimed at working towards building effective mitigation actions in post-2012 (Kypreos and Lehtilä, 2016; Chan *et al*., 2018).

During COP17 discussions, delegates recommended that, to aid the establishment of a new legally binding protocol, a roadmap is critical to ensuring transition towards achieving emissions reduction targets beyond 2020. The adopted roadmap, Durban Platform for Enhanced Action, took the global temperature rise into account. To achieve the 2◦C global

temperature target, delegates concluded that an elaborated and clear pathway is required to reduce emissions of greenhouse gases (Boran 2017; Chan *et al*., 2018; Groen, 2020). For the study, results have shown that COP17 attracted a greater attention in 2011, contained in more than 70% of the articles. During the pre-conference year, it was found that COP17 appeared in just over 16% of the articles. It is notable that this proportion of coverage was similar to that recorded in 2012.

Considering the above, the relatively poor coverage of COP17 in 2010 and 2012 does not mean that there were no discussions about the climate change focussing events. Rather, it implies that COP17 was overshadowed by other topics. Of the several top stories in the country, the 2010 FIFA World Cup and the 2012 Marikana massacre featured prominently in the national news media (R Mulaudzi 2017, personal communication, 25 May). Across the years in which COP17 appeared, statistical analysis indicated significant newspaper attention (Max Chi^2 = 0.0000, P<0.05).

Given monthly variations in coverage, it is important to recognise changes in newspaper attention over the months. It is clear from Figure 5.6 that attention to COP17 only became visible in the last two months of the year. This may be credited to the fact that the conference was convened from November to December 2011. For February, May and June, there were no stories about COP17 in the *City Press*, *The Sunday Independent*, and *Sunday Times*. In February, the State of the Nation Address by the president was of major importance in news weeklies. The 2011 local government election dominated mass media in May and June. Although newspaper attention was almost similar in January (5 articles) and September (4 articles), COP17 was not actively reported in March, April, July, August, and October. However, an observed change in relationship between attention to COP17 and month was statistically significant (Max Chi^2 = 0.0200, P<0.05).

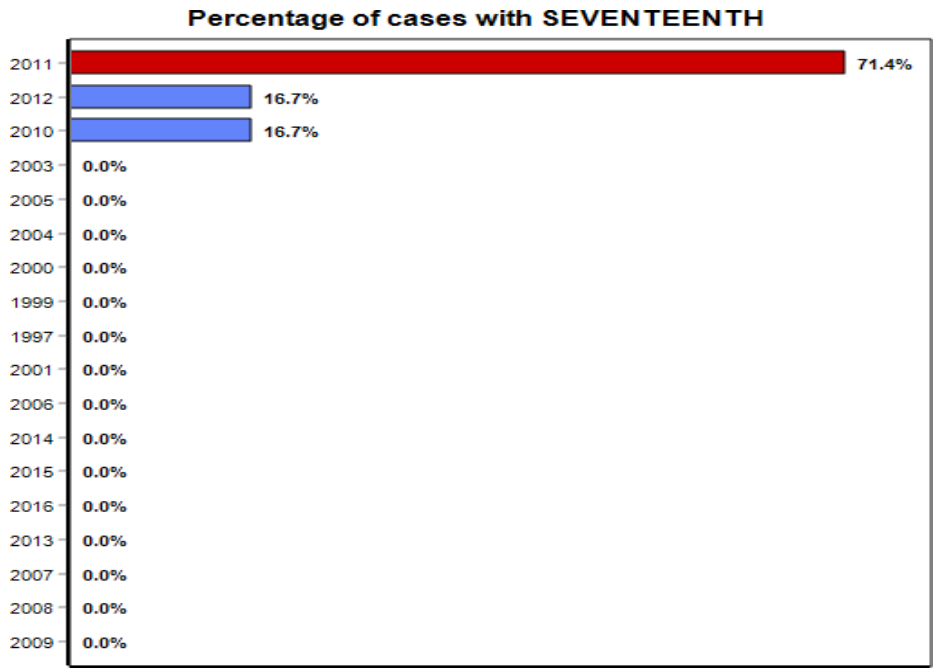

Figure 5.5: Attention to COP17.

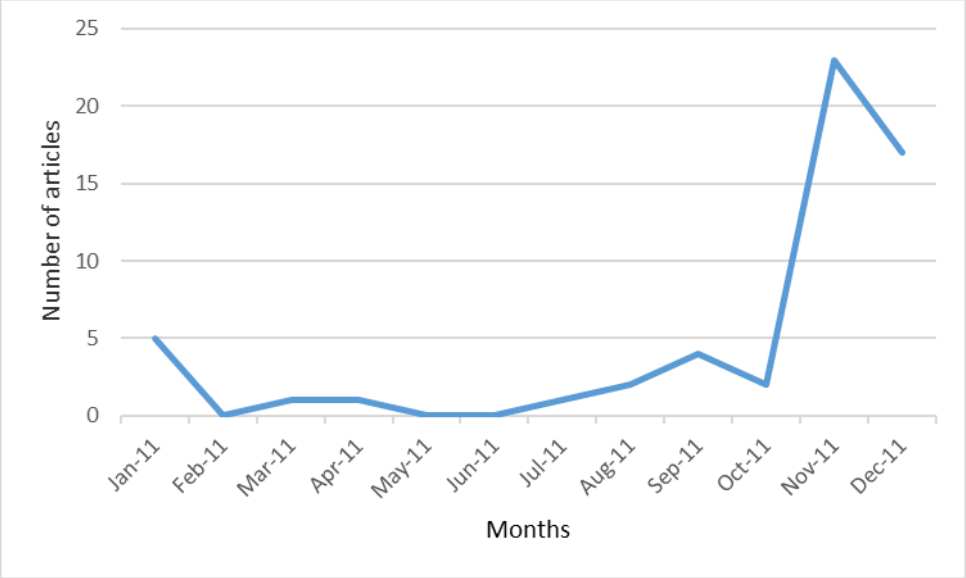

Figure 5.6: Monthly coverage of COP17.

5.2.5 Paris Conference (COP21)

During the 2015 COP21 in Paris, France, there was increasing awareness of the need to sign a new global climate treaty. The story of a replacement agreement for the Kyoto Protocol was one of the longest running global climate negotiation efforts to reduce greenhouse gas emissions. The delegates adopted a landmark climate accord, the Paris

Agreement. This was the most important agreement since the adoption of the Kyoto Protocol and indeed has been hailed as one of the great climate negotiation success stories of the 21st century. Its primary aim was to provide a comprehensive legally binding principle of action at the international level (Dimitrov, 2016; Hulme, 2016; Schleussner *et al*., 2016; du Pont and Meinshausen, 2018).

Based on the previous goal of reducing global temperature below 2°C, an important development is a decision by the delegates to further limit an increase by 0.5°C. In terms of financial commitments, the Paris Agreement highlighted the need to strengthen and expand the binding obligations by the developed countries to support mitigation and adaptation projects, particularly in the developing countries (McCollum *et al*., 2018; Tolliver *et al*., 2019; Michaelowa *et al*., 2020).

The first story on COP21 was not recorded in news weeklies until September 2014 when the *Sunday Times* published an article that was reported in two foreign news agencies, *The New York Times* and *Reuters.* During the year of COP21, a total of three articles appeared in news weeklies. Despite increasing global publicity of the Paris Agreement post-COP21, there was no substantial newspaper attention in 2016. These results show that COP21 was not very important in the *City Press*, *The Sunday Independent*, and *Sunday Times*. The researcher made several observations. First, the murder trial of the former South African Olympic and Paralympic athlete, Oscar Pistorius, dominated news media from March 2014 (e.g., Biber, 2019). It was followed by the first elective conference of the third opposition party in the country, Economic Freedom Fighters (EFF), which took place in December 2014. Second, the first nine months of 2015 were characterised by political stories. For example, the expulsion of the General Secretary of the Congress of South African Trade Unions (COSATU), election of the first black leader of the Democratic Alliance (DA), the publication of the Marikana Commission of Inquiry report, and the second birthday celebration of the EFF. In October 2015, a biggest student-led protest in post-apartheid South Africa, #FeesMustFall, spread across all universities in the country. The protest was reported in a significant number of news stories across the South African newspapers. Lastly, the frequently cited stories in 2016 were around the political corruption investigation, State Capture.

The findings confirmed the theories of issue-attention cycle and agenda-setting in news media. For instance, this study demonstrates the *pre-problem* stage in the issue-attention cycle to be correct for coverage of COP15 and COP17. The coverage of COP15 was non-existent until 2007. The research also found that COP17 began to appear in the news

articles in 2010. This study suggested that other issues took prominence over climate change focusing events. The rise in coverage of COPs 15 and 17 in 2009 and 2011 exhibited the stage of *alarmed discovery* in the press. The Copenhagen Climate Summit and the Durban Climate Summit were the major drivers of climate change coverage in South Africa. More generally, South Africa's news coverage of climate change reached an all-time high during the Durban Climate Summit. Why did the coverage of COPs plummet post-2011? The period 2012 to 2016 saw a significant decline in climate change coverage across South Africa. This study found that topics other than climate change focusing events received more attention in the press. The findings were consistent with the *decline* stage in the issue-attention cycle – news media interests decline due an appearance of a new issue in the agenda.

This study revealed how the prominence of non-scientific issues in the press contributes to lack of focus on climate change focusing events. The findings validated the well-established theory of agenda setting in that the significant press attention devoted to non-scientific issues weakened the coverage of climate change. This could primarily influence the importance of climate change in the public. For example, newspaper readers may tend to regard climate change as insignificant. This finding has been demonstrated by McQuail (2010) to argue that coverage of some issues over others could influence public opinion.

5.3 Discussion

This section focuses on the second objective – dealing with COP events and climate change issue coverage in the South African newspapers. COP events are one of the many drivers of newspaper attention. Although several studies on climate change focussing events have reported the influential role of COP events in issue attention for the past two decades (Schmidt *et al*., 2013; Kumpu, 2016), this study found that COP meetings were considerably under-reported in the South African press. The visible conferences are COP3, COP15, COP16, COP17 and COP21. What is more important is to look at the overall dominance of COP3 or the 1997 Kyoto Protocol beyond 2005. The fact is, as has been discussed by a number of researchers (Schmidt *et al*., 2013; Grubb *et al*., 2018; Maamoun, 2019), COP3 remained the cornerstone of climate talks over the years. In this study, COP3 dominated news stories in 2009 and 2011, a shift that was widely credited with a significant increasing call for the replacement of the Kyoto Protocol. Based

on the findings, attention to COP3 appears to have faded post-2011. This presents evidence that the COP3 is likely to have shown influence on the coverage of climate change in the South African press. In their analysis of the Japanese newspaper coverage of climate change, Sampei and Aoyagi-Usui (2009) attributed issue attention to the start of enforcement of the Kyoto Protocol in 2005.

While the South African newspapers devoted less attention during this period, the findings clearly illustrated that a surge in COP3 coverage in 2011 coincided with the overall highest peak. Elaborating on the above, it was easy to determine the force behind newspaper attention to COP3. In December 2011, twelve months before the expiration of the Kyoto Protocol, the future of this landmark treaty was in the spotlight. A large number of studies articulated the fact that there was uncertainty regarding another period of commitment to a legally binding agreement (De Boer, 2012; Moncel and van Asselt, 2012). Moncel and van Asselt (2012) acknowledged that it was the failure of the Copenhagen conference (COP15) that made the climate change negotiation issue particularly difficult.

Although news stories about COP15 and COP17 were nearly half that of COP3, the findings showed an uncommon trend which suggested that the South African newspapers were lagging behind. In support of this viewpoint, evidence showed that there was a remarkable peak in 2009 (Kumpu, 2016; Chand, 2017). This was aligned with a general increase in global coverage of climate change. This study revealed that newspapers seem to focus more on COP during the year of the event. For example, only a few stories reported COP15 two years before and after the event. This may be a primary reason why more coverage was observed in November and December. However, it does not necessarily mean that there was sufficient attention in the South African press. For example, together with the US, China, India, and Brazil, South Africa played a major role during the drafting of the Copenhagen Accord, yet between November and December 2009 there were less than 20 articles in both the *City Press*, *The Sunday Independent*, and *Sunday Times*. This certainly means that the direct involvement of South Africa during COP15 may be linked to the level of newspaper coverage of climate change. However, in keeping with the global coverage, this study argues that the South African press failed to match the representations of COP across the globe (Schmidt *et al*., 2013). For instance, considerable attention to climate change was shown to be crucially linked to COP15 across newspapers in the US, UK, Australia, Denmark, and Finland (Schmidt *et al*., 2013; Kumpu, 2016; Eskjær, 2017; Lidberg, 2018).

It is widely documented that climate finance was an issue of climate change negotiation concern and has led to a formal establishment of a climate fund in 2010. Results showed that despite renewed emission reduction targets and monetary commitments by the developed world to help developing countries in climate change mitigation and adaptation, COP16 failed to dominate news stories. It is a known fact that this was a declining period of newspaper attention to climate change across the globe. It was evident that the Cancun conference was not influential in the overall coverage of climate change in South Africa. While other studies such as Arcila-Calderón et al. (2015) have shown that COP16 was featured consistently in news media towards the end of 2010, Kumpu (2016) argued that there was a sharp decline compared with the previous COP event in Copenhagen. Similarly, Boykoff *et al*. (2020) gave an excellent corroboration about the plunge of newspaper climate change in general during the year 2010. It was possible that poor COP16 coverage in the South African press may be attributed to the aftermath of the 2010 FIFA World Cup. This finding was more consistent with the notion that climate change focussing events can positively or negatively impact the overall newspaper coverage of climate change.

In general, COP16 did not significantly contribute to newspaper attention on climate change in South Africa. Evidence of the positive effect of COP events was found in this study. While COP17 was not constantly featured in newspapers over the months, attention skyrocketed in November 2011. By the first month of 2011, COP17 had already been reported, but clear newspaper coverage did not surface until September. However, a decline in coverage still appeared in October. The State of the Nation Address and local government election were viewed by this study as evidence that COP17 did not feature prominently in South African newspapers from February to October. Prior to COP17 (November to December 2011), there were fewer than three articles about the event recorded in October. The issue of climate change seemed to have been less important before the Durban conference. This suggested that newspaper coverage was boosted by the event. It could be alluded to that COP17 was hosted in South Africa.

While greenhouse gas emission reductions and the Kyoto Protocol were critical issues of interest in the coverage of COP17, the Durban Platform for Enhanced Action was at the centre of attention. Furthermore, COP17 was perceived as a turning point for South Africa in climate talks (Banerjee, 2012). While the results have shown a steady increase in COP17 coverage during the last two months of 2011, newspaper attention was generally at its low in Australia, UK, US, and Scandinavia (Boykoff *et al*., 2020). Therefore, there was no doubt that climate change coverage had grown appreciably over the last two months

due to COP17. This was strongly consistent with the findings of studies conducted in the Danish newspapers during the Copenhagen conference (Eskjær, 2017). A similar pattern was exhibited by French newspapers during the Paris conference (Gurwitt *et al.*, 2017). This study could, therefore, argue that the rise in COP17 in the South African press was extremely dependent on the active participation and hosting rights of South Africa. This played a critical role in increasing attention to the climate change issue in 2011.

It is worth noting that before (2010) and after (2012) the conference, COP17 was slightly featured in news stories. While several analyses of COP coverage have suggested that the Paris conference was critical to newspaper attention to climate change elsewhere (Gurwitt et al., 2017; Das, 2020), COP21 did not gain strong traction in the *City Press*, *The Sunday Independent*, and *Sunday Times*. The analysis of the overall coverage revealed that climate change had already been declining three years before the Paris conference, thus, explaining the drastic ramification pertaining to the presence of COP21 in the South African press. Having found that COP21 was poorly presented in newspapers before the conference in 2014, during the conference in 2015, and after the conference in 2016, it can be argued that less attention was probably attributable to increase in several political and social events in the country. For example, the 2015 nationwide student protest was seen as a major threat to coverage of other issues, and it attracted immediate attention beyond the borders of South Africa. Other stories which involved political figures (i.e., expulsion of the Congress of South African Trade Unions' leader and election of the first Democratic Alliance leader) may be equally important in the manner in which newspapers treated the coverage of COP21. In addition, it was found that a year before COP21, there was insufficient recognition of the conference. This observation can be related to several events in which political agenda was at the centre of discussions, notably Economic Freedom Fighters first elective conference. It is also important to note that the study identified a similar pattern post-COP21. There was very little interest among South African newspapers; State Capture stories tended to have been more prolific at the time.

It was not clear what caused low coverage of the Paris conference, but it is worth highlighting that the study showed that newspapers devoted more attention to domestic events between 2014 and 2016. Such findings were likely to have profound effects on effective communication of climate change. The results mean that COP21, which birthed a landmark climate accord (Paris Agreement) since the adoption of the Kyoto Protocol, was not considered an issue of greater importance even though it is renowned for capturing the attention of international news media outlets. It is now understood that the basis for the poor coverage of climate change can be pinpointed to low COP21 attention.

Although several studies have reported fluctuations in climate change coverage during COP21, Gurwitt *et al*. (2017) argued that the conference became particularly important for the French news media. Its importance can be attributed to the fact that France was the hosting nation of the event. Similarly, the Copenhagen conference was unquestionably vital to the coverage of climate change in the Danish press (Eskjær, 2017). Based on this evidence, it might thus be appropriate to state that increasing COP coverage has to do with the fact that newspapers in the hosting country focus primarily on reporting COP-related stories. It is, however, impossible to ignore the impacts of COP21 outside the hosting country. A good example of this was a significant increasing coverage of the Paris conference in some of the leading Asian newspapers (Pandey and Kurian, 2017; Das, 2020). In Australia, Lidberg (2018) provided compelling evidence by highlighting that COP21 seemed to have been more important than COP15 in *The Sydney Morning Herald*. Therefore, the findings of the current study might simply suggest that the South African newspapers were undoubtedly not paying enough attention to international climate talks. What is important to note however, is that South Africa was always a participant in climate talks.

5.4 Conclusion

This chapter demonstrated the results relating to the second objective of the study. It offered a clear account on the coverage of focussing events. The chapter outlined climate change conferences cited in the newspapers. It was shown that COP3 was given more attention. Newspaper coverage declined during the COP15. A further decline was recorded during the COP16. Although there was an increase in attention given to focussing events during the COP17 compared to the previous two COPs, newspaper coverage decreased significantly during the COP21. The following chapter offers newspaper reader's opinions on climate change science information.

This chapter answered the question about the influence of COP events on the coverage of climate change objective facts. The findings show that their influence was not significant. This chapter is based on the following research paper: Mulaudzi, R and Kioko, J. 2020. Content analysis of South African Sunday newspaper coverage of the Durban and Copenhagen climate change conferences. *Studies in Media and Communication*, 8(2), 34-40. https://doi.org/10.11114/smc.v8i2.4749

CHAPTER SIX: NEWSPAPER READER'S OPINION ON CLIMATE CHANGE SCIENCE INFORMATION – A CASE STUDY OF A RURAL SOUTH AFRICAN COMMUNITY

6.1 Introduction

Over the years, the public has been obtaining scientific information from news media (Uzelgun and Castro, 2014; Painter and Gavin, 2016). As newspapers play a crucial role in the communication of climate change science, the way in which the readers make sense of the information can determine the impact of the message. The following chapter presents public opinion about climate change science from a rural audience perspective. It begins by considering the results on the confidence of the public in dealing with climate- related matters in newspapers. The chapter also examines the overview opinion of climate change science coverage in weeklies and the level of trust regarding the reported stories. The opinion of newspaper attention to observed climate trends is recognised. There is, however, consideration of opinion about newspaper attention to projections and impacts of climate change, response measures, and focussing events. Considering the association amongst the objective facts, the chapter presented results on newspaper stance towards future climate change. Finally, the last section of the chapter offers a detailed discussion of the findings.

6.2 Results

6.2.1 Confidence dealing with climate-related matters in newspapers

Based on the total number of respondents, gender distribution was equal (15 males and 15 females). With over 56% under the age of 35 years, almost 60% of the respondents had an undergraduate degree. However, less than 30% of the respondents indicated that they are in the field of research and development.

To assess the background of the respondents in climate science stories, the responses on the level of confidence are shown in Figure 6.1. Although climate change science stories are unevenly distributed in South African weeklies, 40% of the respondents expressed that their confidence to deal with climate matters in newspapers was above average (3 out of 5). When the number of those who rank the level of confidence 5 out of 5 was considered, there was a difference of 16.7% compared to the former.

What is the association between self-assessed confidence and interpretation of climate change science information? In general, it is thought that the presence of factual indicators in news media provides the foundation for knowledge on climate science (Romps and Retzinger, 2019).

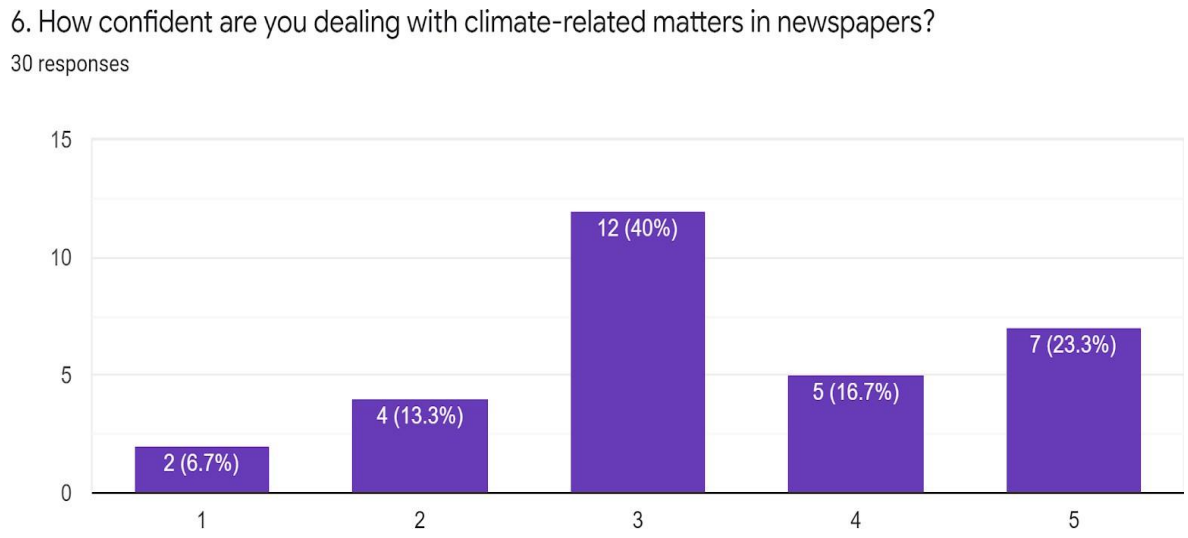

Figure 6.1: Responses regarding confidence dealing with climate-related matters in newspapers

6.2.2 Coverage of climate change science in Sunday newspapers

To understand the current state of public interpretation of climate change, it is important to reflect on the sufficiency of climate change science information reported by the South African press. In the context of Sunday newspapers, while more than 26% of the respondents expressed that climate change science is "*not at all sufficient*", only 10% indicated that it is "*sufficient*". However, over 40% considered that climate change science is "*slightly sufficient*" in Sunday newspapers (Figure 6.2). It is clear that weeklies need to report more climate change science. It is important to specify as precisely as possible that the majority of articles were dominated by social, political, and economic stories. Despite the progress in addressing inequality in post-apartheid era, many people live in abject poverty.

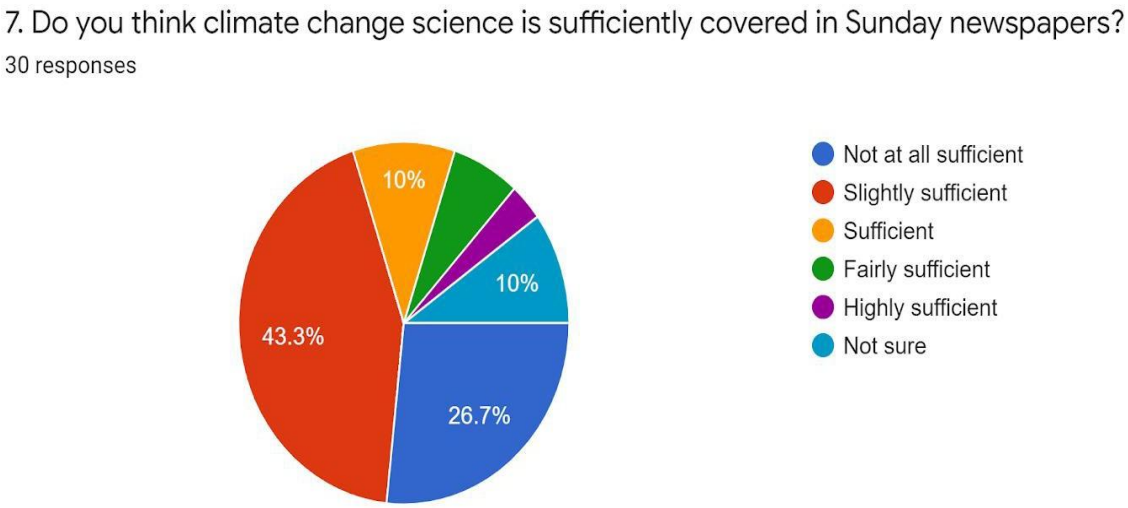

Figure 6.2: Responses on the coverage of climate change science in Sunday newspapers

6.2.3 Main source of news

The results in Figure 6.3 revealed that almost 80% of the respondents obtain their news from the *Sunday Times*. The second main source of news was the *City Press*. Nine respondents answered that they read the newspaper. However, there was a finding worth noting. *The Sunday Independent* was used less frequently than any other newspapers. Only one respondent considered *The Sunday Independent* as the source of news on Sunday. The findings showed that the *Sunday Times* was arguably the most important Sunday publication. It was credited as the biggest Sunday newspaper in South Africa. What drives readership figures for the *Sunday Times*? Based on personal observations, the key factor seemed to be the significant coverage of job opportunities under the careers section.

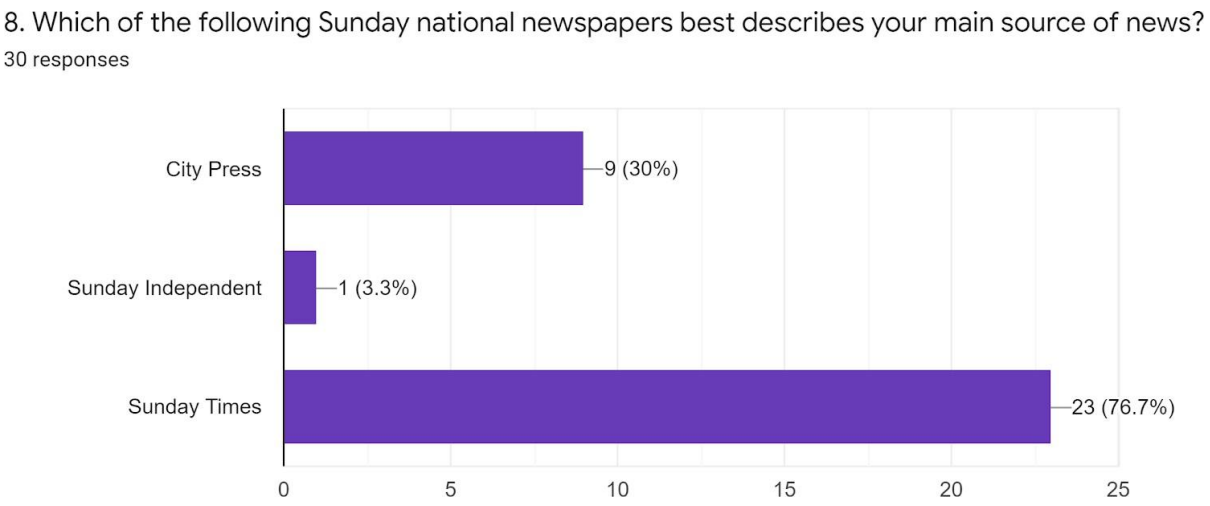

Figure 6.3: Responses on the newspaper which is the main source of news

6.2.4 Level of trust about climate change science stories

Today, more than a decade after the "climategate" (Ravetz, 2011; Leiserowitz *et al*., 2013; Ampollini and Bucchi, 2020) few people have more trust in climate change science stories. As illustrated in Figure 6.4, only 10% of the respondents expressed a high level of trust (5 out of 5). While more than 46% of the respondents highlighted an above-average trust, results revealed that the same is not true for over 35% of the respondents. Although newspapers are credible sources of news, they can be used as a tool for spreading disinformation. Again, previous studies have shown a disconnect between science and the public (Boykoff, 2005; Ruddell *et al*., 2012; Kiem and Austin, 2013; Moser, 2014). Although the scientific information about climate change science is broadly known, the key actors do not fully convey the message to the public in a simplified language (Howarth *et al*., 2020).

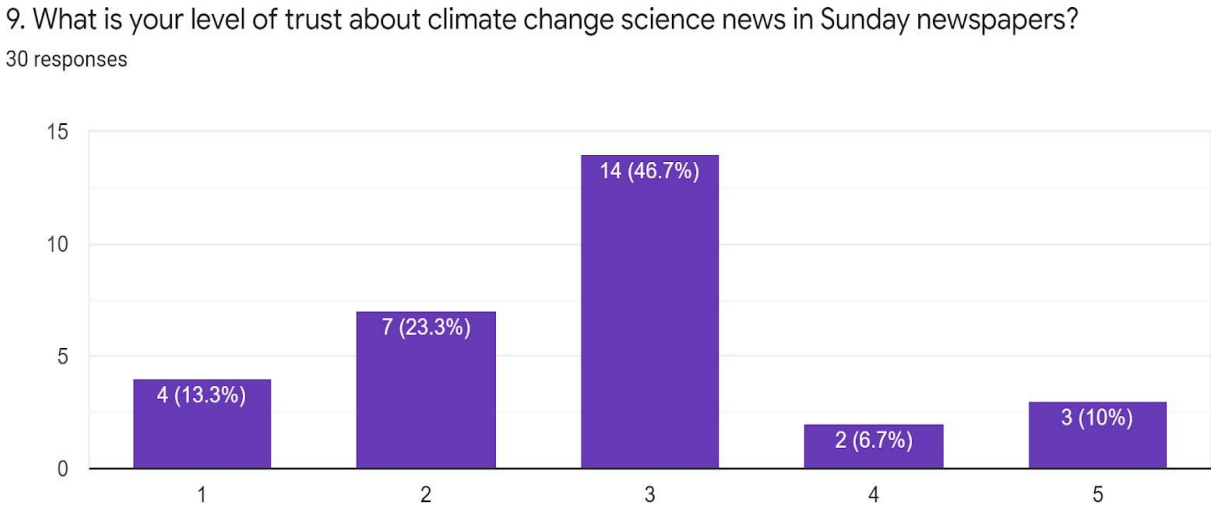

Figure 6.4: Responses on level of trust about climate change science stories

6.2.5 Observed climate trends

Understanding climate trends is increasingly important to the public given the extent of the magnitude and frequency of extreme events in Africa (Funk *et al*., 2016; Pinto *et al*., 2016; Nangombe *et al*., 2019). A total of 70% of the respondents mentioned that newspapers pay attention to extreme events (46.7%), and rainfall trends (23.3%). Figure 6.5 shows that respondents indicate insufficient attention to greenhouse gas emission concentrations (13.3%), and temperature trends (16.7%). With respect to extreme events, South Africa has been affected by the consequences of droughts and floods over the last decade. In 2015, severe drought conditions occurred in most parts of the inland regions. The extensive analysis conducted in 2017 revealed that the Western Cape experienced the worst drought in more than 100 years (Otto *et al*., 2018; Wolski, 2018; Burls *et al*., 2019). In April 2019, Durban floods caused more than 50 deaths. Although these extreme events were reported widely in South Africa, they also generated media attention across the globe. For example, the news stories were reported in the British Broadcasting Corporation (BBC) in the UK, and *The New York Times* in the US.

How important are rainfall trends? It is scientifically known that changes in rainfall can lead to extreme dry or wet conditions. Broadly, it is surprising that respondents said less attention is dedicated to two main factual indicators (greenhouse gas concentrations, and temperature change) in climate change science. The fact is that scientists continue to

report the influence of atmospheric concentration of greenhouse gases to surface temperature.

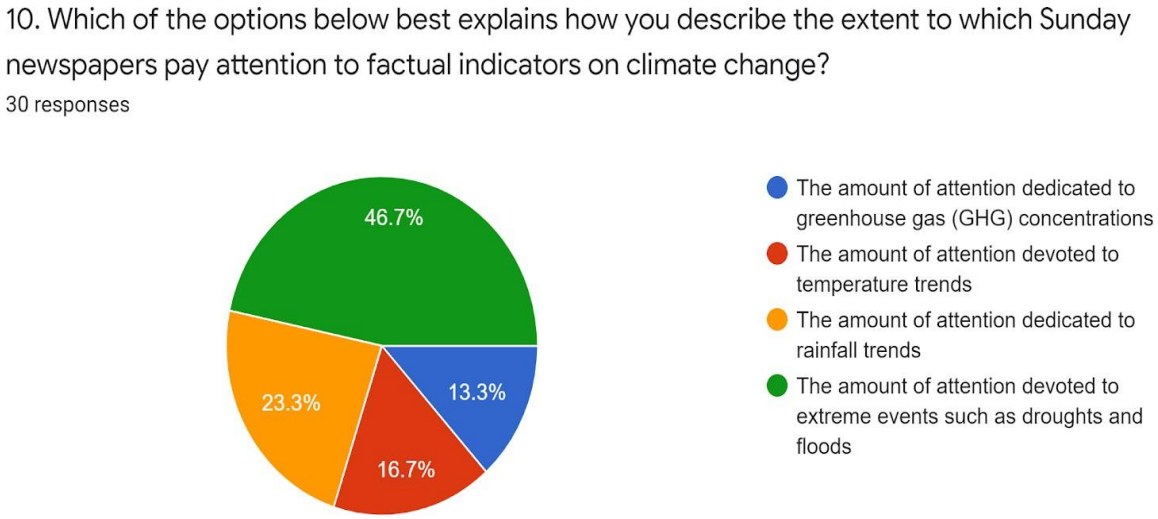

Figure 6.5: Responses on the newspaper attention to observed climate trends

6.2.6 Climate change projections and impacts

The projection of changes in climate trends is important in order to determine the future impacts. Our knowledge of the projected future has come to rely on the global climate models (GCMs). Considerable numbers of models are required to produce a useful amount of analysis about the past changes and long-term future change of climate (Davis- Reddy and Vincent, 2017). Although rainfall trends and drought conditions were separated, Figure 6.6 shows that over 70% of the respondents said that the key messages about projections were on rainfall changes (46.7%), and drought conditions (26.7%). In addition, temperature change projection was noted by 26.7% of the respondents. These findings were particularly useful for determining the portrayal of objective facts in news media.

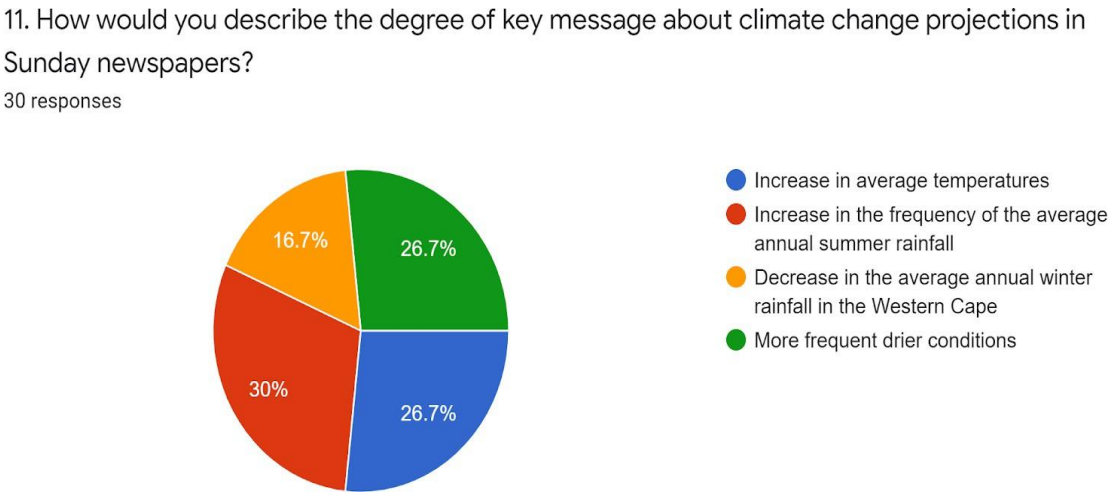

Figure 6.6: Responses on the newspaper attention to climate change projections

Several accounts have articulated that the impacts of climate change are likely to increase. The most important factor relates to the amount of carbon dioxide concentrations in the atmosphere due to anthropogenic activities (Solomon *et al.*, 2009; Rahman, 2013). Understanding how climate change impacts both social and natural systems have a great practical importance to humankind. For example, extinction of species transforms the functions of the ecosystems. Biodiversity loss may affect the livelihoods of many people in rural areas.

Respondents were asked to rank coverage of climate change impacts on agriculture, biodiversity, water resources, and human health. Results were somewhat consistent among the four sectors – agriculture (Figure 6.7), biodiversity (Figure 6.8), water resources (Figure 6.9), and human health (Figure 6.10). As the figures indicate, less than
15 respondents (50%) ranked the coverage of the impacts below average. However, Figure 6.9 shows that ranking for the impacts on water resources was slightly high compared to other sectors.

So where does the country fit into these findings? South Africa is one of the driest countries in the world. On the face of this, water is a scarce resource, and this is particularly true for rural areas. The demonstration that climate change could exacerbate water scarcity was made in the news media during a 3-year period (2015 to 2017) of drought in Cape Town. In addition to the coverage of a varying degree of socio-economic and environmental effects of the extreme drought, local and international news media

reported numerous stories about strengthening water conservation and efficiency commitments (National Geographic, 2020; The Washington Post, 2020; Booysen *et al*., 2019; Enqvist and Ziervogel, 2019).

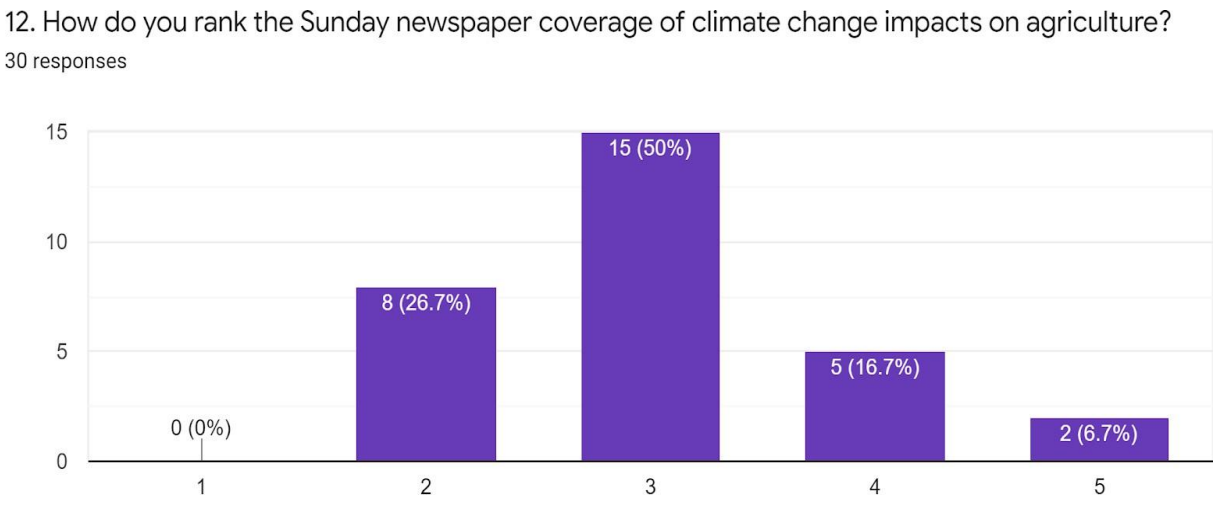

Figure 6.7: Responses on newspaper attention to climate change impacts on agriculture

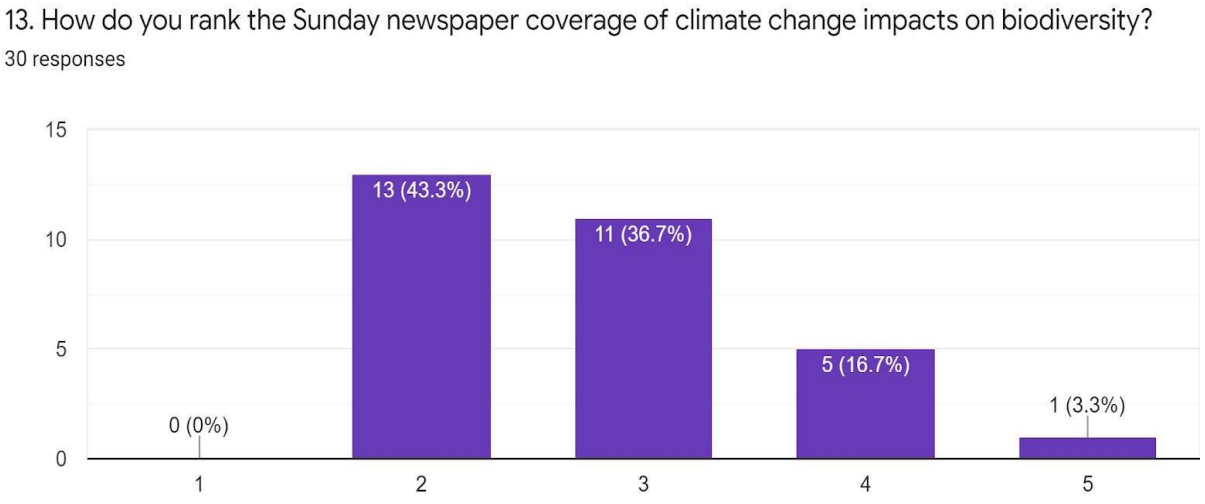

Figure 6.8: Responses on newspaper attention to climate change impacts on biodiversity

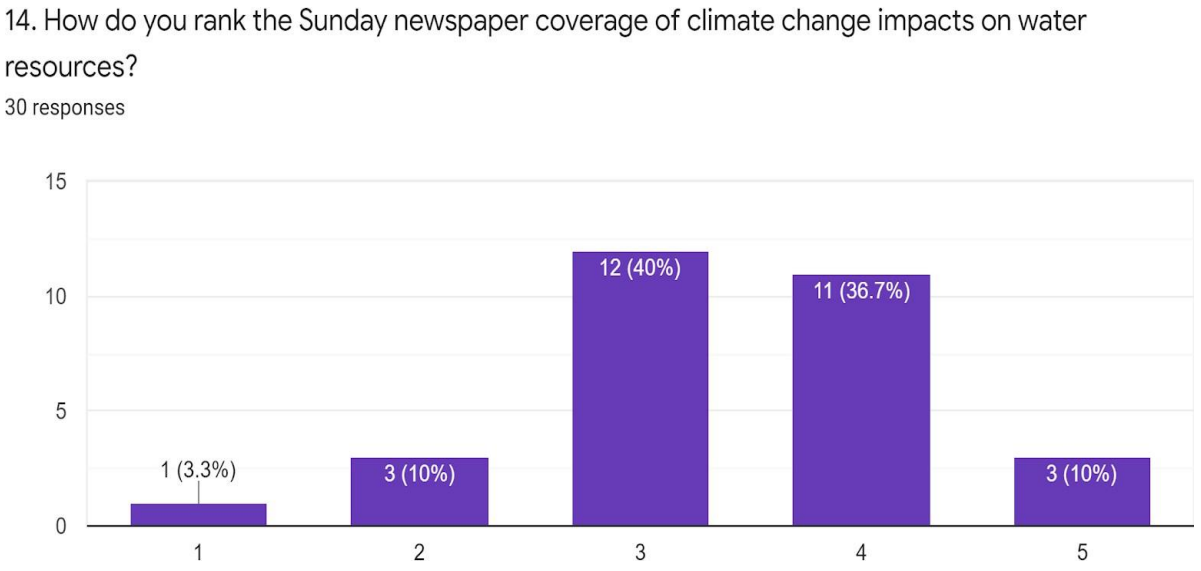

Figure 6.9: Responses on newspaper attention of climate change impacts on water resources

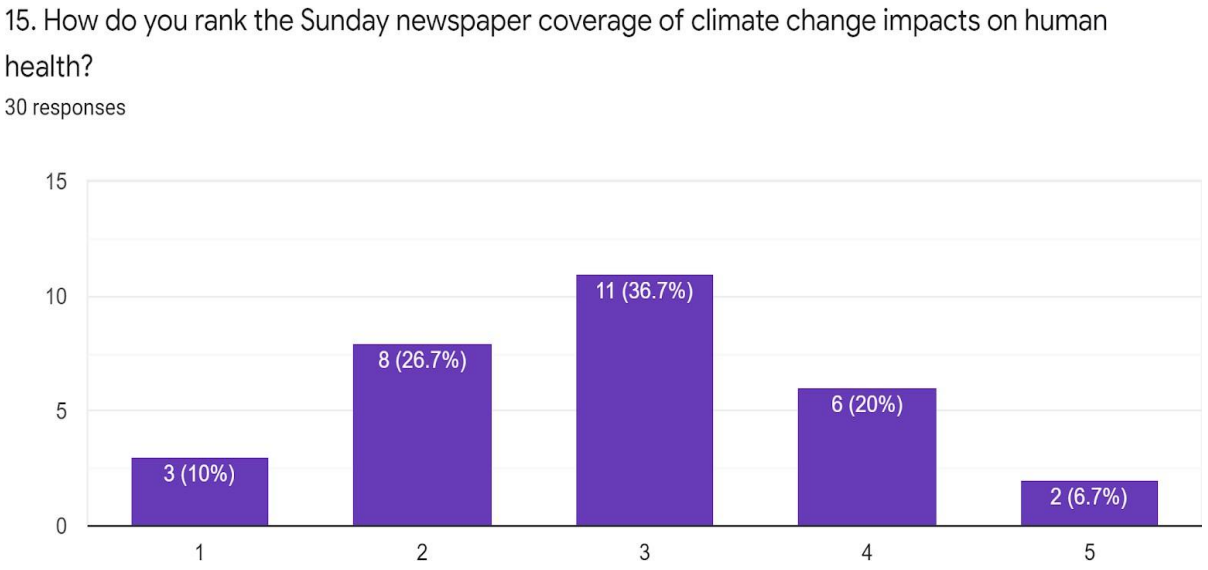

Figure 6.10: Responses on newspaper attention of climate change impacts on human health

6.2.7 Response measures

Despite limited financial resources in developing countries, implementation of response measures to tackle climate change impacts deserves high priority. Half of the respondents (50%) maintained their neutrality of satisfaction regarding Sunday newspaper coverage of adaptation and risk reduction strategies. While 20% of the respondents were satisfied with newspaper attention to response measures, the same percentages of respondents show dissatisfaction (Figure 6.11). Although it is not easy to precisely pinpoint the reason for poor public satisfaction, if the audience is increasingly dissatisfied by the information reported by news media, it is clear that society will have difficulties in recognising the urgency of building adaptive capacity to the impacts of climate change.

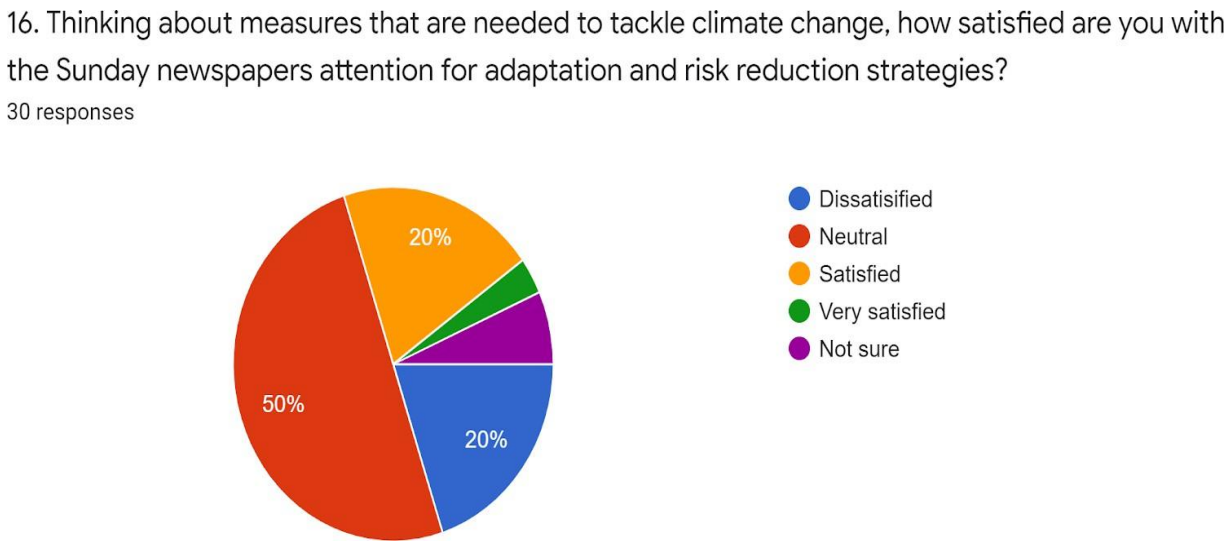

Figure 6.11: Responses on newspaper attention to climate change response measures

6.2.8 Climate change focussing events

The extent to which the respondents report about newspaper attention to climate change focussing events is given in Figure 6.12. Almost half (46.7%) of the respondents believed that the United Nations Climate Change Conferences dominate newspaper coverage. The attention of climate change meetings has been particularly evident since the mid-1990s. The first climate change conference was perceived as a crucial meeting in accelerating high-level commitments by countries to reduce greenhouse gas emissions. It is important

to note that the meeting captured the vital features for the Kyoto Protocol. An additional factor to consider is that United Nations Climate Change Conferences have been convened every year since 1995 (Bodansky, 2010; Kumpu, 2016; Lidberg, 2018).

As shown in Figure 6.12, nearly 25% of the respondents said that newspapers devote attention to inter-governmental political forums. A similar observation was made for attention to the publication of climate change assessment reports. First, the fundamental fact to note is that a major breakthrough in the climate science and policy spheres was reflected through the establishment of the Intergovernmental Panel on Climate Change (IPCC) in 1988 (Hulme and Mahony, 2010). In 1990, the IPCC dominated the coverage of climate change, particularly with the release of the First Assessment Report (FAR) on global climate change. However, the reports are not published every year. For example, the supplementary report for FAR was available in 1992, followed by the second assessment report (SAR) in 1995, third assessment report (TAR) in 2001, fourth assessment report (AR4) in 2007, and fifth assessment report (AR5) in 2014 (Alexander 2016; Scott *et al*., 2016; Minx *et al*., 2017; Porter *et al*., 2017).

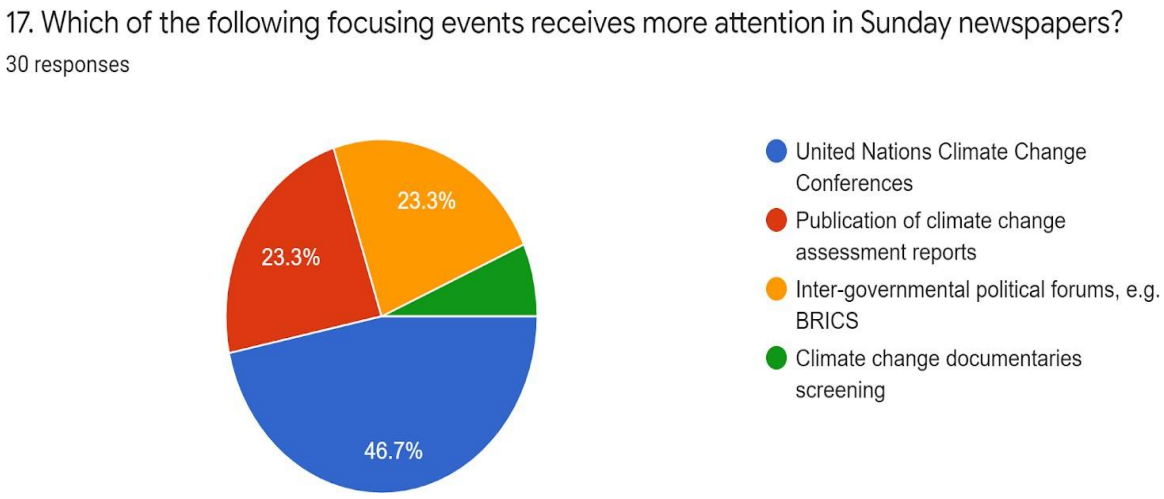

Figure 6.12: Responses on newspaper attention to international climate change focussing events

6.2.9 Tone of reporting future climate change

The majority of the respondents acknowledged that the stance towards future climate change is neutral. Three respondents expressed that the nature of stories is negative and a similar number had differing views (Figure 6.13).

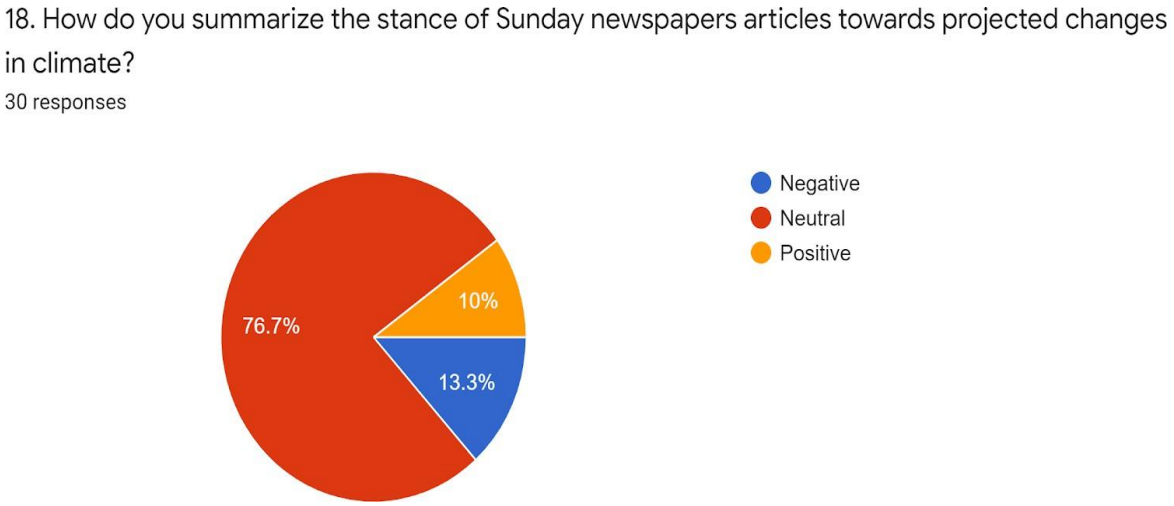

Figure 6.13: Responses on newspaper stance towards future climate change

6.3 Discussion

The previous chapters discussed how three leading weeklies portray climate change science objective facts, and the manner in which COP events are represented. This section gives an in-depth analysis regarding the public opinion about climate change science in the *City Press*, *The Sunday Independent*, and *Sunday Times*.

On the question of climate-related matters in newspapers, a few respondents were highly confident about dealing with climate change information in the press. Even though several respondents were under the age of 35 years, and in possession of undergraduate degrees, the findings indicate that less than half of them have shown a better than average level of confidence to deal with climate matters in newspapers. This would seem to suggest that higher education qualification is not enough to underpin the understanding of climate change. However, it is worth pointing out that the number of respondents with research and development backgrounds was significantly low. The basic understanding of research not only becomes a crucial component for newspaper readers but enables them

to engage with climate change science information. If newspaper readers are not aware of the extent to which climate is changing, their opinion of the phenomenon may be limited. It is, however, well-established that understanding of climate change does not translate to actions (Sturgis and Allum, 2004).

The findings showed that the respondents tended to agree on the viewpoint that climate change science is not sufficiently reported in newspapers. Clearly, there appears to be a consistency with the results about the analysis of the portrayal of objective facts in the fourth chapter. The insufficiency standpoint, therefore, of the newsreaders would be seen as a reflection of the manner in which the issue is portrayed in the press. Thus, it could be argued that the South African newspapers are shaping newsreaders' opinion on climate change at a local scale. Many studies about media influence on society have presented extensive evidence that news outlets shape public opinion (Smith 2005; King *et al*., 2017; Bolin and Hamilton, 2018).

While it was generally accepted that the *Sunday Times* makes a positive contribution as the main source of news, its competitors have shown to be lagging behind. It was evident that the newsreaders' opinion on climate change information was strongly influenced by the *Sunday Times*. Moreover, this study can argue that the implication of having one dominating source is that the views are oriented towards a single direction, thus providing a one-sided narrative about the issue.

Public trust in climate change news stories is crucial in gauging the effects of news media on public opinion; however, this study has shown that the level of trust was not significantly high. This highlighted a moderate trust between media and the general public. Taking into account previous research, there is good evidence to agree that the current study does not differ significantly with the findings on media scepticism and public trust of climate change issue (Tsfati, 2003). Furthermore, studies have shown that climate change controversy was by far the main reason for a drastic collapse in the level of trust (Leiserowitz *et al*., 2013; Stoutenborough *et al*., 2014). One of the observations made by Lucas *et al*. (2015), in a review of public trust to climate change, is that mistrust tended to be common for both scientists and media. The suggestion is, therefore, that the present finding about moderate trust at least partly reflects the widening gap between climate change science and the public. This perspective has been outlined in the past. A particular insight was shown in the work of Ruddell *et al*. (2012). They argued that public

perception was closely linked to major extreme environmental conditions. In fact, changing temperature was one example.

Although it is possible for scientists and media to put emphasis on the current extreme weather events to gain public trust, the challenge is the manner in which science information is disseminated. There is still a conundrum about the language used around the issue of climate change, which creates more problems for the public. This may explain why climate change is still perceived as a distant issue in rural areas of South Africa. While the level of public trust in climate change stories is not strong, findings have shown that observed climate trends prove to be well established in newspapers. According to a considerable number of respondents, South African newspapers put emphasis on extreme events and rainfall trends compared with greenhouse gas emissions and temperature trends. Previous research has outlined the effect of drought and climate change on public opinion (Dessai and Sims, 2010). There appears to be an observation that the public opinion about climate change has to some extent been driven by the impacts of drought. The results shown in the current study suggest no difference. The severe drought of 2015-2017, in combination with observed changes in rainfall, appeared to be the most important factors shaping public opinion. Furthermore, flood events are also essential.

This study noted that respondents have expressed that newspapers pay less attention to temperature change. The finding was generally inconsistent with previous work. For instance, there is ample evidence which suggests that changing temperatures highly influence public interpretation (Brooks *et al*., 2014; Zaval *et al*., 2014; Howe, 2019). More commonly, however, high temperatures were not disassociated from severe drought events, which may be a reason that the respondents see poor newspaper articulation of changing temperature. Furthermore, respondents hold a viewpoint that there is a weak emphasis on greenhouse gas concentrations. Generally, there is evidence to support the claim that people tend to make sense of climate change based on the environmental changes that they are experiencing (Borick and Rabe, 2014; Demski *et al*., 2017). Further, the results of this study indicated that most respondents mentioned that climate change projections were centred on rainfall changes and drought conditions. This was likely to highlight that there was a strong connection between projected average rainfall and drier conditions. From the perspective of the evidence presented in climate science literature over southern Africa, rainfall is one of the two major variables subject to major changes. The other is annual temperature (Davis-Reddy and Vincent, 2017). However, temperature change projection was not considered to be a constant feature in newspapers. As

reported in the fourth chapter, objective facts were persistently low in the South African newspapers. Given the findings, it was no surprise that the respondents pointed out that newspapers were neglecting the coverage of future temperature change.

Newspaper readers' opinion on climate change impacts merits attention. Generally, the results presented a clear picture that sectoral impacts are moderately reported. The observed patterns of coverage did not vary from sector to sector but impacts on water resources were shown to be given extra attention in the press. Amidst rising risks of adverse impacts, it is important to acknowledge that less than 60% of respondents believed that newspapers were paying attention to climate change impacts on agriculture, biodiversity, water resources, and human health. The impacts were exacerbated by drought triggered by alteration in the rainy season. The evidence from elsewhere indicated that impacts of floods and heat waves immediately spark public concerns (Whitmarsh, 2009; Taylor *et al*., 2014). Newspaper readers' opinion on climate change in this study was partly due to the newspaper coverage of the impacts that are driven by extreme events. However, the factors which led respondents to report about moderate coverage of climate change impacts were unknown but could be linked to the way newspapers portrayed objective facts. This validated the notion of insufficient newspaper attention to observed trends and impacts of climate change.

Over the last decade, there has been a growing call for climate actions. Arguably, better understanding of adaptation and risk reduction strategies is crucial. The results of this study found that while response measures were well outlined by various news media, there was a neutral satisfaction among the respondents. There was still, however, a few respondents who were satisfied about newspaper coverage of climate change response measures. The results presented are inconsistent with the findings about newspaper attention to response measures in the fourth chapter. Scepticism about climate change is highly likely to offer an ideal explanation. Previous studies indicated that one of the critical barriers in public concern about climate was scepticism and uncertainty (Poortinga *et al*., 2011; Whitmarsh, 2011; Hornsey *et al*., 2018). Public opinion on climate change is probably guided more often by worldviews (Bain *et al*., 2012; Lewandowsky *et al*., 2013; Hornsey *et al*., 2016). Based on current observations, opinion about newspaper coverage of response measures seemed to be dependent on the level of public trust. Therefore, the findings suggested that the extent to which the public trusts climate change news stories influenced the degree to which respondents viewed response measures in the press.

Public trust in climate change stories is recognised in the sense that it can shape climate opinion (Funk, 2017; Gauchat, 2018). Therefore, this study argued that level of trust is highly likely to impact people's opinions on climate change. Despite the complexity of understanding public interest in climate change, the influence posed by level of trust tended to be an important explanation of the findings. Newsreaders' opinion on climate actions in the press, therefore, depends not only on the climate change message, but the dynamics pertaining to public trust in the reported stories.

In exploring newspaper readers' opinion on important climate change events, the study revealed that the respondents pointed out that the three leading newspapers were not paying enough attention to COP events. Furthermore, publication of IPCC reports was shown to be inadequate in the press. At the same time respondents expressed that intergovernmental political forums and release of climate change films were among the less prominent features. This was to be expected because findings in the previous chapter have shown that on average Sunday broadsheets were not paying more attention to the topics. It must be noted that coverage of COP events and IPCC reports are likely to impact public opinions about climate change (Kaiser and Rhomberg, 2016; Lück *et al*., 2016; Hopke and Hestres, 2018). Even after several climate talks over the past two decades, it thus seemed that there was a lack of adequate coverage in South Africa. Given this evidence, it must be highlighted that the manner in which newspapers covered COP events may have informed the way in which the respondents view focussing events. The study also showed that the respondents were sceptical with respect to the tone of reporting future climate change. There is evidence that climate scepticism is generally driven by lack of public concern. For instance, Engels *et al* (2013) showed that climate change scepticism results from low-risk awareness.

Several respondents considered the message tone to be neutral. This finding may be largely due to the fact that many news outlets often underrepresented scientific findings (Petersen *et al*., 2019). This is largely supported by several studies of news media and climate change (Carvalho, 2007; Lorenzoni *et al*., 2007; Boykoff, 2008; Osaka *et al*., 2020). Despite the recognition that climate change is an international agenda, disconnection between scientific information, media and the public is still common.

6.4 Conclusion

The results of the third objective were provided in this chapter. It highlighted a number of crucial aspects about public opinion on newspaper attention to climate change science. They include the level of trust regarding the stories in the broadsheet newspapers, newspaper attention to observed climate trends, newspaper attention to climate change projections, and newspaper attention to climate change focussing events.

This chapter has shown strong evidence to suggest that newspapers play a role in influencing public opinion relating to the climate change issue. A detailed account on the overall conclusion of the study is discussed in the next chapter.

CHAPTER SEVEN: CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

The main aim of this study was centred around the exploration of climate change science portrayal in news articles within South Africa's major broadsheet newspapers (*City Press*, *The Sunday Independent*, and *Sunday Times*) over 20 years, and a case study of readers' opinion about the disseminated information. The chapter sheds light on the following: (i) representations of climate change objective facts (observed climate trends, climate change impacts, and climate change projections) in South African newspapers, (ii) influence of conference of the parties (COP) on newspaper coverage of climate change, and (iii) newspaper readers' opinion about climate change - a case study of South African rural community. The chapter highlights the relevance and contribution of the study on news media attention to climate change. It concludes with recommendations to news outlets, and future research.

7.2 Summary of the findings

Overall, the findings indicated that the coverage of climate change was relatively low for nearly a decade, from the mid-1990s to the early 2000s. Newspaper coverage was at its peak in 2011. A year later, there was a sharp decline. When coverage of climate change issues is considered for the same month every year for the period of study, on a calendar-month basis newspaper attention appreciates in November and December, as has been demonstrated in the majority of previous studies examined (e.g., Gunster, 2011; Lyytimäki, 2011; Fernández-Reyes *et al*., 2015; Robbins, 2018). This trend is based on the fact that COP events are traditionally taking place during the last two months of the year. However, a closer look at reporting of objective facts shows a different story. While newspapers have shown a slight interest on issues relating to climate change projections, climate change impacts and observed climate trends between 2006 and 2007, response measures represented a greater proportion of coverage over the timeframe of this study.

Despite poor newspaper attention to objective facts, the findings have shown a strong linkage between observed climate trends and climate change impacts in news articles. In addition, climate change projections were directly linked with climate change impacts. The study concludes that these findings reflect that news media outlets are aware of objective facts, and it is clear that newsrooms are failing in their role to report basic scientific facts.

This represents a greater need for closing the gap between objective facts and media. However, it should be recognised that the reliance of the South African newspapers on foreign news agencies can slow the efforts to bridge objective facts-media gaps. For instance, this study found that almost half of the climate change-related news articles were reporting news stories from the Global North. Thus, the coverage of climate change science was to a greater extent modelling the trend in the developed countries. More interesting, however, is the fact that 2011 provided an ideal opportunity for South African newspapers to report more about domestic news. Therefore, the study suggests that the overall 2011 peak was caused largely by the COP 17. The analysis of climate change coverage surge in Europe during the period of the 2009 Copenhagen conference and the 2015 Paris conference provide support for this conclusion (e.g., Gurwitt *et al*., 2017).

This study represents a clear picture that newspapers reported about fossil fuel emissions as a vital issue related to the public. Although often given more attention elsewhere, energy was poorly reported as an issue of public importance. This provided evidence that South African newspapers are lagging behind in terms of reporting energy issues in the context of climate change. In spite of inadequate coverage of objective facts, newspapers were shown to rely heavily on scientists as the source of climate change scientific information. However, it is a great concern that this research revealed a considerable disconnect between the scientific dimension of climate change and the newsroom.

If scientists are highly cited in news stories, then what caused poor coverage of objective facts in the press? It is possible that scientists are not simplifying scientific information relating to climate change. A basic understanding of the objective facts is clearly needed to close the gap between climate change science and the South African newspapers, because factual information is known to be the starting point of departure to gauge how climate has changed and to what extent it is going to change in the future. In addition, news media outlets should ideally engage with scientists consistently in order to report climate change issues without distorting the meaning of the message. Distortion of factual information can severely affect the manner of the public's perceptions, beliefs and attitudes. This study does not look at the period 2017 and beyond, and it acknowledges the possibility of improved coverage of objective facts due to extreme events over the past few years. However, the overall findings of the study are giving a blurred image about portrayal of objective facts in the South African broadsheet newspapers. They present a great opportunity for news media outlets to reflect on climate change science content that is communicated to the public. This will not only help them to improve their reporting but also increase the degree of public trust.

This study demonstrated that news stories were dominated by issues related to the Kyoto conference. It is suggested that the most important factor which attracted newspaper attention was the Kyoto Protocol. There is a general acceptance that as soon as this international agreement had been adopted as a legally binding treaty, it became a point of reference for other climate talks (Sampei and Aoyagi, 2009; Fernández-Reyes *et a*l., 2015). In fact, this study highlights that the COP3 was significantly cited in the South African press during the Copenhagen conference and Durban conference.

With much of the global news media attention on COP15 in 2009 (McAllister *et al*., 2021), the findings revealed the opposite in the major South African broadsheets. This study concludes that the event was not essentially important in the press. However, it should not be underestimated that within the few months before the conference, South Africans elected a new president. South Africa's politics is always a top priority for many news media outlets (R Mulaudzi 2017, 25 November), and this was the case in 2009. In 2010, COP16 was undoubtedly overshadowed by the aftermath and popularity of the 2010 FIFA World Cup. This is not the only explanation for poor attention to the Cancun conference. It is generally accepted that the global newspaper coverage of climate change plummeted in 2010. While this study found that South African newspapers have shown climate change issue coverage peak in 2011, COP17 attention was not significant compared to similar events elsewhere. However, it does not necessarily mean that the event failed to play a crucial role in terms of the overall coverage of climate change. The justification is based on the fact that contrary to a popular trend of a relatively decrease in issue attention across the globe in 2011 (e.g., McAllister *et a*l., 2021), South African newspapers increased their overall coverage.

In spite of greater publicity throughout the world, COP21 was not given considerable attention in the South African newspapers. The study makes an argument that newspapers have devoted attention to social and political issues. For example, the 2015 student protest is arguably recognised as a story that garnered considerable attention from various news media outlets (R Mulaudzi 2018, 20 March). In the context of this perspective, this study presents evidence that climate change events are poorly reported due to overemphasis of political and social news stories across South African newspapers. For COP to receive more attention in news media, it is safe to suggest that a surge in coverage is common in domestic news outlets throughout the hosting nation during the event. For instance, at a time when many newspapers across the globe were

paying less attention to climate change (McAllister *et al*., 2021), it was no wonder the findings have shown a peak in South Africa during COP17. This helps to draw a conclusion that there is no consistency in the coverage of COP events in the *City Press*, *The Sunday Independent*, and *Sunday Times.* However, it was clear that COP17 was crucial in newspaper coverage of climate change.

Given a picture on how South African newspapers portray climate change, this research used a case study of thirty active Sunday newspaper readers to explore their opinions on climate change science content in the press. From a rural audience perspective, evidence shows that readers feel that climate change science is not sufficiently reported in the Sunday newspapers. One of the striking features of the findings was that the public's impression on climate change coverage is similar to the observation made about newspaper portrayal of objective facts. This leads to the conclusion that the manner in which newspapers report climate change science influence readers' opinion. Due to the fact that climate change objective facts were not an ever-present feature in the newspapers, it is suggested that it was one the factors associated with the decreasing public trust in climate change science stories. This explanation is exemplified by the level of few readers who have shown trust in climate change science stories. However, findings about readers' opinion on the coverage of observed climate trends highlight that the majority of respondents indicate that extreme weather events and rainfall patterns were given attention. It is quite possible that personal experience could have contributed to such a finding.

Despite notable greenhouse gas emissions and changing temperatures, the study has shown that the respondents were convinced that newspapers are not doing enough in terms of reporting them. Findings on reader's opinion about climate change projections demonstrate that the majority of the respondents said that future rainfall pattern is the dominating variable in the *City Press*, *The Sunday Independent*, and *Sunday Times*. While it was clear that water scarcity was given considerable attention compared with agriculture, biodiversity, and human health, respondents felt that climate change impacts across sectors are equally important. Unlike the findings discussed about portrayal of objective facts, respondents show a differing view regarding the coverage of response measures. They were sceptical about the reporting about newspaper coverage of measures needed to tackle climate change. The most surprising finding is that the respondents revealed that the coverage of COP events was average. In addition, there was public scepticism about the newspaper tones of reporting future climate change.

Although the thesis made important contributions regarding the understanding of newspaper portrayal of climate change science and the public opinion about climate change in South Africa, it is important to recognise some of the limitations to the study. First, the study was limited to news articles (N=266) in the leading South African broadsheet weeklies (*City Press*, *The Sunday Independent,* and *Sunday Times*). Second, the focus of the study was on the period 1996 to 2016. The progress, therefore, of newspaper coverage of climate change from 2017 is not taken into account. It is therefore acknowledged that portrayal of the issue post-2016 is likely to yield different results. The study was limited to portrayal of the three main climate change science objective facts (observed climate trends; climate change impacts; and projected climate change futures) and climate change focussing events. Third, the study utilised a case study of newspaper readers from a South African rural community. Thirty participants provided sufficient data for the analysis.

7.3 Contribution and relevance of the study

The study provided insights into how South African broadsheet newspapers are reporting the phenomenon of climate change science. It added a significant contribution to a holistic understanding of the nature of South Africa's press coverage of the science of changing climate. This study also contributed to ongoing research on issue attention and agenda-setting. Moreover, the study also provides a contribution to the scholarship of news media influence on public opinions on climate change. Based on the results of this study and recent studies (Bohr, 2020; McAllister *et al*., 2021), research on newspaper coverage of climate change has evolved over time. Furthermore, recent studies have delved into the trends of media coverage of climate change in the UK and US and ask questions about its role in shaping public opinion. However, there were still existing research gaps in the Global South, particularly in Africa. This study has closed a knowledge gap in literature from a South African perspective. The findings have relevance to the development of effective ways to help news media outlets improve their reporting on climate change science. This is because the study identified that the coverage of stories on key objective facts, for example, observed climate trends, was extremely low in South African news media.

7.4 Recommendations

This research shows that South Africa's newspaper coverage of climate change has been unstable over the past 20 years, and reporting of the scientific dimension remained low. This led to significant uncertainties in public opinion on the phenomenon. With the dearth of climate science journalism in the newsroom, poor coverage of the scientific dimension in news articles appears likely. The study is proposing a new approach for reporting climate change science in South Africa.

In order to better report the scientific dimension of climate change, there is an urgent need for a new guide designed specifically for news media outlets in South Africa. The guidebook could help newsrooms improve coverage of the basic scientific facts about climate change and tell the climate crisis story beyond the focusing events. It will also serve as a handbook for climate change journalism in the Global South. To evaluate the effectiveness of the approach, the researcher plans to expand on this work partnering with news outlets to help editors and journalists improve objectivity when telling climate crisis stories. It is anticipated that the guidebook will bring scientific facts closer to newsrooms, and ultimately a broader enhancement of public understanding of climate change. This research suggests that the difficulty for journalists and editors to understand the basic scientific facts are a major reason why newsrooms grapple with reporting objectivity in news articles. To overcome this problem, the content of the guidebook covers concise evidence-based information on the basics of climate change (Appendix B).

7.5 Future research

The strong point of this study was the analysis of newspaper portrayal of climate change science across major national broadsheets over a longer time frame. To date, most studies have concentrated on a shorter period of time. In addition, these studies often overlook the effects of newspaper coverage of climate change on readers' opinion. This study presented a clear picture of the prevalence of the science of climate change in South African newspapers. Future research could use a descriptive qualitative approach to fully interrogate scientific texts in order to determine the accuracy of media coverage of climate change. It is also suggested that future studies should explore comparative research. Thus, future research should place emphasis on content analysis of climate change science issues reported by other types of media such as TV and radio. According to literature on media coverage of climate change, comparative analysis has shown to provide insights into the relationship between media agenda and other agendas (Schmidt *et al*., 2013). A comparison of large sample sizes of ruralite newspaper readers is suggested as a critical area for future research to help improve understanding of public opinion trends on climate change in South Africa.

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APPENDIX A: EDITING CERTIFICATE

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16/04/2022

RENDANI MULAUDZI
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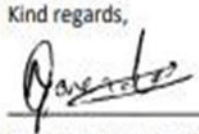
RE: EDITING CERTIFICATE

FOCUS AREA: AN ANALYSIS OF CLIMATE CHANGE SCIENCE COMMUNICATION IN POST-APARTHEID SOUTH AFRICA OVER THE PERIOD 1996 TO 2016

Degree of Doctor of Philosophy in the Department of Environmental and Occupational Studies at the Cape Peninsula University of Technology, District Six

This serves to confirm that this research article has been edited for clarity, language and layout.

Kind regards,



Nereshnee Govender (PhD)

APPENDIX B: A GUIDEBOOK FOR CLIMATE CHANGE JOURNALISM

Title: *Bridging the Gap Between Climate Change Scientific Facts and Newsrooms: A Guidebook for Journalists in South Africa*

Purpose: To support South African journalists in enhancing the accuracy, depth, and relevance of climate change reporting. It aims to bridge the communication gap between complex scientific knowledge and impactful journalism.

Structure of the Guidebook:

1. **Introduction**
    - Overview of the guidebook's objectives and its relevance to climate journalism in South Africa.
2. **Understanding Climate Change Science**
    - A brief history of climate science and foundational concepts.
3. **Evidence and Causes of Climate Change**
    - Historical climate trends over the past century
    - Changes in climate extremes
    - Human-induced drivers (e.g., fossil fuel use, deforestation)
    - Natural causes (e.g., volcanic activity)
4. **Impacts of Climate Change**
    - Sector-specific impacts on:
        - Agriculture
        - Ecosystems
        - Water resources
        - Human health
        - Human settlements
        - The economy
5. **Climate Change Projections**
    - Projected changes in:
        - Temperature
        - Rainfall patterns
        - Frequency and intensity of extreme events

6. **Climate Change Interventions**
    - Mitigation strategies
    - Adaptation strategies
7. **Conclusion**
    - Summary of key insights and a call to action for journalists to promote evidence-based climate reporting.