AN EXPLORATORY STUDY OF PSYCHOLOGICAL RESILIENCE FACTORS ASSOCIATED WITH CLIMATE CHANGE ADAPTATION BY SUBSISTENCE FARMERS IN A RURAL COMMUNITY IN MARULENG, LIMPOPO PROVINCE

by

KGOPA BONTLE PATIENCE

THESIS

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SUPERVISOR: Professor Tholene Sodi

CO-SUPERVISORS: Professor Kingsley Kwabena Ayisi & Professor Chris Burman

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DEDICATION

I dedicate this work to my beloved late mother Mokgohlwe Mahlatse Mello-Kgopa (1972-2021). Thank you for being the best mother I could have asked for, for being there through everything, your unwavering support and unconditional love up to your last breath on earth. O robale ka kgotso Hunadi ‘a Phaahla le Mohlapa, o e kgathile tema ngwana Pheladi’ a mokgekolo.

DECLARATION

I declare that **AN EXPLORATORY STUDY OF PSYCHOLOGICAL RESILIENCE FACTORS ASSOCIATED WITH CLIMATE CHANGE ADAPTATION BY SUBSISTENCE FARMERS IN A RURAL COMMUNITY IN MARULENG, LIMPOPO PROVINCE** is my own work and that all the sources I have used or quoted have been indicated and acknowledged by means of complete references and that this work has not been submitted before for any other degree at any other institution.

Full names **Date**

Kgopa Bontle Patience

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GLOSSARY AND ABBREVIATIONS

IPCC	The Intergovernmental Panel on Climate Change
DRR	Disaster Risk Reduction
UNFCCC	United Nations Framework Convention on Climate Change
SSA	Sub-Saharan Africa
CCA	Climate Change Adaptation

ABSTRACT

Climate change poses a major threat to both the well-being of people and the environment. Subsistence farmers are particularly affected because they rely on local supply systems that are sensitive to climate variation. The aim of the study was to explore psychological resilience factors associated with climate change adaptation by subsistence farmers in a rural farming community in Maruleng Municipality in Limpopo Province (South Africa). The objectives of the study were to: investigate subsistence farmers' notions of climate change and adaptation; determine the psychological resilience factors influencing the farmers' adaptation the climate change; determine strategies that the farmers use to cope with climate change; and, based on the farmers' notions of climate change and adaptation, and the associated resilience factors, develop a psychological explanatory model on climate change adaptation by subsistence farmers.

Data were collected through direct interactions with participants using a grounded theory research design. An open-ended interview guide was used to collect data with a sample of 15 participants selected through theoretical sampling within the Maruleng Municipality. The research findings indicate that farmers have limited conceptual knowledge relating to climate change and its causes. The results further indicated that participants have become resilient to climate change through mitigation strategies including mulching, adaptive irrigation techniques and being innovative. From a psychological perspective, the subsistence farmers' resilience factors that emerged included passion for farming, hope, enthusiasm, courage, acceptance or tolerance, livelihood and a coherent belief system. Based on the findings of the study, a psychological explanatory model in climate change adaptation by subsistence farmers was developed. The explanatory model suggests that resilience factors are influenced by notions and adaptations of climate change. The study is concluded by, among others, recommending that counseling services be made available to farmers to help them deal with the stress associated with the negative impact of climate change.

Keywords: climate change, psychological resilience factors, human adaptation

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CHAPTER 3 Theoretical Framework	This chapter outlines and discusses Michael Ungar's Social Ecological Theory of Resilience as a lens through which the current study will be understood.
CHAPTER 4 Methodology	This chapter outlines the paradigm, research approach, research design, data collection, analysis, ethical considerations and quality criteria.
CHAPTER 5 Presentation of results	This chapter is the presentation of the results/ findings and their interpretation. The chapter includes the subsistence farmers' resilience model inducted from the data analysis.

CHAPTER 6 Discussion of results	The chapter outlines the discussion of the current study's results in relation to the existing literature. The implications are also discussed in this chapter.
CHAPTER 7 Conclusions	This chapter outlines the conclusion of the study, discuss limitations and strenghts of the current study, give recommendations and contributions.

CHAPTER 1
INTRODUCTION

This chapter will introduce the present study. The background to the study will be presented in the first part. The research problem will be outlined followed by operational definition of concepts used in the study. In the third part of the chapter, the purpose of the study is presented.

1.1 Background to the study

Climate change is one of the greatest modern threats to human health and well-being (Costello et al., 2009). Climate change poses a major threat to the well-being of both people and the environment (Shaffril et al., 2017). In the past two decades, climate change-related natural disasters, like floods and droughts have become increasingly frequent and severe, affecting the emotional and psychological well-being of those who are both directly and indirectly exposed to them (Chen et al., 2020; Hayes, 2018). The past decade (2010-2019) has seen the hottest climate recorded contributing to numerous international disasters over the years (Chen et al, 2020).

Climate models predict that climate change will lead to, among other things, an increase in unpredictability of rainfall, warmer temperatures, and an increase in the harshness and prevalence of extreme weather events (Taing & Mahadeo, 2020; Chen, 2007). Similarly, Impacts of climate-induced extremes include variation of the ecosystem, disturbances of food production and water supply, destruction of infrastructure and settlements and consequences for mental health and human well-being (Allen, 2015; Semenza, 2014). The Intergovernmental Panel on Climate Change (IPCC) reported these impacts to be happening worldwide (Drouet et al., 2015). Through its assessments, the IPCC regulates the state of knowledge on climate change and establishes where there is consensus in the scientific community on topics related to climate change (Biesbroek et al., 2013; Füssel & Klein, 2006).

Created by the United Nations Environment Programme (UN Environment) and the World Meteorological Organisation (WMO) in 1988, the IPCC has 195 member countries including South Africa (Lee, 2007). The IPCC prepares concise and inclusive Assessment Reports on the state of scientific, technical and socio-economic knowledge on climate change, its impacts and future risks, and options for reducing the rate at which climate change is taking place (Lahn, 2021; Swart et al., 2009). It is becaue of these negative impacts that have brought about the United Nations Framework Convention on Climate Change (UNFCCC) to call for the regulation of greenhouse gas concentrations as the first important step to control the climate system (Chang et al., 2017). The UNFCCC secretariat (UN Climate Change) is the United Nations entity tasked with supporting the global response to the threat of climate change and was developed in 1992. The Convention has near universal membership (197 Parties) and is the parent treaty of the 2015 Paris Agreement (Krantz, 2021; Weiss & Daws, 2018). The main objective of the Paris Agreement is to maintain the global average temperature rise as close as possible to 1.5 degrees Celsius above pre-industrial levels (Allen et al., 2019; Blau, 2017).

The 1997 Kyoto Protocol was derived from the UNFCCC (Oberthür & Ott, 1999). The ultimate goal of all three UNFCCC commitments is to " strengthen gas concentrations in the atmosphere at a level that would halt harmful human intervention with the climate system in a timeframe that allows for sustainable development and ecosystems to adjust naturally (McKenzie, 2021). The UNFCCC has further called for countries such as South Africa, the United States of America and China for their devotion that they will devote and abide to their national climate plans (Ott et al, 2014; Stern, 2018). These were among many countries mentioned because their livelihood depends on rainfed agriculture and they are affected by climate change. Despite the global calls such as the one made by UNFCCC, it is envisaged that climate change will escalate the unsteadiness of both temperature and rainfall patterns which will, in turn, have an unfavourable impact on people's livelihoods (Cooper et al., 2008).

Predictions suggest that climate change will bring dramatic shifts in agriculture (Corwin, 2021). For example, a global warming of 2℃, would decrease agricultural production by almost 25% (IPCC, 2014; Pachauri et al., 2014). It has been stated that changes in climatic patterns have made already disadvantaged indigenous groups around the world, many of whom are largely subsistence farmers dependent on rain-fed crops, even more vulnerable (Ghosh-Jerath et al., 2021). They are exposed to a wide range of climate threats due to their physical placement in environmentally susceptible areas (such as mountains, forests, deserts, and floodplains) (Morton, 2007; Walpole et al., 2013). Additionally, it puts their delicate, balanced cycle of subsistence in danger, raises the chance of low crop yields, and reduces their access to culturally significant resources (Arbuckle et al., 2013). Subsistence farmers are among those deemed to be among the most vulnerable to current climatic variability on a global scale (Shemdoe, 2011). Because they lack the resources to invest in adaptive resilience strategies to protect their homes, families, and livelihoods, subsistence farmers in underdeveloped nations find it particularly difficult to cope with such climate-related threats (Thorlakson & Neufeldt, 2012).

In sub-Saharan Africa (SSA), climate change is expected to affect food and water resources that are important for livelihoods of the people, more specifcially the poor who mostly depend on local supply systems that are sensitive to climate variation (Hassan & Nhemachena, 2008). Additionally, agriculture is the foundation of sub-Saharan Africa's adaptation to climate change in order to ensure food security and good nutrition (Mohammed & Uraguchi, 2013). For instance, Burkina Faso's subsistence farmers depend more on one rainy season for crop production and income creation, as well as for their household's food security and dietary needs (Myers et al., 2017; Zougmoré et al., 2014). The possible impacts of climate change on the food security of subsistence farmers is a serious worry(Shrestha & Nepal, 2016).

A rising body of research, according to Troy et al. (2015), shows that severe temperatures have a negative impact on crop output. Based on these findings, current predictions indicate that climate change will cause significant changes in agriculture: a global warming of 2°C, as predicted by the most optimistic projections, would result in a reduction in agricultural production of about 25%. (Change, 2014; IPCC, 2014). The rural poor in developing nations are likely the most susceptible group of people exposed to this shock. As a result of their location in tropical regions, where climatic changes will happen more quickly and intensely and where agriculture is a major source of income, they will be more affected (Aragón et al., 2021). As the climate changes, climate change adaptation is being increasingly recognised as both a necessary and important reaction (O'Brien, 2009). Additionally, it has been proposed that one effective tactic for lessening the effects of climate change is adaptation to its effects (Linnerooth-Bayer & Mechler, 2015). However, according to Käkönen & Kaisti (2012), many poor nations lack the financial, institutional, physical, and technological capacity to adapt to climate change. The poor in developing nations (such as India, Japan, SSA, and the Philippines, for example) are the most vulnerable groups, as high levels of poverty, a lack of social safety nets, and limited access to healthcare and education have made them more vulnerable to climatic change (Mirza, 2011; Tubiello & Fischer, 2007). (Dulal et al., 2010).

This adaptation and mitigation possibility are nowhere more profound than in developing countries where agricultural productivity remains low while poverty, vulnerability and food insecurity remain high and the direct impacts of climate change are harsh (Lybbert & Sumner, 2012). The environment, and by extension, society has in its framework the ability to cope with climate changes, an ability commonly referred to as resilience. According to Petzold (2018), increasing resilience and decreasing society's vulnerability to climate change are the same thing. In this sense, resilience helps society become less exposed to these changes. Farmers have long had to discover ways to deal with unforeseen circumstances, including dealing with crop or animal diseases, changes in the availability of family labor, and extreme weather disasters like drought, flood, or hail (Thorlakson & Neufeldt, 2012). Farmers must, however, increasingly deal with the effects of several, concurrent shocks and changes, which may have either temporary or long-lasting effects (Darnhofer et al., 2010).

This new perspective of the world as being essentially unpredictable is addressed by the concept of resilience, which marks a major shift from equilibrium-based strategies (Darnhofer, 2014). Resilience is a term that is used to describe the capacity of individuals, groups, and entire systems to resume normal functioning following a shock across a variety of disciplines and industries (Kais & Islam, 2016). The goal of resilience, known as "systems meta-stability," has made it a central framework for addressing climate change's issues. The idea, which describes a person's capacity to retain regular psychological and emotional functioning both during and after stressful situations, has gained special appeal in psychology (Adams et al., 2021). Extreme events are becoming more common and having a greater impact due to climate change, which could have serious emotional consequences for the impacted individuals and communities (Merdjanoff & Piltch-Loeb, 2021).

Governments advise fostering community resilience to lessen their effects. The majority of community resilience strategies make use of the idea of social capital, which contends that communities with more extensive pre-existing networks of reciprocity and trust are better able to plan for, respond to, and recover from disasters (Ntontis et al., 2020). Although there is a lot of interest in understanding how anxiety and resilience differ in response to natural disasters, enthusiasm often seems to outweigh empirical clarity because there is still a lot of uncertainty regarding what factors lead to resilient or pathological outcomes after exposure to natural disasters. Results show that resilience is more prevalent than pathological results overall (Chen et al., 2020).

1.2 Research problem

According to scientific data, the earth's climate is changing drastically due to increases in greenhouse gas emissions (Pachauri et al., 2014; Stern, 2006). For instance, it is anticipated that SSA will experience temperatures above the global average and that rainfall will decrease in some areas of the region (Serdeczny et al., 2017). The populations known as "subsistence" or "smallholder" farmers, who are primarily found in developing nations, will experience some of the most significant effects of global climate change (Morton, 2007).

One of the groups most exposed to present climate change is subsistence farmers (Bishaw et al., 2013; Praharaj et al., 2017). Enhancing resilience is equivalent to lowering society's risk from climate change, argue Burkett et al. (2001). In this sense, resilience helps society become less exposed to these changes. According to a study by Morton (2007) on the effects of climate change on subsistence farmers, for instance, these farmers have important resilience factors such as labor productivity gains from using family labor, a variety of livelihood options that spreads risk, and indigenous knowledge that enables them to take advantage of risky environmental niches and deal with crises. One of the findings was the need for more empirical research on the conditions under which present methods for dealing with catastrophic events encourage or prevent long-term adaptation (Berman et al., 2012; Morton, 2007). These studies provided evidence in support of the current study's goals for additional research in the field, with an emphasis on psychological resilience characteristics and adaption techniques.

One of the segments of society that often shows relatively high levels of psychological resilience to climate change are farmers. For example, a study by Belay and Fekadu (2021) and Ardalan et al. (2019) in Ethiopia has indicated that farmers in developing countries have shown some high levels of psychological resilience to climate change-related risks like droughts and floods through practicing diverse adaptation strategies. Their findings from focus groups, interviews, observations, and structured questionnaires showed that shifting crop planting dates and crop kinds were frequent adjustments. Farmers relocated to highland areas for a while in cases of severe drought (Belay et al., 2017). Resilience is currently promoted by the usual practice of storing crop wastes (maize straw) as an emergency feed during drought years. Another study by Davies et al. (2009) discovered that as a result of climate change, the intensity and frequency of stresses are changing, necessitating the use of strategies such as social protection, disaster risk reduction (DRR), and climate change adaptation (CCA) to increase local resilience and broaden people's experiences.

These previous studies imply that resilience does not happen or take place as an independent factor or process. It is evident the importance of proper adaptation measures for subsistence farmers in order to foster strong resilience factors. Resources and support from various structures are also important. This is still reinforced by (Belay et al., 2017), who stated that a variety of institutional, policy, and technological support, some of it targeted on smaller, poorer, or female-headed families, is required to support the indigenous adaptation techniques of farmers. Government and NGOs must play an important part in this situation. Although the above studies point to the psychological resilience of farmers in countries in America and Europe, little is known about the psychological resilience factors associated with climate change adaptation by farmers in developing countries such as South Africa. In order to fill this gap, the current study focused primarily on psychological resilience factors linked to farmers' adaptation to climate change in the rural community of Maruleng in the Limpopo Province.

This community was chosen because of the high prevalence of subsistence farmers in the area. An observation was also made that although the world is facing adverse climate change, with Sub-Saharan regions being more affected, the subsistence farmers in Maruleng Municipality have not stopped farming. The researcher wanted to find out their resilience factors as it was both evident that they are experiencing climate change impacts and are still farming, what keeps them going? It was also found in the literature that subsistence farmers are given less attention from the government and NG0's in terms of funding as compared to smallholder farmers and commercial farmers (Deressa et al., 2009; Hassan & Nhemachena, 2008 & Morton, 2007). Inspite of all the subsistence farmers' challenges they face of being at the bottom of the farmers food chain, they still farm every year.

1.3 Operational definition of concepts

- **Psychological resilience**

  Many academic fields have adopted the concept of resilience. Resilience is defined in psychology as the ability to manage stress and survive the effects of stressors. The ability to bounce back from a stressful situation called resilience. Resilience is described from a genetic perspective as the quality that shields people who are genetically predisposed to psychopathology and maladaptation from experiencing these issues (Cicchetti, 2010). Resilience is seen from a slightly wider perspective in humanistic psychology, the area of study that emphasises the value of individual responsibility and choice, and is understood to be, "... a person's ability to flourish and reach their potential in spite of or perhaps even because of such pressures... Resilient people not only appear to be able to handle unique pressures and stressors well, but they also seem to encounter difficulties like learning and development chances (Bahadur et al., 2010).

  In the context of social and ecological systems, resilience is frequently discussed in terms of society and ecology in the social sciences. There is broad agreement among social and natural scientists that understanding resilience necessitates the use of cross-disciplinary and multidisciplinary methodologies due to the close relationship between natural and social systems. This recognises the necessity of using tools like fragility, systems thinking, and complexity theory (Bahadur et al., 2010). In addition to being thought of as a process that evolves over time, psychological resilience has also been conceptualised as a personality trait. For instance, it was described as a "dynamic process comprising beneficial adaptation within the setting of considerable adversity" by Wright et al. (2013). Those who support the idea of resilience as a process disagree with it (Mahoney & Bergman, 2002; Ungar, 2008).

These findings are consistent with the idea that resilience is a capacity that grows through time in the context of interactions between people and their environments (Egeland et al., 1993). When conceptualising resilience, the relationship between individuals and their circumstances is crucial (Fletcher & Sarkar, 2013).

- **Climate change**

  According to the IPCC, climate change is any change in the climate over time, whether it is brought on by natural variability or human action. Contrary to the Framework Convention on Climate Change, where the term "climate change" refers to a shift in the weather that can be directly or indirectly linked to human activity that modifies the composition of the earth's atmosphere in addition to normal climate variability seen over comparable time periods (Change, 2007). Shifts in temperatures and weather patterns over a long period of time are referred to as climate change. These changes might be brought on by natural processes, such changes in the solar cycle. However, since the 1800s, human activity has been the primary cause of climate change, mostly as a result of burning fossil fuels like coal, oil, and gas (Msiska et al., 2022; United Nations, 2022).

  A considerable shift in average weather, such as an increase in temperature, precipitation, or aridity over several decades or more, is typically referred to as climate change. The difference between climate change and natural weather variability is in the longer-term tendency. Every living thing experiences climate change, however not all living things do so in the same way. The most vulnerable populations in the world are those who have made the smallest contributions to the causes of climate change, including those who are economically disadvantaged and people of color. What causes climate change, how it affects the earth and its inhabitants, and what can be done about it are briefly discussed here (Mall, 2021).

Climate change, as used in the current study, refers to long-term changes in temperatures and weather patterns. These changes might be seen as natural, but since the 1800s, human activities have been the primary cause of climate change. This is partly because burning fossil fuels, such as coal, oil, and gas, results in the production of heat-trapping gases.

- **Climate change adaptations**

  Genetic traits known as adaptation help specific species live and reproduce in the environments they inhabit. Humans have the capacity to "manage" and plan adaptation. A system changes during adaptation in response to a force or disruption, in this example a shift in the climate. The properties of the disturbance, those of the affected system, or those of the reaction can all be discussed as a starting point for analysis of adaptation. The term "adaptation" refers to a system's adjustment to present or anticipated climatic stimuli or their effects, which mitigates harm or takes advantage of beneficial chances (Eisenack, 2012). In a system (environment, home, community, group, sector, region, country), adaptation can be a process, action, or result that aids the system in better coping with, managing, or adapting to the changing conditions, pressures, hazards, dangers, or opportunities connected with climate change (Smit & Wandel, 2006).

In the context of interacting non-climatic changes, adaptation entails modifications to social-ecological systems in response to current and anticipated impacts of climate change. Aiming to achieve more than just climate change goals, adaptation methods and actions can range from short-term coping to longer-term or deeper alterations. They may or may not be successful in minimizing harm or seizing advantageous chances (Moser & Ekstrom, 2010). For the purposes of this study, adaptation has been defined as "adjustment in natural or human systems in response to actual or anticipated climatic triggers or their effects, which moderates harm or exploits beneficial opportunities" within the framework of the Intergovernmental Panel on Climate Change (IPCC) (Orlove, 2005).

- **Subsistence farmers:**

  According to Davidova et al. (2009), "subsistence farming" is defined as "farming and associated activities which together form a livelihood strategy where the main output is consumed directly, where there are few if any purchased inputs and where only a minor proportion of output is marketed." However, the term is also occasionally used to denote the activity of self-provisioning with agricultural produce or a relative move toward such activity. It is widely used in a non-technical context to describe the rural underprivileged in emerging nations. If a household simply raises enough food for itself, that is considered subsistence farming or smallholder agriculture. Most of the time, there isn't much harvest left over to sell or trade, and whatever there is is usually saved to see the family through until the next harvest.

  The majority of the rural poor in sub-Saharan Africa depend on this form of agricultural cultivation in order to survive. It's a technique that rural farmers find appealing because it enables food production (at very little cost) in rural areas, reduces the need for them to find transportation to a city, and offers them the chance to stay in a community (where housing and land are much more affordable). Additionally, it indicates that the family is able to provide for themselves. In an ideal world, nothing would have to be bought or borrowed (Mboya & Kolanisi, 2014). The term "sustenance farmers" will be used in this study to refer to people who only farm for subsistence. When farmers cultivate crops for their own consumption and that of their families on smallholdings, this is known as subsistence agriculture.

1.4 Purpose of the study

1.4.1 Aim of the study

- To explore psychological resilience factors associated with climate change adaptation by subsistence farmers in a rural farming community in Maruleng Municipality.

1.4.2 Objectives

- To investigate subsistence farmers' notions of climate change and adaptation.
- To determine the psychological resilience factors influencing the farmers' adaptation the climate change.
- To determine strategies that the farmers use to cope with climate change.
- Based on the farmers' notions of climate change and adaptation, and the associated resilience factors, develop a psychological explanatory model on climate change adaptation by subsistence farmers.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This review will start by discussing the impact of climate change on farming followed by literature relating to culture and climate. The second part of the review will provide an overview of climate change and human adaptation. Subsequently, climate change and psychological resilience factors will be discussed before concluding with a summary of the literature review in the context of the research.

2.2 Impact of climate change on farming

According to scientific data, climate change poses a global threat to people's socioeconomic activity, health, way of life, and food security (Amuzu et al., 2018; Ayanlade et al, 2017; Manyeruke et al., 2013). The vast majority of climate studies (97-98%) concur that climate change is real and caused by humans (Hamilton et al., 2015). However, it is clear that the problem caused by climate change is distinct, extremely complex, and challenging to express (Bushell et al., 2017). According to a study, 53% of New Zealanders believe that climate change is true and that humans are to blame for it, compared to 10% who don't, 7% who think it's real but not driven by humans, and 31% who aren't sure (Milfont et al., 2014). Climate change has an impact on both rich and poor people, as well as developed and underdeveloped countries. However, less developed countries and the impoverished are more vulnerable (Clarke et al., 2012). According to studies, frequent storm occurrences, excessive heat, drought, and other climate-related events are anticipated to increase as a result of both natural and man-made activities, making Africa prone to climate variability (Orimoloye et al., 2019).

The predicted negative effects of climate change on ecosystem services, agricultural output, and livelihoods in Africa will provide a challenge to the continent's development. One of the causes is the prevalence of gender-based disparities in the developing countries. Even though they make up approximately 80% of the agricultural workforce in Africa, women are still weak and underprivileged. 70% of the 1.3 billion individuals in the developing countries who live below the poverty line are women (Denton, 2002). A high level of physical and social vulnerability on the continent is thought to make the effects of climate change on African agriculture especially detrimental (Asante et al., 2017; Asante et al., 2021; Maddison, 2007). The African farmer is considered to be a high-risk taker with limited protective capabilities due to vulnerability, which is a function of exposure to contingencies and the capacity to endure these adaptive characteristics (Yaro, 2013).

Due to the enormous effects of climate change on agriculture, forestry, and rural areas, producers are forced to adapt their operations to the new conditions (Molua, 2008). Climate change is a significant challenge for emerging nations like Cameroon and most African governments (Molua, 2009). There is increasing worry that climatic impacts on agriculture and their costs may be amplified in Cameroon and outside the Central African sub-region as a result of global warming given the statements made by climatologists regarding the evidence of global warming (IParry et al., 2007). The types, frequency, and intensities of crop and livestock pests and illnesses, the availability and timing of irrigation water sources, and the severity of soil erosion are already being affected by current climate change (Molua, 2009). Communities that depend on natural resources are aware of their surroundings and are quick to spot climatic irregularities and their impacts (Fedele et al., 2016). Farmers in the Sahelian region of West Africa note decreasing water bodies, disappearing vegetation and crops, and shifting habitation patterns as signs of decreased rainfall over the final three decades of the twentieth century (Roncoli et al., 2016). Despite the fact that farmers have important knowledge of the weather and climate and apply native adaptation techniques correctly, the importance of local knowledge in studies of climate change has received minimal but growing attention (Yaro, 2013).

According to reports, African farmers have a thorough understanding of the climate and have strong opinions about changes in rainfall, temperature, and winds (Ejembi & Alfa, 2012). For instance, a research in Senegal discovered that although families are aware of climate change, they consider wind and sporadic excess rainfall to be the most harmful climate elements (Mertz et al., 2009). However, when questions about how land usage and livelihoods are changing are not specifically posed in the context of climate change, farmers frequently identify economic, political, and social factors as the cause of change rather than climate change (Kemausuor et al., 2011; Mertz et al., 2009;). The implications for agricultural and economic policy-making should concentrate on providing adaptable options rather than precise answers to a constantly changing climate (Mertz et al., 2009).

Studies have revealed that the majority of agricultural farming in Nigeria is rain-fed, making rainfall the most significant climatic factor. As a result, changes to the country's rainfall patterns might have a significant impact on both crop and livestock farming (Akinnagbe & Irohibe, 2014; Apata et al., 2009). These studies demonstrate that producers of crops and livestock are likely to be more severely impacted due to their inability to adjust to climate change and variability (Ayanlade et al., 2017). Local knowledge should be used in conjunction with scientific knowledge systems for impact mitigation, even though strong agricultural management practices have the ability to serve as the foundation for efficient climate change adaptation strategies. Farmers suffer greatly as a result of their ignorance or lack of preparation when crop yields are low due to losses brought on by climate change, as seen by shifting dates for the beginning and end of the wet (growing) and dry seasons (Ayanlade et al., 2018).

According to climate change forecasts, climatic variability may grow in the future and climate extremes are probably going to happen more frequently in southern Africa (Kusangaya et al., 2014). This is due to the region's high levels of geographical and temporal variability in rainfall as well as, in some situations, its limited water supply. The region's limited capability for adaptation, extensive poverty, and slow adoption of new technologies all increase vulnerability.

Due to its higher baseline temperatures and lower precipitation rates than other parts of the world, SSA is predicted to see greater consequences from climate change on dryland agriculture than other parts of the world (Calzadilla et al., 2013). The feasibility of dryland agriculture will be impacted by the projected increasing variability in precipitation and rising temperatures, which would have a significant negative influence on farm production (Kotir, 2011; Stringer et al., 2009). This is a result of many dryland farmers' limited capacity for adaptation due to their dependence on precipitation, low income, lack of alternative sources of support, relative lack of safety nets, and inadequate institutional resources required to protect against climate change (Amjath-Babu et al., 2016). Rural farmers in SSA are especially vulnerable to climate change, in part because of the problems of poverty, the lack of technological advancement, and the reliance on rain-fed agriculture, which are all exacerbated by poverty (Kydd et al., 2004).

According to a different study, the consumption forgone by subsistence farmers or the consumption that would not be made in the case of market-oriented farmers constitutes the revenue gap. Given the higher projected impacts and higher elasticity, drier farmers in Zimbabwe may experience a greater fall in the consumption indicator for grains than farmers in other nations (Tui et al., 2021). It is noteworthy that, despite the fact that South Africa's predicted income decline will be greater than that of nations like Zimbabwe and Cameroon, the indicator for the decline in cereal consumption in Cameroon will be higher than that of South Africa because the latter's cereal consumption is more flexible (Amjath-Babu et al, 2016). Southern Africa is already seeing warming trends, according to Nicholson et al. (2013). In South Africa, for instance, temperatures have risen by about 2% during the past ten years compared to the years 1970–1979, and some regions are at least 6% drier. Strongly favourable temperature changes for South Africa were also demonstrated by Kruger and Shongwe (2004). According to estimates, agricultural losses in Northern and Southern Africa are expected to range from 0.4% to 1.3% by the year 2100. (Hulme et al., 2001; Mendelsohn et al., 2000).

In an analysis of observed trends in annual rainfall over South Africa, Kruger (2006), on the one hand, found no statistically significant trends in local observation data at the majority of stations, but also showed that every 1% decrease in mean annual rainfall will likely lead to a 1.1% decline in maize production (Gandure et al., 2013; Hulme et al., 2001). But there is spatial coherence among the patterns observed independently at several weather stations, suggesting a tendency for rainfall to be decreasing over sections of north-eastern South Africa, including Limpopo and the north-eastern Free State (Kusangaya et al., 2014). On the other hand, central South Africa, comprising the North-West Province, the western Free State, and the northern heartland of the Eastern Cape, have simultaneously had a steady pattern of increasing rainfall. Increases in the length of rainy spells and severe rainfall events have been seen over central South Africa, supporting the aforementioned assumption (Piketh et al., 2014). Farmers blame climate conditions, particularly wind, for poor animal health, decreased crop yields, and other issues (Ejembi & Alfa, 2012).

Numerous specific and direct effects of climate change on subsistence farmers have been discovered in the literature (Morton, 2007; Thompson et al., 2010). Subsistence farmers are particularly vulnerable to any shocks to their agricultural system, which is their primary source of income, as was previously addressed and is the subject of the current study (Thorlakson & Neufeldt, 2012). The farmers are frequently subjected to pest and disease outbreaks, extreme weather events, and isolation, all of which result in significant crop and income losses, as well as food insecurity (Oyo & Kalema, 2016). While agricultural growth has been the precursor to the acceleration of industrial growth in a number of emerging economies such as China, Brazil, and India, for SSA, current agricultural productivity is low and there have been numerous failures in getting agriculture moving (Chauvin et al., 2012).

According to Dumenu and Obeng (2016), the four ecological zones are experiencing the effects of climate change in relation to irregular rainfall, protracted droughts, shifted cropping seasons, and decreased agricultural output. The irregular weather patterns brought on by the climate system's fluctuations and variability are the cause of these associated impacts (Kotir, 2011; Thornton et al., 2014). The beginning and duration of the rainy and dry seasons are impacted by erratic weather patterns, which shifts the farming season (Abdul-Rahaman & Owusu-Sekyere, 2017, Asante et al., 2017). The rainy season used to begin in April and last until late September or early October (Nicholson et al., 2000). The rainy season now occasionally begins in June or July and ends in November on rare occasions, with exceptionally high rains occurring in September or October. This is an unexpected outcome given that the dry season typically starts in nations like Ghana in October and November and that there is seldom any rainfall during this time (Owusu & Waylen, 2013). The timing of seasons is impacted by such variable weather patterns, which in turn impacts the time of planting and the harvesting/cropping season (Dumenu & Obeng, 2016).

According to a study by Altieri et al. (2015), temperature has a dramatic and direct impact on insect development, reproduction, and survival. Climate is a crucial driver of pest population dynamics. For instance, increased infection during the following crop season results from larvae being able to overwinter in places that are currently restricted by cold due to warmer winter temperatures. With changes in humidity and temperature, new pests may potentially spread to new areas. For instance, pests from lower latitudes could migrate to higher ones. Changes in wind patterns also affect the transmission of bacteria and fungus, the culprits of many agricultural diseases, as well as wind-borne insect pests (Ayyogari et al., 2014; Coakley et al., 1999). Predicted climatic changes are expected to moderate the spread of invasive species, which are pests of agriculture, stored goods, homes, and buildings and may also be disease parasites (Ward & Masters, 2007). Insects pose a special threat since they have the potential to harm local biodiversity in addition to causing significant agricultural losses (Altieri et al., 2015).

In support of this view, Yaro (2013) noted that agriculture-related activities like crop farming and dry-season gardening are the main sources of income in Savanna communities. Due to the scarcity of irrigation infrastructure in these locations, farming operations reliant on irrigation are all but nonexistent. There are irrigation facilities that are poorly built and managed, and relatively few farmers are able to use these irrigation facilities (Inkoom & Nanguo, 2011). Rainfed and subsistence farming generates sporadic and meager income. The rural population is exposed to negative climate change and variability because of their heavy reliance on rain-fed crops (Dumenu & Obeng, 2016; Silva & Matyas, 2014). Therefore, rural farmers in Sudan and Guinea whose reliance on rain-fed agriculture is essentially their whole means of subsistence are extremely vulnerable to climate change (Dumenu & Obeng, 2016).

Another problem noted by Dumenu and Obeng (2016) is that relying exclusively on subsistence farming for revenue affects the security of subsistent farmers' livelihoods, especially in times of low crop output, negatively influencing the amount of food produced and sold for the farmers' well-being. When faced with risks and difficulties like those related to climate change, subsistence farmers with little resources struggle to ensure the wellbeing of their constituents (Eriksen et al., 2007). In a study by Swim et al. (2011), it was discovered that while there is an increasing focus on the physical health effects of climate change and related environmental alterations, it is only recently that their psychological and emotional effects have come to light. This makes them extremely vulnerable to the effects of climate change. For real multidisciplinary and interdisciplinary research and policy activities addressing the implications of climate change, this psychological gap on adaptation to climate change is undoubtedly essential (Bradley & Reser, 2017).

Both immediate and long-term climate and environmental changes have been linked to a number of mental health outcomes (Bourque & Cunsolo Willox, 2014). They include increased incidence of anxiety and mood disorders, PTSD, increased drug and alcohol misuse, and feelings of hopelessness, despair, and suicidal ideation (Bourque & Cunsolo Willox, 2014; Cunsolo & Ellis, 2018). Farmers with pre-existing mental illnesses, marginalised groups, communities reliant on rain-fed agriculture, and villages vulnerable to climate change are anticipated to experience climate change-related mental health impacts the most severely, according to the American Psychological Association Task Force on the Interface between Psychology and Climate Change and as noted in the IPCC's Fifth Assessment Report (Bourque & Cunsolo Willox, 2014; Woodward et al., 2014).

In order to better understand and address global climate change, including attempts to adapt to and mitigate it, the APA Task Force on the Interface between Psychology and Global Climate Change convened in 2008–2009. (Obradovich & Minor, 2022). The study includes discussions on the psychological and mental health effects of actual and perceived climate change, including stress and anxiety, as well as strategies to support healthy coping, adaptation, and responses to climate change (Doherty & Clayton, 2011). The effects of climate change on agricultural productivity, livelihoods, and food security have a significant national policy influence for the South African government, according to studies by Masipa (2017) and Tibesigwa et al. (2014). In addition to having an immediate impact on farmers in the form of food shortages, climate change's effects on agricultural productivity also have an overall impact on the economy and revenue (Vermeulen et al., 2012).

The smallholder sector in South Africa would be severely impacted by these extreme weather events because it is still the most vulnerable due to its significant reliance on rain-fed agriculture and lack of adequate adaption measures (Olutola, 2021; Schulze, 2011). Extreme weather events can have a wide range of negative effects on ecosystems, food production, water availability, infrastructure, human settlements, illness, mortality, and human wellbeing (Semenza, 2014). The latter is less studied because most of the study on climate change comes from the natural sciences. According to the IPCC, these effects are occurring across the globe, including, to name a few, Europe, Australia, the United States of America, and Africa (Alexander, 2016). Because agricultural ecosystems are susceptible to climatic variations, climate change will unavoidably have a large impact on agricultural output. Crop growth, grain yield, and food quality are all directly impacted by changes in temperature and precipitation. While mild warming boosts crop and pasture yields in mid- to high-latitude regions, even a small amount of warming reduces yields in seasonal dry and low-latitude regions (Balogun et al., 2013; Li et al., 2013).

In order to create successful mitigation and adaptation strategies that address the consequences of climate change on local agricultural production, farmers must have a solid grasp of climate change. Fortunately, farmers frequently recognize the indications of climate change because they are important members of agricultural ecosystems. They can create efficient adaptation methods for combating climate change based on these perceptions and a variety of other criteria (Li et al., 2013). The bulk of the rural poor in SSA continue to rely on rain-fed agriculture as their primary means of subsistence Cooper et al (2008). According to Sewankambo et al. (2016), climate variability poses a number of threats to human health throughout the world, particularly in Africa, which includes South Africa. Since it affects every aspect of human existence, including health, natural resources, and agriculture (Aswani et al., 2015), the impact of climate on the environment has been investigated (Orimoloye et al., 2019).

By carefully examining the connections between climate adaptation, health threat, and risk reduction, it has become clear that there is a risk that the environment poses to human health. This has created a growing interest in the relationship between climate adaptation and health threat. The relationship between heat-related incidents and human health is examined and explored in this review. Moreover, to adopt a more comprehensive perspective on how the possibility of catastrophic weather impacts human health and welfare (McMichael, 2017). Therefore, it is important to investigate the cultural concerns related to climate change in order to comprehend the relevance of these dangers, how they affect the environment, subsistence farmers, and the essential foundation of human functions.

2.3 Culture and climate change

Early climate change researchers highlighted the special contributions of anthropology, such as the ability of ethnographic and participatory methods to disrupt the cognitive and cultural context in which farmers' understanding of climate and climate information is grounded, as well as the decision-making processes and environment that influence farmers' adaptive strategies (Crate, 2005; Lepofsky et al., 2005). There is currently a lot of information available about the physical changes brought on by modern climate change, both current and projected (Parry et al., 2007). Natural scientists have provided more than enough evidence to demonstrate to the public that: (a) there is current global climate change; (b) this change is unprecedented compared to previous natural climate cycles that have occurred over the past 600,000 years; and (c) this change is, in large part, a result of human activity (Hulme, 2015; National Research Council, 2008).

The development of the discipline of ethnoclimatology is directly tied to the study of climate change in the context of place-based people (Crate, 2011). It became obvious that indigenous knowledge systems to anticipate weather patterns were becoming unreliable as research in ethnoclimatology advanced and as climate change significantly distorted the ability of local farmers to predict the weather (Crate, 2011; Gonzales-Iwanciw et al., 2020; Roncoli et al., 2016).

A farmer's adaptive methods depend on how strongly they believe in the local consequences of climate change and how they have personally experienced those effects, which in turn affects how vulnerable they are to those effects (Challinor et al., 2014; Roncoli et al., 2016). The degree to which local government planners execute various climate change adaptation methods can be explained by the degree of belief in the local consequences of climate change (Woodruff & Stults, 2016). Farmers who value culture, identity, community unity, and sense of place are less likely to consider themselves as vulnerable to climate change, according to previous research, which helps us understand which values are more at danger (Crate, 2011).

When Ben Orlove and two other meteorologists looked into the central Andean weather forecasting customs, they discovered that farmers used the Pleiades star cluster to predict whether it will be dry or rainy three months from now based on whether it was bright or cloudy (Orlove et al. 2002). The Pleiades' overcast look is a sign of the impending advent of the El Nio phenomenon, which prevents the normal precipitation in October, according to the meteorological explanation, which supports the locals' perspective (Crate, 2011). Daily connections between culture and climate can be observed, such as in dress rules, forecast techniques, social memory of historical climatic extremes, and emotional states (Hulme, 2016). However, there is a lack of coherent literature that approaches the complex relationships between culture and climate in a systematic manner.

There aren't many reference books that provide an overview of culture and climate, and some of them are confusing (Hulme, 2015). It is not possible to simply assume that science is the sole cultural activity that can make global climate change apparent since that would be giving this one form of cultural knowledge an excessive amount of authority (Descola, 2013; Hulme, 2015). Rudiak-Gould (2013) proposes the idea of "constructed visibilism," according to which many distinct cultural works including visual art, memory, myth, performance, fiction, and song are required in order to make climate change plausible.

This was a good stance because it provided "a balance between an intellectual, undemocratic invisibilism and an anti-intellectual visibilism" (Rudiak-Gould, 2013). This is also the stance taken by Roncoli et al. (2009) in their report based on the four axioms they used to illustrate how various cultures interact with the concept of climate change. Without a question, the concept of climate in western cultures—now known as climate change—provokes a greater spectrum of emotional and spiritual emotions than it did 30 years ago (Hulme, 2009; Hulme, 2015). When viewed in light of climate, all facets of human existence are reflected. Climate change has evolved into a new medium through which human life is lived, allowing all human practices and conflicts to be articulated (Hulme, 2015).

The widely reported observation of a "displaced weather cycle" among apple growers, according to a research by Vedwan (2006) conducted in India, links modern concerns of climate change with the more resilient elements of traditional ecological knowledge. The loss of autonomy is a recurring theme in which outside cultural influences, the state's frequently unwanted presence in daily life, and the defiance of societal standards are all considered as the root causes as well as indications of growing disorder in the citizens' social and moral lives (Vedwan, 2006). What does it mean to suggest that values associated with culture, identity, community, and sense of place are frequently sensitive to climate change in addition to being crucial for human well-being? Adger (2010). According to a simplified interpretation, farmers are particularly vulnerable to climate change because they lack the capacity to adapt, or to "plan for and take action to limit bad impacts, moderate harm, or exploit beneficial opportunities" (Blennow et al., 2019).

2.4 Climate change and human adaptation

Mitigation attempts to lessen greenhouse gas sources or improve sinks must take a long time because the climate is changing. Therefore, adaptation is important and a problem in developing nations, especially in Bangladesh and Africa, where vulnerability is high due to a lack of ability to adapt (Adger et al., 2003; Ayers & Huq, 2009). In the face of shifting climatic and socioeconomic conditions, such as climate variability, extreme weather events like droughts and floods, and volatile short-term shifts in local and large-scale markets, adaptation aids farmers in achieving their goals of food, income, and livelihood security (Ajani et al., 2013).

Taking strategic measures in response to these developments will help farmers lessen the possible harm. In order to help farmers in Africa's rural economy adapt, it is crucial to analyze adaptation (Hassan & Nhemachena, 2008). Although African farmers have a limited ability to adjust to such changes, they have throughout time found a variety of techniques to live and cope. Designing incentives to promote private adaptation will require a better knowledge of how they have accomplished this (Nhemachena et al., 2014). This is significant for the current study, which tries to create a model to comprehend and support farmers. Supporting local farmers' coping mechanisms through appropriate public policy, investment, and group efforts can encourage the adoption of adaptation measures that will lessen the negative effects of anticipated future climatic changes, which will be extremely beneficial to vulnerable rural communities in Africa.

Adaptation can greatly lessen the economic effects of climate change on African agriculture, according to empirical studies (Benhin, 2006). (Hassan & Nhemachena, 2008). It was crucial to review the literature on regional adaptations and coping mechanisms because the current study was based on one particular community. Coping mechanisms are frequently location-specific (Ofoegbu, 2016). Localised interventions that aim to facilitate adaptation are more likely to be successful. This results from the fact that localisation is a necessary and inevitable part of adaptation to climate change (Wilk et al., 2013).

Therefore, there is evidence to support the claim that incorporating existing local coping mechanisms into climate change policies and interventions can result in solutions that are affordable, locally relevant, and long-lasting (Nkomwa et al., 2014; Twomlow et. al., 2008). According to prior studies on extreme weather events in rural areas, (a) not all farmers are capable of adapting to the challenges of climate change, and (b) not all farmers' present coping mechanisms are efficient in lowering the risks of climate change (Ofoegbu et al., 2016). Additionally, a number of studies (Byrne, 2014; Goldman & Riosmen, 2013) have shown that farmers, even those living in the same community, use various coping mechanisms (Egyir et al., 2015).

These systems are complicated, established within communities, and employed to produce subsistence crops, suggesting a greater reliance on the utilization of indigenous knowledge (Mugambiwa, 2018). Planning for the production of subsistence crops in the face of climate change takes into account farmer understanding of the seasons, soil fertility, and crop variability that improve sustainable crop production (Rankoana, 2016). These community-based adaptation strategies are based on local priorities, needs, knowledge, and capacities, giving people the ability to prepare for and deal with the effects of climate change (Reid et al., 2009). There are few studies on how rural populations perceive climate change and their capacity to adjust to its threats (Rankoana, 2016).

Agricultural producers are compelled to change their methods of operation and coping strategies in response to the changed environmental conditions as a direct result of climate change (Molua, 2009). In order to decrease the negative effects of climate change on crop output, farm profit, and household income, farms and rural households employ a number of adaptive strategies.

In general, the defense of strategies to deal with an unstable, changing climate consists of the following: (a) changing the crop mix to include more drought-tolerant and short-season varieties and crops; (b) initially reducing the area planted; then gradually increasing the area planted, depending on the nature of the season; (c) delayed planting dates (early or late planting); (d) increasing plant spacing; and (e) enhancing the use of clay soils where these are available since clay soils are particularly suitable for (Molua, 2009; Molua & Lambi, 2012). Farmers who raise crops and cattle each have different coping mechanisms and adaptations to climate change. For instance, agricultural growers have mostly adopted a new planting pattern as an adaptation to climate change (Tesfaye & Seifu, 2016). Changes in planting times during the early and late growth seasons are part of this adaptive strategy. To adapt to climate change, the majority of livestock producers relocate to greener pastures, while some choose to use different water sources (Ayanlade et al., 2017).

Different farmers in varied places have different opinions and understandings of how to adapt to the consequences of climate change. Crop diversification, using different crop varieties, varying the planting and harvesting dates, increasing irrigation use, increasing use of water and soil conservation techniques, shading and shelter, cutting the length of the growing season, and diversifying from farming to non-farming activities are some of the adaptation strategies farmers perceive as appropriate (as opposed to the strategies they actually implement) (Hassan & Nhemachena, 2008). For many local farmers who operate in rural areas, this is not a reality because getting these changes can be quite difficult.

For instance, depending on their educational background, gender, age, and local climate, farmers in Ethiopia's semi-arid regions might plant various crop varieties, trees, protect the soil, or boost irrigation (Bryan, 2009; Iiyama et al., 2017; Tazeze et al., 2012). While Sahel farmers understand that climate change has negative effects, such as an increase in livestock disease and a decline in agricultural yields, they also clearly recognise climate variability and are motivated to utilise indigenous means of adaptation. In response, they changed their land-use strategies to better prepare for climate change (Conway, 2009).

Smallholder, subsistence, and pastoral systems are frequently characterised by livelihood strategies that have evolved (a) to reduce overall vulnerability to climate shocks (adaptive strategies), and (b) to manage their impacts (coping strategies), particularly those located in marginal environments, areas of high variability of rainfall or high risks of natural hazards (Thornton et al., 2007; Morton (2007); and Tadesse and Dereje) (2018). The line between these two groups is frequently unclear because what begins as coping strategies during difficult times can develop into adaptations for homes or entire communities (Morton, 2007). Many defining characteristics of dryland livelihoods in Africa are thought to be climate-adaptive strategies (Antwi-Agyei et al., 2014; Morton, 2007).

Some adaptations include "negotiating for rain" and distributing farm labor according to erratic intra-seasonal rainfall changes (Morton 2007). In Ceará, a state in northern Brazil, Lemos et al. (2002) discovered that farmers' acceptance of climate projections was significantly influenced by their availability to water storage facilities for irrigation and other technology. Additionally, it was discovered that farmers in six different municipalities lacked the resources, assets, and decision-making power to select among a variety of climate change adaptation strategies (Below et al., 2010). For instance, they lack the ability to store water for irrigation. In contrast, Ziervogel (2004) contends that despite having limited access to resources, farmers in Lesotho have a variety of alternatives for reacting to forecasts.

Farmers mentioned a variety of adaptation techniques they employ, such as decreasing the density of field crops, adopting drought-tolerant plants, or planting fewer grains of maize and wheat (Below et al., 2010). According to Ofoegbu et al. (2016), farmers in the Makhado, Musina, and Thulamela regions employed a variety of adaptations to lessen the impact of climate variability and extreme weather events on their way of life and means of subsistence. Certain adaptations weren't practical for long-term adaptation. For long-term adaptation, a tactic like planting crops close to streams in response to variable rainfall episodes is inappropriate (Bryan et al., 2013; Crane et al., 2011). This is due to the possibility that streams would dry up if irregular rainfall persisted for many seasons.

In Ghana and Nigeria's rural areas, rainwater collection has also been noted as a common coping mechanism (Boon & Ahenkan, 2012). (Ajani et al., 2013). The size of the storage tanks that farmers construct affects the efficiency and sustainability of rainwater gathering methods. More farmers found it challenging to utilize this method effectively due to the extreme poverty in the community (Domènech & Saur, 2011). Some residents built modest storage tanks, while others had none at all. Few massive containers they owned were essential to them. Due of this difficulty, some homes kept water in storage for a few days (Ofoegbu et al., 2016). Using dug-out well irrigation and planting drought-tolerant plants like watermelons were two strategies utilised to cope with erratic rains. Similar findings from research on risks like excessive or insufficient rainfall, drought, and crop failure in rural people were presented in the Chad Republic by Perlis (2009). Growing crops that can withstand erratic rainfall and drought problems is done as a precaution to support household livelihoods. The success of this strategy mostly depends on the household's financial capacity and access to quality planting stock (Ofoegbu et al., 2016).

According to Tambo (2016), farmers in the area adopted a range of coping strategies and adaptation strategies, such as seasonal and long-term migrations, new crop varieties, and irrigation techniques, to adjust to climate change. Their capacity to successfully respond to the increasing frequency of shocks must be strengthened in light of the fast changing climate (Crowder & Harwood, 2014). To address the problems farmers face as a result of climate change, it is essential to increase their resilience and capacity for adaptation (Williams et al., 2019). Resilient households are better at anticipating, avoiding, coping with, and recovering from shocks, which explains why (Tambo, 2017). Tambo (2016) also found that crop rotation, utilised by 95% of farmers, is the most common adaptation strategy.

Research organizations are promoting a number of enhanced early-maturing or drought-tolerant crop types to help farmers in the area adjust to the region's shorter growing season and frequent dry spells (Fisher et al., 2015; Kummer et al., 2012). Two more adaption strategies include irrigation and the development of water collection systems (Tambo, 2016).

Farmers in the study region are supported in their production of dry-season vegetables by two significant irrigation dams (Tono and Vea), as well as a number of smaller reservoirs. A few farmers have also built shallow wells and dugouts to capture groundwater for irrigation during the dry season or as supplemental irrigation. About 18% of respondents use techniques for conserving soil and water, such as stone and earth bunds (Tambo, 2016). Farmers' top priority for climate change adaptation methods, according to a multi-country study conducted between 2007 and 2010 on the resilience of African smallholder farming systems to climate variability and change, is: utilising alternative fallow and tillage techniques to address climate change-related moisture and nutrient issues, as well as (a) using green manures and organic residues to improve soil fertility, (b) conserving water and soil, (c) creating mechanisms for the establishment and maintenance of local strategic food reserves, (d) preserving indigenous fruit trees and other locally adapted crop varieties, and (e) supporting traditional social safety nets to protect vulnerable social groups. (g) altering land topography to address moisture shortages brought by by climate change and reduce the likelihood of agriculture deterioration (Mapfumo et al., 2013).

According to Altieri et al. (2015), several large-seeded crops, such maize and beans, can be successfully direct-sown into cover crop residues. Tomato and some late-spring brassica plantings also do well. By retaining soil moisture through mulching, cover crops planted in no-till fields can not only fix nitrogen in the short term but also prevent soil erosion and mitigate the long-term impacts of drought (Altieri et al., 2015). By encouraging deep macro-pores in the soil, cover crops increase soil water storage by allowing more water to permeate throughout the winter (Altieri, 2019; Altieri et al., 2011). Yaro et al. (2015) found that smallholder farmers' capacity for sector-specific adaptation is influenced by their social capital in terms of their capacity to access labor resources.

This has a direct bearing on how well farmers can handle or adjust to the effects of climate change. Farmers' adaptation skills at the local level have been studied by Wrigley-Asante et al. (2019) and Nakuja et al. (2012) utilizing variables like knowledge, use, availability, accessibility, and consultation. Including indigenous knowledge in climate change policy can result in the development of long-term, cost-effective, and inclusive adaptation strategies (Nyong et al., 2007). Methods of adaptation are actions that help a person or a group deal with or adapt to the consequences of climate change in their local environment. These strategies will include the implementation of effective environmental resource management techniques, such as the planting of early-maturing crops, the adoption of hardy kinds of crops, and the selective rearing of livestock in regions with less rainfall (Laukkonen et al., 2009; Nkomwa et al., 2014). On the other hand, including indigenous knowledge into discussions on climate change shouldn't come at the expense of modern/western scientific knowledge. Indigenous knowledge should collaborate rather than compete with existing global knowledge systems. It has been demonstrated that local farmers in Sub-Saharan Africa conserve carbon (C) in soils by cultivating with zero till, mulching, and other soil management methods (Ajani et al., 2013; Assefa et al., 2020).

Natural mulches are adaptations that reduce illness and harmful pests while regulating soil temperatures and extremes. Prior to the invention of artificial fertilizers, a substantial portion of local farmers relied on organic farming, which can help lower GHG emissions. It is well known that forests are crucial to the global carbon cycle because they store and sequester carbon (Ajani et al., 2013). The Northeast Chinese farmers' response to climate change has included modifications to crop shape and composition as well as the deployment of cutting-edge technologies that have substantially accelerated agricultural development (Li et al., 2013). Major climate dangers such as extreme heat, disease, biodiversity loss, and water scarcity all pose a challenge to the way of life of populations that depend on subsistence food production for survival (Chikosi et al., 2019). Additionally, the persistent drought has caused substantial ecological variability, which has led to a decline in water resources and biodiversity and put the lives of rural inhabitants in peril (Kupika et al., 2019 & Rankoana, 2016).

On the other end, rural people have created culturally based adaptation strategies to deal with the unfavorable climatic circumstances that endanger their subsistence agricultural production. To maintain human livelihoods in the face of drought, lack of rain, and decreasing crop production, community-based strategies are implemented (Rankoana, 2016). Increasing rainfall variability as a result of climate change only makes things worse (Kotir, 2011). To be able to adapt to climate change and the anticipated future rise in climate variability, agricultural communities and stakeholders in SSA must first be better equipped to manage the opportunities and restrictions of the current climatic variability (Twomlow et al., 2008).

In order to better identify, describe, and map the agricultural impacts of climate variability and to design climate risk management strategies that are specific to stakeholders' needs, new tools and methodologies are now available (Cooper et al., 2008). But there are obstacles that make adaptation difficult. Terms like limits (Dow et al., 2013), challenges (Jones & Boyd, 2011), impediments, and restraints are frequently used interchangeably when defining barriers to adaptation. By defining the former as "factors that make it harder to plan and implement adaptation actions" and the latter as "the point at which an actor's objectives or system's needs cannot be secured from intolerable risks through adaptive actions," Azhoni et al. (2017) differentiated between adaptation constraints and limits.

On the other side, positive barriers were defined by Moser and Ekstrom (2010) as "obstacles that can be overcome with concerted effort, creative management, change of thinking, prioritisation, and corresponding transformations in resources, land uses, and institutions." As a result, there is growing agreement among researchers that the term "limit" refers to "the threshold beyond which existing adaptation efforts cannot overcome it" (IPCC, 2014), and studies on the term "adaptation barrier" typically concentrate on the difficulties caused by socioeconomic and institutional factors. In accordance with the ultimate objectives of adaptation, Adger et al. (2009) claimed that limits (and barriers) are endogenous and originate from "inside" society.

As a result, they depend on ethics, attitudes toward risks, knowledge, and cultural values. In order to emphasise the contextual character of adaptation barriers, Eisenack et al. (2014) defined them as "an hindrance to specified adaptations for specified actors in their given environment that originates from a circumstance or collection of factors." Barriers might, thus, "be valued differently by different parties, and can, in theory, be lessened or overcome." This means that obstacles depend on the adaption characteristics, the actors, and their context (Azhoni et al., 2018).

Farmers mentioned a lack of credit in South Africa and a lack of land, information, and credit in Ethiopia as the key obstacles to adaptation (Tessema et al., 2013). Wealth, availability to credit, information about the climate, and access to extension services are factors impacting farmers' decisions to adapt in Ethiopia and South Africa, respectively (Bryan et al., 2009). Furthermore, lack of perceived political, business, or industry action, ideological, political, and religious beliefs, worry about free riders, social norms, skepticism, distrust in information sources, externalizing responsibility and blame, optimism bias, attention to other priorities, reluctance to change lifestyles, habit, and fatalism (Berry et al., 2010; Doherty & Clayton, 2011; McDonald et al., 2015).

The intensity of such feelings of psychological distance from climate change may depend on people's perceptions of the risks, their actual exposure to risks, and other factors (Azadi et al., 2019; Singh, 2017; Spence et al., 2012). The perception of heightened risk from climate change to oneself and one's family, for instance, is linked to the readiness to adapt behaviour. Similar to this, when people consider potential local climate change adaptations, their willingness to take personal action to reduce emissions improves, which presumably encourages them to consider the local risk (Evans et al., 2014). Increased climate change concern is more closely correlated with personal experience with the effects of climate change, such as flooding or extreme weather events, especially when the occurrences are linked to climate change. Concerns about climate change are heightened even on days that are warmer than usual. Personal risk exposure or greater personal risk awareness causes worry or generally increases action readiness (Milfont et al., 2014).

Previous studies on climate change adaptation in SSA proposed that a few countries in West and Central Africa (Cameroon), Southern Africa (Zimbabwe, South Africa), and the Horn of Africa (Horn of Africa) pursue dryland (rainfed) smallholder agriculture (Ethiopia). Three different types of adaptive policy options are possible in areas where negative climate change impacts are anticipated, according to Cooper et al. (2008): (1) changing farm management in response to effects (for example, using irrigation or changing crop choice), (2) sectoral shifts in employment (for example, moving from subsistence farming to wage labor), and (3) relocation (Amjath-Babu et al., 2016).

2.5 Climate change and psychological resilience

The connection between mental health and climate change is growing, with more studies about the effects of prolonged drought on farmers' mental health coming out of Northern Australia (Hayes et al., 2018). According to the American Psychological Association Task Force on the Interface between Psychology and Climate Change and as noted in the IPCC's Fifth Assessment Report, areas most vulnerable to climate change, marginalised populations, communities reliant on local ecosystems, and people with pre-existing mental illnesses are expected to experience the most severe effects on their mental health (Hayes & Poland, 2018; Swim et al., 2009). These important associations and scientific groups have pushed for further research on the effects of climate change on mental health, especially in areas considered to be at high risk economically, geographically, or culturally (MacDonald et al., 2015).

The medical literature has increasingly documented the impacts of climate change on physical health, but little has been written about the effects on mental health. However, many scientists anticipate that a significant portion of the negative effects of climate change will be psychological, and that these effects will be persistent, significant, and cumulative (2014, Bourque). While attention has been drawn more and more to the consequences of climate change and related environmental changes on physical health, the effects of these changes on psychological and mental health have only recently been studied (Fritze et al., 2010).

This psychological approach to adaptation to climate change shows crucial adaption factors that have been ignored in climate change science (Bradley, & Reser, 2017). Because they effectively moderate public risk perceptions and understandings, effective coping responses and resilience, overt behavioral adjustment and change, and psychological and social implications, intra-individual and societal "psychological adaptation" processes are particularly crucial (Bernstein et al., 2008; Reser et al., 2015; Schipper & Burton, 2009).

For true multidisciplinary and interdisciplinary research and policy efforts addressing climate change's ramifications, there is no question that this psychological gap on adaptation to climate change is required (Reser & Swim, 2011). Studies that employ a resilience paradigm are the second area of interest for community-based climate change research (Cutter et al., 2008; Galappaththi et al., 2019; Groulx et al., 2014). In these research, ecological concepts are used to describe how a people's resilience and susceptibility interact with ecosystem feedbacks and how cultural qualities and distinctions contribute to a group's success in adapting to its environment (Head et al., 2011; Nelson & Finan 2009; Nelson et al., 2009). A significant conclusion from these studies is that societies' adaptability to climatic fluctuation and change is not entirely a result of technical fixes. Human adaptation, however, is usually influenced by sociocultural interactions, which result in a web of reciprocities, obligations, and assets, including social capital, an important asset for acquiring access to resources in stressful situations (Adger, 2001; Crate et al., 2010; Roncoli et al., 2009).

According to Bonanno and Mancini (2011), factors that foster resilience are diverse and include a range of person-centered variables (coping mechanisms and personality), demographic variables (male gender, older age, higher education), and socio-contextual factors (supportive relationships and community resources). It is unexpected that while other elements are more universally adaptive, some factors that foster resistance to potentially traumatic events may be detrimental in other contexts. Psychotherapeutic treatment should only be provided to individuals who truly require it, given the mounting evidence that resilience is widespread (Bonanno & Mancini, 2008).

According to the Asian Cities Climate Change Resilience Network (ACCCRN), flexibility at an individual, organizational, and systemic level, with each level able to respond and contribute to each situation and to respond to shifting and unforeseen situations, is essential (Beigi, 2015; Brown et al., 2012; Taylor, 2013).

The Rockefeller Foundation established the ACCCRN in 2008 and spent the funds in ACCCRN programming that was concluded in 2016 with a legacy of work aimed at enhancing urban communities' resilience to climate change in six Asian nations, including Bangladesh and the Philippines (ACCCRN, 2022). As described earlier in this paper, resilience thinking would encourage adaptation planners and practitioners to think beyond simply developing plans based on expected changes to the environment. Instead, they should also take failure scenarios and redundancy into consideration. For adaptation responses based on social and human systems, this entails acknowledging that societies or communities are constantly in flux and that the goal should not be to preserve or ensure the status quo but rather to effectively empower individuals and institutions to deal with the variety of changes and disturbances that will occur (Bahadur et al., 2010; Bahadur et al., 2013; Davoudi et al., 2012).

Despite recurrent droughts that have plagued rural South Australia over the past ten years, the majority of farmers still operate their farms. What enables them to "get by" was questioned, as well as whether or not this indicates that they are robust. (2009) Greenhill et al. Which is the identical question posed in the present study. When it comes to mental health and wellbeing, resilience indicates a strengths-based approach, whereas other drought response programs put more of an emphasis on identifying and addressing issues or inadequacies. We should go beyond the idea that resilience is a collection of traits or qualities that shield a person from the effects of adversity in order to use resilience to understand mental health and wellbeing in farm families (Gray & Lawrence, 1996; Hunter, 2012; Jones & Tanner, 2017). Instead, we see resilience as a systemic process rooted in a larger social context that empowers people to assess situations and come to decisions that are best for themselves, their families, and their communities (Greenhill et al., 2009).

Smith et al. (2012) examined how resilient people believed themselves to be to changing environmental conditions. They specifically proposed that individual resilience is made up of general assessments of one's own adaptive capacities, a willingness to learn about and prepare for the potential effects of altered environmental conditions, and awareness of localised hazards brought on by climate change. They proposed that social network characteristics and a person's social-psychological reliance on their immediate surroundings both have an impact on resilience (Smith et al., 2012). The findings also confirmed their theory that people's perceived resistance to shifting climatic conditions is influenced by their social psychological dependencies on the local environment. Decision-makers can concentrate on policy solutions that boost adaptive capacities and foster social resilience by better understanding how people's social networks and social-psychological dependencies influence how they perceive their ability to adapt to changing environmental conditions (Smith et al., 2012).

Farming families are under growing strain as a result of the drought's impact on farm viability (Caldwell & Boyd, 2009). It's crucial to recognize that a farm serves as a source of income, a way of life, and a home for many farmers; but, frequently the only training they have is in how to run a farm economically and effectively (Edwards et al., 2009; Galt, 2013). Rural agricultural communities also have a low level of post-secondary education, which poses challenges for children and teenagers seeking work outside of the farm. The prospect of losing a farm, which is commonly passed down through decades and is the legacy left for future generations, causes a significant deal of worry for all members of agricultural families (Caldwell & Boyd, 2009; Price & Evans, 2009). Personal qualities including modesty, humility, honesty, and psychological strength have been related to a person's ability to adapt to adversity and thrive in the long run. Adopting positive coping methods in a situation where work and home life cannot be separated is critical to achieving a decent work-life balance (Leipert & Reutter, 2005).

Positivism, independence, building local resources, education, information, and seeking out social support are qualities that considerably aid residents' adaptive coping in remote environments (Wilson, 2012). The resources currently available to rural families are increased by external resources like friends and extended relatives (Boucher, 2018; Boucher et al., 2020). Numerous studies have found that people in rural areas rely more on communal values, group coping mechanisms, and social cohesion when dealing with stress than people in urban areas, who rely more heavily on individualistic values and coping mechanisms (Caldwell & Boyd, 2009). These include leadership, social networks and support, a positive outlook, education, formative experiences, a healthy lifestyle, infrastructure and support services, a sense of purpose, a diverse and innovative economy, and the ability to accept and value others' differences as well as one's own beliefs (Dharmasena et al., 2020; Price-Robertson & Knight, 2012).

In order to promote resilience, these elements take into account interactions between people, the community, infrastructure, the environment, and the economy. The findings build on prior research by recognising infrastructure, support services, and environmental and economic factors as elements that enhance resilience. This broadens the little body of knowledge available to individuals looking to increase resilience at the community level (Buikstra et al., 2010). The qualities of communities that influence responses have received far less consideration. Given that the resilience of communities where people reside and the resilience of individuals are intricately linked, this is a significant constraint (Patel et al., 2017). Economic development, or the amount, distribution, and diversity of economic resources within a community, and social capital, which includes concepts like received and perceived social support, sense of community, collective efficacy, and place attachment, are examples of community resources that foster resilience (Norries et al., 2008; Sherrieb et al., 2010).

Resilience is assumed to be hampered by higher levels of disaster exposure at the community level. Given the suggested interdependence of resilience at many levels, it is probable that community resources and exposure have a direct impact on an individual's psychological resilience and also have an impact on the relationship between an individual's exposure to disasters and resilience (Lowe et al., 2015). The fact that resilient people tend to maintain largely consistent levels of typical healthy functioning is a crucial differentiator. This is true even though many robust people have temporary distress reactions (such as anxiety, intrusive thoughts, and difficulties concentrating) (Bonanno, 2004). Previous research has shown that between 35% and 55% of those who have been exposed to PTEs have this kind of resilient result (Bonanno et al., 2008; Bonanno et al., 2010). Because of their comprehensive and time-tested knowledge of subsistence survival as well as their inclination for innovation in the face of environmental, sociocultural, political, and economic change, indigenous people have a comparatively high ability for adapting to uncertainty and change (Howard et al., 2008).

Despite this, they are still extremely susceptible to being taken advantage of by parties with more advanced technology (Crate et al., 2008). Along with major political, economic, social, and cultural changes brought on by globalisation and state-led assimilation initiatives, climate change is also occurring at this time (MacDonald et al., 2015; Richmond, 2009). Studies show that Indigenous communities will be more vulnerable to the effects of climate change because of their reliance on the natural environment, the historical and intergenerational trauma associated with past colonial practices, and their residence in climate-vulnerable areas. As a result of these changes, climate change will have a significant impact on mental health and well-being (Bauer, 2022; Clayton, 2020; Doherty & Clayton, 2011; Stern, 2011). Does this farmers' resilience to the environment, politics, and the other elements mentioned above? Rural populations in West Africa's Sahelian region have historically managed their resources and means of subsistence in the face of difficult natural and socioeconomic circumstances (Mortimore & Adams, 2001; Papa et al., 2020).

They have largely been successful in creating livelihood methods that allow people to continuously manage with and adapt to variable weather, severe insect infestations, changing laws at the local, national, and international levels, and other factors (Mertz et al., 2009). Others challenge the idea of a permanent crisis in Sahelian households and emphasise the resiliency of Sahelian farmers and their shown capacity to cope with even the most severe crises, such as the droughts of the 1970s and 1980s (Sendzimir et al., 2011). Furthermore, it is claimed that the importance of local knowledge in studies of climate change hasn't gotten enough emphasis (Adade-Williams et al., 2020). Farmers recognise and respond to changes in climate factors, for instance, by maintaining flexible methods with short and long cycle crop types (Nyong et al., 2007). Farmers also have valuable indigenous adaptation mechanisms, such as early warming systems (Mertz et al., 2009). Adaptive capacity is determined by the degree of vulnerability or resilience to climate change (Byrne, 2014; Lemos et al., 2013).

Similar results were seen by Joerin et al. (2012) in Chennai, India. Despite the households' prior exposure to flood-related disasters, their resilience in the latter trial remained low due to their insufficient capacity for adaptation. Accordingly, households' resistance to climate tragedy is limited to a cycle of absorbing, managing, and rebounding unless they have sufficient adaptive capacity (Darnhorfer, 2014; Joerin et al., 2012). Real-world shocks and stresses are caused by a variety of factors, including climate change, changes in soil fertility, land use for food production, and the vulnerability of food allocation for consumption and sale (Oyo & Kalema, 2016). Effective public mitigation and recovery strategies, as well as proactive planning in advance, are necessary to increase resilience to these shocks and stresses (Oyo & Kalema, 2016; Oyo et al., 2018). Morton (2007) found in a review paper that smallholder and subsistence farmers, including pastoralists, had important resilience factors like efficiency in using family labor, livelihood diversity allowing risk spreading, and indigenous knowledge allowing exploitation of risky environmental niches and crisis management.

Additionally, he found that the relationship between stressors and resilience-building factors produces complex positive and negative livelihood trends that are greatly influenced by policy environments. According to Below et al.(2010) farm characteristics and a farmer's personality both have an impact on how well they are able to take in and apply climate forecast information. There is little research on the factors that influence acceptance. Roncoli et al. (2009) found that cognitive traits like experience affect how farmers perceive the likelihood of climatic events and their ability to use climate forecasts in a case study in Burkina Faso. However, Archer (2003) and Archer (2007) found that in Southern Africa and South Africa, farmers' willingness to believe climatic projections is influenced by gender. Group discussions, interviews, and a household survey were undertaken as part of a case study in the South African community of Mangondi in the Limpopo Province. The results showed that the ability to accept climate projections is critically dependent on the medium through which they are communicated.

Women stated they prefer an agricultural extension officer to deliver seasonal forecasts since their schedule is not flexible enough to allow them to listen to a radio program at a set time, but men said they are flexible enough to listen to a radio program at a set time (Archer, 2010). In addition, the ladies added that they preferred asking questions than receiving only one-way information (Below et al., 2010). Several studies have examined the role of agriculture economics on the acceptance of climate forecasts (Below et al., 2010; Patt & Gwata, 2002; Thomas et al., 2007). Access to land is a crucial aspect for farmers who lack resources (Mpandeli & Maponya, 2013; Vogel, 2000; Reid & Vogel, 2006). In a case study in Zimbabwe, Phillips, Makaudze, and Unganai (2001) found that a farmer's inability to access draft animals restricts his or her capacity to alter planting dates in response to seasonal climatic forecast information. Subsistence farming has always been a precarious industry for a number of well-known reasons. Farmers typically survive because of their resilience, which they display by using a variety of risk-coping techniques (Oduniyi, 2018). Most importantly, government, donors, and non-governmental organisations (NGO) support farmers' attempts to self-provision is essential to effective subsistence farming. As a result, each farming community receives a unique kind of outside help (Oyo & Kalema, 2016).

There is typically a worry that social support programs implemented by municipalities or provincial government agencies have ulterior political goals (Ofouegbu et al., 2016). The introduction of governmental social support services is driven more by political interest than by a desire to protect households from drought, according to Twomlow et al. (2008) and Thomas et al. (2007). In a South African study, the relationship between family, neighbors, and local community-based organisations' support and obstacles to the adoption of coping mechanisms in homes was examined (Ofoegbu et al., 2016). Receiving assistance from neighbors and admitting trouble coping with climatic variability and change were related. Except for a lack of funds or access to credit, all other concerns identified in this study had a substantial correlation with support from neighbors (Ofoegbu et al., 2017). Less than 14% of people who claimed they received assistance from their neighbors reported having difficulty adjusting to climate change and variation. As a result, social support systems like neighbors are essential for helping households deal with the issues caused by climate fluctuation and change in their neighborhood (Ofoegbu et al., 2016).

2.6 Concluding remarks

The purpose of this review was to discuss relevant literature on the impact of climate change on farming and the literature on culture and climate. An overview of climate change and human adaptation and climate change and psychological resilience factors were also discussed. It is clear from the research reviewed that the notions of climate change by farmers, in general, have a variety and wide understanding. Along with this, it is also clear that the field of psychological resilience factors on climate change is still limited, and continues to be problematic. It is therefore in this regard that psychological resilience factors by subsistence farmers still need to be studied further and more.

CHAPTER 3
THEORETICAL FRAMEWORK

3.1 Introduction

In this chapter the researcher discusses the theoretical framework chosen for the present study, outline the theory and give a summary of the chapter. A theoretical framework serves as a foundation for any study. In the present study, resilience theory was chosen as a framework that generally guided and oriented the attainment of the study objectives. This chapter will focus specifically on the Social ecological resilience theory which will inform the process of resilience.

3.2 Resilience

- Resilience has many different and varied definitions. Resilience has been characterised in various ways by researchers. Some have defined it as the capacity to respond favourably to stressful situations, while others have described it as the capacity to continue to function normally in the face of chronic stress. According to the American Psychological Association (APA), resilience is the ability to "bounce back" from challenging situations and adapt well in the face of adversity, trauma, tragedy, threats, or severe causes of stress (Comas-Diaz, 2016).

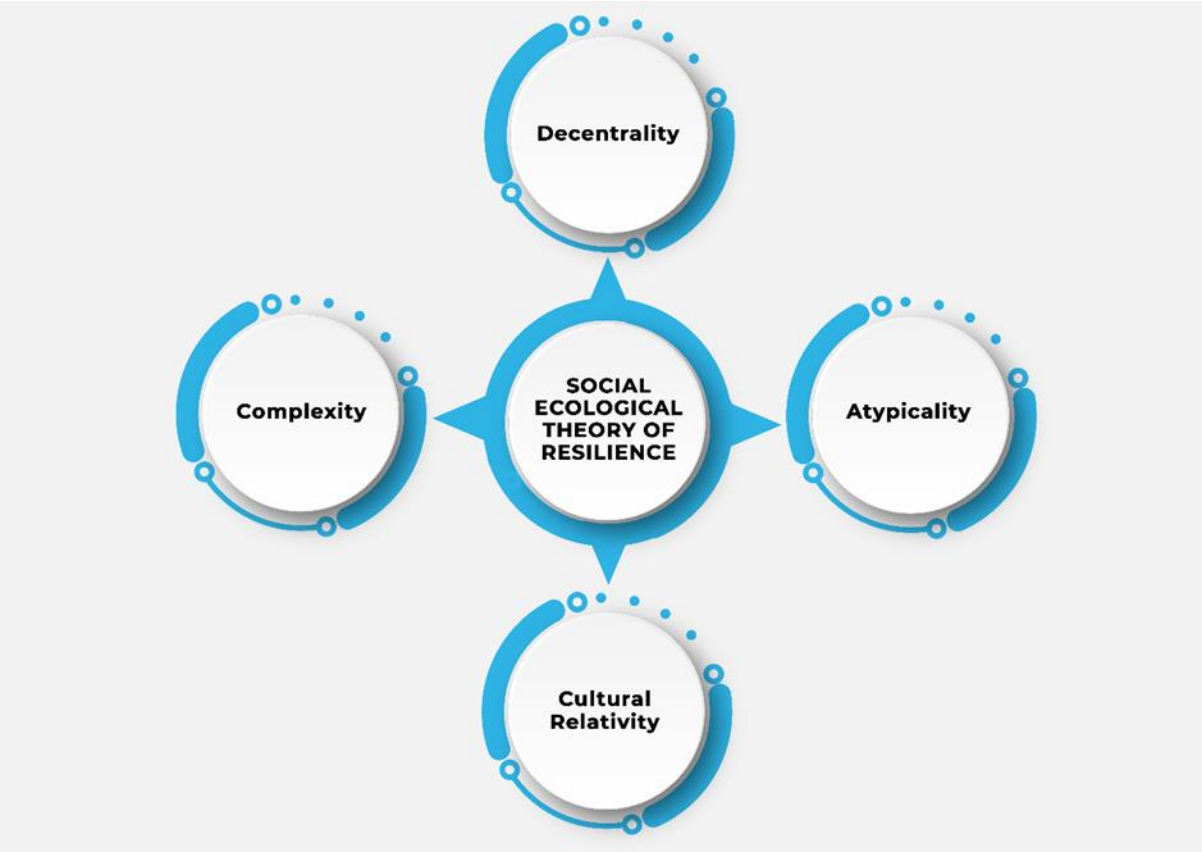
- Resilience is needed to handle life's ups and downs. Resilience is a complex phenomenon that is influenced by the presence or absence of a variety of elements that foster resilience. When these resources are developed, they improve a person's capacity to handle increased stress and challenging situations in life (Joyce et al., 2018).

3.3 MIchael Ungar's social ecological theory of resilience

In the present study, the researcher used Michael Ungar's Social Ecological Theory of resilience as a lens to understand and conceptualise psychological resilience factors associated with subsistence farming in Maruleng Municipality. Ungar (2011) asserts that the social-ecological concept of resilience emphasises the importance of the dynamic link between individuals and their social ecologies to successful coping with challenges. Resilience was described by Ungar as more than a particular combination of traits. They are able to overcome the hardship they encounter and forge paths to resilience because of the institutions that surround them, the services they receive, the way health information is produced, and other factors.

He raised four principles that require consideration, namely a) decentrality, b) complexity, c) atypicality and d) cultural relativity (Ungar, 2011).

Figure 1 : Michael Ungar's social ecological theory of resilience



a. Decentrality

The concept of resilience could be understood by looking at the interaction between individuals and the environment (Ungar, 2013). It is critical to have a strong influence on how people engage with these surroundings. Such research implies that in high-risk contexts, individual factors are less important than the availability and accessibility of culturally relevant resources. According to this ecological approach, resilience is a notion that prioritises the social and physical ecology of the child first, followed by interactions between the environment and that unique child and their propensities for healthy growth. Although the area of psychopathology has already begun to move its emphasis to a greater emphasis on the environment (Miller et al., 2009), the field of resilience research has not yet seen the same degree of change (Hudziak & Bartels, 2008). We need to refocus our efforts away from altering individuals and toward creating more supportive social and physical contexts if we hope to advance psychological sciences and guide treatments. In this regard, Masten's distinction between resilience—which is process-driven—and resilience, which emphasises the intrinsic traits of the human, is congruent with the idea of decentralisation. Decentralisation emphasises the obligations and contributions of social ecologies, to put it another way (Ungar, 2011).

b. Complexity

Both the terms complexity and chaos are used to describe unsavory behaviour that defies the law but never comes to an end. The state of being on the cusp of positive and negative is how it is defined. According to research, people with abundant and limited resources can react differently to risk factors. According to the complexity hypothesis, context- and time-specific models must be created in order to explain resilience-related outcomes. Despite the possibility of patterns, the research implies that until social and physical ecologies are maintained as constants, generalisations should not be made.

Equifinality and the complexity principle can coexist, not reducing the importance of resilience in inquiry and intervention. Numerous distinct processes that are pertinent to various ecologies can result in a variety of beginnings that are equally good in the end (Ungar, 2011). This is further confirmed by a study that revealed that, when contextual circumstances are taken into account, a well-supported child does not always perform better. The onus here, as elsewhere, is on the need to pay far less attention to the child's own characteristics and much more to the complexity caused by a thorough examination of the quality of the child's environment (Ungar, 2004). Complexity highlights the fact that building resilience is not an easy task. Instead, it involves the dynamic and intricate relationship that exists between a person and their social environment (Ungar, 2011). Because resilience is so complicated, what encourages adaptive adjustment in one situation or during one developmental stage could not promote resilience in a subsequent developmental stage or in the process of another person (Ungar, 2011).

c. Atypicality

This idea of equifinality, which overlaps with complexity, directs our attention toward processes rather than specific traits. The value of resilience related traits as protective variables is defined by context rather than by good or bad behaviour (Ungar, 2011). Unexpected behavioural patterns may be culturally and contextually significant to excellent development when considered in a wider or longer term context when the standards for that growth are defined locally. Therefore, when investigating resilience as a process, understanding the functioning of behaviour when other pathways to development are blocked is more crucial than concentrating on predetermined outcomes to gauge the success of growth trajectories (Ungar, 2011). The principle of atypicality can be used to argue that resilience can manifest in ways that we don't want to promote but that are necessary because of the social ecologies in which individuals survive, which brings us back to the earlier point about the need to focus on environments as much as or more than individuals (Ungar, 2011). Long-term environmental changes should, one would expect, lead people to use other, more socially acceptable coping strategies. However, rather than being impacted by human attributes, such decisions are most likely to be influenced by the status of the environment (Ungar, 2011;2013).

Resilience is a context-dependent process that is influenced by both cultural and sub-cultural factors, according to atypicality. Ungar (2011) asserts that even when resilience approaches are not socially acceptable, a range of experiences, resources, or chances can provide positive results.

d. Cultural relativity

Positive growth mechanisms under pressure are ingrained historically, culturally, and chronologically (Ungar, 2008). Although the necessity to properly account for cultural relativity is not unique to the study of resilience, culture is notable for its positive influence on psychological health due to the processes that are associated to resilience (Ungar, 2013). Culture is the way that people and groups of people express a set of shared ideals, worldviews, languages, and customs through their daily conduct (Wong, Wong, & Scott, 2006). Recognising resilience as a complex concept with variable outcomes requires taking into consideration the competing truth claims of the overlapping cultures in which people live.

3.4 Relevance to the current study

As stated above, Ungar defined resilience as more than just a certain combination of traits. They are able to overcome the hardship they encounter and forge paths to resilience because of the institutions that surround them, the services they receive, the way health information is produced, and other factors.

The four principles that form this framework helped understanding the divergence in why some subsistence farmers may succeed under stressful conditions while others may fail (Ungar, 2011; Ungar, 2013; Ungar, 2018). The present study aimed at exploring the psychological resilience factors by subsistence farmers in Maruleng Municipality, also looking at the available resources in the area as either being helpful or not in fostering resilience. Despite the extreme weather changes resulting climate change in Maruleng Municipality, (a lack of proper housing, poverty and resources), farmers still proceed to farm and harvest. This can be attributed to both internal and external factors. Most of them have lands that should be used for farming.

Ungar and Liebenberg (2013) discovered that social organisations and culture contribute immensely to the quality of a neighbourhood. The principle of decentrality is relevant to the present study as it emphasises that subsistence farmers can show psychological resilience despite the adversity of climate change by using available resources from their surrounding environment.

Complexity is equated to equifinality, meaning multiple beginnings might result in multiple desirable outcomes by different processes in different ecologies (Collette & Ungar, 2020). The principle of complexity is relevant to the present study as it aimed to investigate, explore and describe climate change adversities while fostering psychological resilience according to subsistence farmers with a variety of demographics. It should also be noted a resilient person, whatever defined at one point in time, should not be expected to be doing well every minute of the day, under all imagined conditions, or in perpetuity (Masten & Powell, 2003).

Atypicality principle will help the researcher in understanding the results by looking at the notion that individuals who find themselves in unpleasant situations sometimes resort to coping strategies that are considered maladaptive and are not socially and lawfully acceptable (Ungar, 2011). Therefore, as argued by (Malindi & Theron, 2010; Theron et al., 2013) resilient behaviour should be looked at in context instead of according to the norm, as protective factors in one context could be risk factors in another.

The present study aimed to investigate atypical behaviours that are used by subsistence farmers in Maruleng Manucipality. This concept helped in understanding certain ways in which the substance farmers fostered their resilience and adaptations even though they might not be seen as acceptable. The cultural relativity was also relevant when looking at the present study because what is considered competent in one culture might be considered as being incompetent in other. South Africa is both multicultural and multilingual. Although Maruleng Manucipality is not both, the area has two ethnic groups namely Pedi and Tsonga which have different cultural practices.

This study aimed to establish what cultural skills and capabilities foster psychological resilience in the subsistence farmers they came from more or less different cultural backgrounds. This was done by exploring the subsistence farmers' perspectives on the principle of cultural relativity. It is evident that despite the numerous adversities and extremely stressful weather conditions that subsistence farmers experience, both physical (enriching environment) and social (relationships and culture) ecologies can facilitate growth and the development of positive wellbeing. This perspective is relevant for the present study because it emphasises the importance of the environment and proposes a social ecological understanding of resilience. It proposes that if meaningful resources are available within the environment, individuals are more likely to engage with them and show resilience.

3.5 Concluding remarks

This chapter outlined the theoretical framework, specifically the Social Ecological Theory of Resilience, as well as the relevance of the theory to the present study. To help guide both research and theory development in resilience as a social ecologically dependent concept, four principles: decentrality, complexity, atypicality, and cultural relativity were discussed. Individual attributes linked with coping under adversity are engaged within this framework to the extent that social and physical ecologies have the capacity to assist processes that protect against risk and promote positive growth. Paying attention to these four principles could also explain a lot of the variation in why some farmers thrive while others fail.

CHAPTER 4
METHODOLOGY

4.1 Introduction

This chapter focuses on the methodology used for this study. In the first part of the methodology, a critical outline of the qualitative approach is presented, including the justification for adopting this approach in the present study. The second part focuses on Grounded Theory as a research design and research methodology that guided the study. The rationale for choosing Grounded Theory is also given. In the third part of the chapter, the focus is on the methods that were used for sampling, data collection and data analysis steps. A description of the setting where the study was conducted is also described. In the fourth part of the chapter the quality criteria that were used are presented. The ethical issues that guided the research in conducting the study are presented in the fifth and last part of the chapter.

4.2 The choice of a qualitative approach

4.2.1 Quantitative versus qualitative approach

Oftentimes people confuse research with information collection, fact-checking, and information-hunting (Leedy & Ormrod, 2001; Williams, 2007). But gathering, analysing, and interpreting data in order to comprehend a phenomenon is the process of research. The research process is systematic in that it adheres to defined frameworks and established norms for defining the purpose, handling the data, and communicating the findings (Williams, 2007). At least one inquiry regarding a particular topic of interest forms the basis of research. What are the psychological resilience variables used by subsistence farmers in reaction to climate change, for instance, was the focus of the current study. The broad strategy a researcher employs when doing a research study, according to (Leedy & Ormrod, 2001).

The selection of the best methodology for any particular research project is important to the resulting quality and value of that project. The selection of the best and relevant methodology is determined within the context of the research aim or objectives (Carter & Little, 2007). Quantitative, qualitative, and mixed methodologies are the three most often used research methods. However, this part will solely cover quantitative and qualitative topics. Numerous techniques for the systematic analysis of social phenomena using statistical or numerical data are included in quantitative research (Watson, 2015). The assumption in quantitative research is that the phenomenon being studied can be measured, hence it incorporates measurement (Yilmaz, 2013). It aims to examine data for patterns and connections as well as to validate the measurements (Watson, 2015). Moreover, Creswell (1994), Queiróset al. 2017 and Jopling (2019) has given a very concise definition of quantitative research as a type of research that is explaining phenomena by collecting numerical data that are analysed using mathematically based methods like statistics.

Therefore, given that the main goal of quantitative research is to gather numerical data to describe a specific occurrence, some questions appear to be ideally suited to being answered using quantitative approaches (Sukamolson, 2007). For instance, how many farmers in Maruleng Municipality are subsistence farmers? How many farmers who rely solely on subsistence farming are opposed to climate change? Is there a discernible difference between the resilience of commercial farmers and subsistence farmers to climate change on average? Quantitative research is also available in many different forms. Survey research, correlational research, experimental research, and causal-comparative research, for instance, can all be included in this category (Apuke, 2017; Sukamolson, 2007). The main benefits of quantitative research include the ability to generalise results to a particular population, the size of data sets and the fact that results are representative of a population, the ability to share and replicate documentation regarding the research framework and methods, and the ability to replicate the study over time (Gelo, 2008).

Main limitations of quantitative research include; data does not provide evidence for why populations think, feel, or act in certain ways. Studies can be time consuming and require data collection over long periods of time (Goertzen, 2017). In that it is concerned with understanding and characterizing the universe in terms of observable physical phenomena, with a concentration on the quantitative measurement of these phenomena, the quantitative research tradition is deeply founded in the materialist and positivist traditions (Goduka, 2012; York & Mancus, 2009). The importance of objectivity and empirical data, i.e. data that can be directly observed and measured using the senses, is emphasised. The classic public health sciences of epidemiology and statistics, as well as medicine and biology, and nutrition itself, are all part of the quantitative research tradition. Qualitative research is sometimes described as the polar opposite of quantitative research (Draper, 2004).

Data that cannot be reduced to numbers must be gathered, analysed, and interpreted in qualitative research. These statistics are related to social world concepts and human behaviour (Anderson, 2010; Ritchie & Spencer, 2002). All social sciences and its related applied domains, such as research in health services, nursing, social sciences, and pharmacy, use qualitative methods of inquiry (Anderson, 2010). In contrast to quantitative research, qualitative research typically begins with 'what,' 'how,' and 'why' questions rather than 'how much' or 'how many' questions (Korstjens & Moser, 2017; Moser & Korstjens, 2018). It also looks at these questions in the context of everyday life, as well as the interpretations and explanations of each individual. Qualitative research is interpretative and naturalistic in nature, as it aims to understand and explain beliefs and behaviors in the context in which they occur (Draper, 2004).

Subjectivists characterise qualitative researchers (Kvale, 2008). Comparative research emphasises the existence of the truth and how it may be measured and discovered objectively, whereas qualitative research emphasises the importance of human subjectivity in the research process (Muijs, 2004). Researchers cannot honestly and impartially observe reality because reality is at least somewhat created by them and their observations. Reality is altered and transformed by the act of observation, hence quality is relative. Since all truth is merely relative and never absolute, as the quantitative claim suggests (Sukamolson, 2007).

A qualitative research paradigm, according to Ejimabo (2010), explores the patterns of meaning that emerge from the participant data. Its main goal is to utilise words to create a comprehensive, complex picture of the participants' perspectives in a setting that is both comfortable and natural. Instead of using surveys like in a quantitative study, this method collects data through observation, in-depth interviews, group interviews, and the gathering of pertinent documents, photographs, and videotapes (Aborisade, 2013; Hox & Boeije, 2005). The benefits of qualitative research, according to the researcher, include its ability to capture context, describe the experience, identify the motivations, highlight the interaction between the perpetrator and victim, identify perceptions or conceptions, and recommend potential future policies (Weil, 2017). Due to the fact that it frequently describes the contexts in which policies will be applied, qualitative research is helpful to policymakers. Using a qualitative research approach, the researcher can look for patterns as well as observe things in their natural habitats while attempting to understand or interpret occurrences in light of the meanings and associations participants establish with them (Ormston et al., 2014).

Participants' words and actions serve as the study's data sources in qualitative research (Ejimabo, 2015). It's critical to select the methodologies that are most suited to the subject under investigation. Researchers should carefully consider their aims because not every research question is fit for qualitative research (Qu & Dumay, 2011). Do they want to learn more about a certain phenomenon (such how farmers feel about climate change)? Or are standard comparisons and variance accounting more important to them? (eg, examining differences in examination grades after changing the way the content of a module is taught).

Qualitative and quantitative research employ quite distinct approaches and data. They are all based on quite different presumptions about how the world works, how our knowledge of it works, and how it is generated (Ormston et al., 2014). These approaches have implications for every aspect of research strategy, including the assessment of the value and generalizability of research findings (Ormston et al., 2014). Regarding the latter, inadequate qualitative research reporting and small sample sizes have a tendency to create the impression that qualitative research findings are only marginally applicable to contexts other than those of the original study (Thomas, 2017). Despite the requirement for more accuracy in reporting, it is crucial to appreciate that qualitative research can produce more universally applicable insights and understandings than quantitative research (Draper, 2004).

4.2.2 Qualitative approach and interpretivism

According to Golafshani (2003), qualitative research is "any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification," but rather, the kind of research that produces findings from real-world settings where the "phenomenon of interest unfold naturally. According to Creswell (2009), Petty et al. (2012), and Vikal (2017), qualitative research is a way to discover and comprehend the meaning that certain people or groups assign to social or human issues.

A qualitative researcher instead seeks clarification, comprehension, and extrapolation to similar circumstances as opposed to a quantitative researcher who seeks cause identification, prediction, and generalisation of findings. A method of inquiry known as qualitative research, which is based on a number of methodological traditions of inquiry, examines a social or human problem. By examining language, reporting on informant information, and doing the research in a natural setting, the researcher develops a rich, comprehensive picture (Isaacs, 2014; Khan, 2014). According to Pathak et al. (2013) and Al-Busaidi (2008), qualitative research is more concerned with the study of human experiences and phenomena through inquiries into participant experiences and observation of participant behavior in a real-world situation. The analysis of the data, which is typically given in narrative form, includes word-by-word interpretation, coding, and categorisation. Alase (2017) asserts that qualitative research helps the researcher to thoroughly examine the human experience. Qualitative research is interdisciplinary and covers a wide range of topics. Simplified, qualitative investigation entails a naturalistic, interpretive perspective on the world (Adler, 2003; Denzin & Ryan, 2007).

The term "qualitative" indicates an emphasis on characteristics of things as well as actions and meanings that aren't (or are rarely) quantified in terms of quantity, amount, intensity, or frequency in experiments. The social construction of reality, the close bond between the researcher and the subject of their study, and the limitations imposed by the context on their research are all highlighted by qualitative researchers (Denzin & Lincoln, 2008). Qualitative methodologies have previously shown to be effective research tools in the social sciences, particularly in anthropology, sociology, psychology, and related fields (Tetnowski & Damico, 2004). The researcher for this study supported qualitative research due to its benefits in capturing context, describing experience, identifying motives, highlighting relationships on ideas of climate change, impacts of climate change, identifying psychological resilience factors and coping strategies and suggesting management measures (Weil, 2017).

Qualitative analysis yields a different kind of knowledge than quantitative inquiry because one side argues from the underlying philosophical nature of each paradigm, enjoying in-depth interviewing, and the other party concentrates on the apparent compatibility of the research methods, "enjoying the rewards of both numbers and words" (Glesne, 2016; Howitt & Cramer, 2010). This indicates that approaches like interviews and observations are prevalent in the naturalist (interpretive) paradigm and supplemental in the positive paradigm, where the use of surveys serves a different purpose (Padgett, 2011).

Different academics have varying interpretations of what is meant by the word paradigm. It can be characterised as "a loose collection of logically connected assumptions, notions, or propositions that orient thinking and research" or as the philosophical purpose or driving force behind a study (Cohen & Manion, 1994). Instead, Mac Naughton et al. (2001) offer a definition of paradigm that consists of three components: a viewpoint on the nature of knowledge, a technique, and validity standards (Mackenzie & Knipe, 2006). While Scotland (2012) and Aliyu et al. (2015) refer to the paradigm as a research methodology, an ontology, or even an epistemology. According to various interpretations, Mackenzie and Knipe (2006) categorise several theoretical paradigms as post-positivist, constructivist, interpretivist, transformational, emancipatory, critical, pragmatist, and deconstructivist. Cause and effect govern philosophy in the post-positivist paradigm (Creswell & Creswell, J.D, 2017). Interpretivist researchers, on the other hand, comprehend "the realm of human experience" (Cohen & Manion, 1994). According to Yanow and Schwartz-Shea (2011), interpretivist researchers learn about reality through participant perspectives, their own backgrounds, and experiences, which is in line with Cohen and Manion's theory (Thanh,N.C & Thanh, 2015).

The Interpretivist paradigm—more specifically, social constructivism—was applied in the current study. The constructivism paradigm, whose mother is the interpretivist philosophical paradigm, was the subject of this investigation. Researchers can view the world using participants' perceptions and experiences thanks to the interpretivist paradigm (Khan, 2014). The interpretivist paradigm uses these experiences to develop and interpret one's understanding from the facts obtained while the researcher searches for solutions (Willis et al., 2007). The phenomenology of Edmund Husserl and the study of interpretive understanding known as hermeneutics developed by Wilhelm Dilthey and other German philosophers are the roots of the interpretivist/constructivist paradigm. The goal of interpretivist and constructivist research methodologies is to comprehend "the universe of human experience," positing that "reality is socially created" (Mertens, 2005).

The interpretivist/constructivist researcher frequently relies on "participants' views of the situation being investigated" and is aware of the influence of their personal history and experiences on their research (Mackenzie & Knipe, 2006). By interpreting the understanding of how respondents both generate meaning and in turn make sense of their worlds, interpretivism allows scholars to investigate the world of their respondents (Noon, 2018). The strength of the interpretivist approach, according to its proponents, resides in how it values and takes into account various viewpoints and interpretations of the meaning-making process. Thus, interpretivists contend that understanding the context of any type of research is essential for properly interpreting the information obtained Lin (1998). The interpretivist paradigm's basic tenet is that reality is socially produced, and interpretivism typically aims to understand a certain context (Thanh, N.C & Thanh, 2015). Contrary to post-positivists, constructivists typically "create or inductively establish a theory or pattern of meanings" during the course of the study process (Creswell & Creswell, J.D, 2017). Most frequently, a constructivist researcher will use qualitative data collecting and analysis techniques, or a mix of qualitative and quantitative techniques (mixed methods).

It is acceptable to use quantitative data in a way that complements or adds to qualitative data, thereby deepening the description (Mackenzie & Knipe, 2006). Constructivists claim that reality is subjective since it is based on the unique viewpoints of the study participants and is therefore many or diversified, much like the qualitative researcher (Adom et al., 2016). Additionally, the researcher interacts with participants in their social and cultural contexts to understand the significance of occurrences. Most constructivism-based research projects start with an open-ended investigation using research questions. The study's findings are then used to develop potential or reliable conclusions. The majority of researchers even develop theories in response to study findings (Adom et al., 2016). The researcher was able to analyse the phenomena of climate change and psychological resilience components and develop a hypothesis thanks to this paradigm, which was relevant to the current study. According to researchers, the interpretivist/constructivist paradigm mostly employs qualitative methodologies (Thanh, N. C & Thanh, 2015).

4.2.3 Justification for choosing the qualitative approach

The researcher must approach the study topic with an open mind in order to arrive at a meaningful and proper understanding of the sociocultural phenomenon under consideration (Yardley, 2000). As a result, any underlying biases or expectations must be identified and minimised as much as feasible. This is critical since the researcher is frequently both the primary interviewer and the data interpretation (Guba & Lincoln, 1994). In order to achieve the study's objectives, the researcher chose qualitative approaches based on the phenomenon under examination and the circumstances in which the phenomenon happens (Hafiz, 2008; Tetnowski & Damico, 2001). The qualitative approach was used in this study because it allowed the researcher to follow these qualitative research aims. To begin, the researcher gathered relevant data in natural and authentic circumstances. In order to understand how the phenomena under inquiry operates, data was collected and analyzed in line with contextual elements that affect operation (Bowen, 2009; Chan et al., 2013).

A second objective allowed the researcher to obtain detailed descriptive information in a realistic setting. The researcher did a sufficient background on the behaviors and factors under consideration because the goal was to understand how the behavioural phenomena works (Johnston et al., 2010; Shenton, 2004). Rather than collecting data using predetermined classification patterns or observational categories with the goal of arriving at numerical conclusions for statistical purposes, the qualitative researcher employs words or pictures to produce actual and memo-written narratives of the behaviors and activities that occur during actual social interactions (Priya, 2016; Tavory & Timmermans, 2014). Once data has been acquired in authentic settings, the researcher can carefully analyse the information to see how behaviors and context interact to produce the phenomenon under examination (Conger, 1998; Mohajan, 2018).

Thirdly, because the overall goal necessitates thorough and sophisticated descriptions and analyses aimed at comprehending the phenomenon's procedural affairs, there must be a focus on the individual (Wertz, 2005). Unlike experimental research, which relies heavily on group data for predictive statistical analysis, qualitative research necessitates a focus on one or a few individuals rather than a large sample (Morgan et al., 2013). In essence, qualitative research analysis works with a small number of participants, whereas quantitative research analysis works with a large number of variables and instances (Damico et al., 1999). As a result, qualitative research is geared toward a more specific description rather than a wide one (Aspers & Corte, 2019).

Finally, the qualitative methodology allowed the researcher to include the perspectives of the participants on the topic under investigation (Williams, 2007). This is due to the fact that the phenomena is largely situational and based on the actions and meanings that the actual participants bring to the occurrence (Sloan & Bowe, 2014). As a result, it's critical that the researcher incorporates the participants' conceptual frameworks into the investigation (Suleman, 2018).

Social scientists frequently utilise qualitative research to build up an in-depth picture of human behaviour and beliefs in the situations in which they occur. This practice stems from their interest in thoroughly understanding human behavior (Rubin, H.,J & Rubin, 2011; Alshenqeeti, 2014). Additionally, this line of research aims to investigate and characterise the "quality" and "nature" of how individuals act, perceive, and comprehend the world through the use of non-numerical data (Mohajan, 2018). The ability of qualitative research to generate hypotheses is one of the major benefits frequently mentioned for qualitative research, according to Hammarberg et al. (2016), who also link people's actions to their beliefs.

Understanding how a particular sociocultural phenomenon functions is the fundamental aim of qualitative research, regardless of methodology (Cassell & Symon, 2011). In other words, to determine "What's going on" with the behaviour or event being investigated (Moen & Middelthon, 2015). Qualitative researchers recognise that most human behavior is systematic, and that this systematicity may be observed and explained even in the most ordinary situations (Tetnowski & Damico, 2001). The qualitative researcher has a different method than the quantitative researcher in that it looks at human social action and tries to figure out how it works. Unlike experimental research, which uses statistical analyses to evaluate a theory, qualitative research does not use such testing (Thorne, 2000; Maxwell, 2008). Rather, qualitative research aims to comprehend the procedural aspects of the social phenomenon being studied; the emphasis is on how events unfold rather than the fact that they occur (Tetnowski & Damico, 2001).

4.3 Grounded Theory as a research design for the present study

Philosophical presumptions made by the researchers before they decide to conduct a qualitative investigation serve as the foundation of the research design process in this type of study. Additionally, researchers bring their own paradigms, sets of beliefs, and worldviews to the research project, which influence the way the qualitative study is conducted and written (Creswell & Poth, 2016).

The current study used Grounded Theory research design. Grounded Theory was originally developed by two sociologists, Barney Glaser and Anselm Strauss.

They stated that in order for new theories to develop, researchers needed a process that would let them get from facts to theory (Thornberg & Charmaz, 2014). The current study's researcher made the same decision as Glaser and Strauss to use this particular research design. Such theories would be specific to the setting in which they had been established. They wouldn't rely on analytic frameworks, categories, or variables from pre-existing theories but instead would be based in the data from which they had emerged. Therefore, the purpose of grounded theory was to create a framework in which new, contextualised theories might be developed (LaRossa, 2005).

Grounded theory is the process of gradually identifying and integrating categories of meaning from evidence, as described by Corbin and Strauss (1990). It is both the procedure (as a method) and the product (as a theory) of category identification and integration (2004). It serves as a tool for identifying categories, forming relationships between categories, and establishing interactions between them (LaRossa, 2005). The end outcome of this process is grounded theory as theory, which gives an explanatory framework for understanding the event under inquiry (El Hussein et al., 2014). To identify, clarify and incorporate categories, and eventually to develop theory, grounded theory researchers use a number of key strategies, including constant comparative analysis, theoretical sampling and theoretical coding (Bryant, 2009). The goal of grounded theory is to make inductive theory discovery possible. It enables the researcher to develop a theoretical framework for a topic's essential characteristics while also establishing the account's empirical support through observations or data (Martin & Turner, 1986).

Grounded theory, which was created forty years ago, is now one of the qualitative research techniques used in social science research the most frequently (Wiesche et al., 2017). The application of grounded theory to social processes and human interactions is advantageous to academics and practitioners (Hutchison et al., 2011; Skeat & Perry, 2008). Producing theoretical stances based on data is essential to grounded theory. In this way, the researcher concentrated on the "ground" of the data and deduced more abstract ideas (Strauss & Corbin, 1998).

To succeed in this, the researcher required to exhibit appropriateness, honesty, credibility, intuitiveness, receptivity, reciprocity, and sensitivity while being adaptable and receptive to constructive criticism. Which in practice is a "tedious" and drawn-out process that requires the researcher to be patient, aware, and smart; as a result, the researcher took a considerable amount of time to gather data and analyse it. Creativity, proximity to the respondents and their claims, immersion in the subject matter, and the capacity to understand events and statements are all necessary for this type of study. In exploratory studies, grounded theory is useful for data analysis (Cuban & Spiliopoulos, 2010), and selecting this research design was pertinent given that the primary goal of the current study was to examine the psychological resilience factors exhibited by subsistence farmers in the face of climate change adversity. In contrast to being glamourous, esoteric, or "grand," grounded theory research is pragmatic and practical, since it involves applying one's senses to a reality in order to gain knowledge about it, as well stated by Glaser and Strauss (1967). Grounded theory research, in contrast to much earlier research, does not seek to validate an existing theory by testing hypotheses. Instead, it functions more as an inductive mechanism for producing theory. The continual comparative method, which alternates data gathering and data analysis, is at the core of this approach.

The most common question is; “what do researchers do when carrying out grounded theory research?” They start by delineating a topic or situation of interest or concern about which they wish to generate theory. An interest that struck the researcher in the current study was; “how do subsistence farmers keep on farming although we are faced with climate change that results in extreme weathers (no rain and hot days)?” After defining the circumstance of interest for which a theory is to be developed, they look for an initial, suitable data collection method. One of the key qualities needed to construct grounded theory is open-mindedness (Gehrke & Parker, 1982). This research design was relevant for the current study as it allowed the researcher to explore and develop a model or theory to understand the psychological resilience factors associated with climate change adaptations by subsistence farmers in Maruleng Municipality.

4.3.1 Philosophical underpinnings of Grounded Theory

Ontology and epistemology are the two primary philosophical features that separate the various research paradigms now in use (Kalof & Dan, 2008; Wahyuni, 2012). They pertain, respectively, to the nature of knowledge and its advancement (Goertz & Mahoney, 2012). The perspective of how one experiences reality is called ontology. In terms of social research, one can conceptualize reality as being independent of social actors and their interpretations of it, known as objectivist or realist (Saunders et al., 2007). (Neuman, 2011). Contrarily, subjectivism holds that people are involved in social phenomena and that reality is dependent on social actors. The study of being, or ontology, asks fundamental questions about the nature of reality and how humans fit into it (Tuli, 2010). Whether reality exists outside from human awareness and experience, or whether reality just exists within our consciousness and through experience, is the eternal ontological question (Kivinen & Piiroinen, 2004). The question of whether things (reality) exist independently of our minds or if our universe is composed of our thoughts is one that is frequently raised.

For the purposes of this chapter, critical realism and relativist ontologies are presented as competing viewpoints. The ongoing debate among scholars over whether there is a single reality or a collection of realities is represented by these two points of view (Duncan et al., 2007). The two ontologies of relativism and realism are examined in this chapter. Critical realism's ontological viewpoint is that reality exists regardless of whether it can be understood or directly experienced by human intellect (Nouman, 2011). In this aspect of ontology, ontological existence does not require epistemological consciousness. Truth is arrived at by reasoning as opposed to observation alone because only the effects of causal forces can be perceived as opposed to the causal forces themselves (Creswell et al., 2007; Levers, 2013). Or, to put it another way, one need not observe an entity in order to determine its existence.

Relativist ontology, on the other hand, holds that reality is a finite subjective experience and that nothing exists outside of the researcher's thinking (Denzin & Lincoln, 2005). From a relativist standpoint, reality is identical to one's subjective experience of it (Denzin et al., 2005). Declaring that the two are indistinguishable is deceptive since it suggests that there are two entities to discern. According to this school of thinking, reality is human experience, and human experience is reality (Burr, 1998). This simply indicates that two persons are not experiencing the same external reality; rather, their worlds and experiences are distinct (Hendricks & KoroLjungberg, 2015). Diverse realities result from multiple interpretations of experiences. As there are many distinct persons, there are many different realities. According to a relativist ontology, which is supported by the current study's use of grounded theory, science's objective is to understand how people perceive reality and various truths.

The views about how to produce, comprehend, and use knowledge that are thought to be acceptable and valid are referred to as epistemology in the second paradigm. In addition to these two core ideologies, methodology is another key idea that influences how we examine reality (Guba & Lincoln, 1994).

It refers of a process model for conducting research inside a specific paradigm (Wahyuni, 2012). Epistemology, or the study of knowledge, is a technique to comprehend and justify how people acquire their knowledge (Chipangura et al., 2016). Ontological beliefs, in essence, constrain epistemological beliefs (Racher & Robinson, 2003), but there is epistemological latitude within ontological boundaries, in accordance with Denzin and Lincoln (2005). Additionally, epistemological inquiry examines the relationship between the knower and the knowledge and asks, "How does one know the world?" For instance, the idea that there is an universe distinct from awareness does not entail that there is meaning in the same sense (Scotland, 2012).

This chapter will discuss the two competing epistemological stances of objectivism and subjectivism. Objectivism is the belief that truth and meaning are contained within an object and are unaffected by human subjectivity, according to Mack (2010) and (Moon & Blackman, 2014). In order to perceive and comprehend events as they are outside of the human mind, those who profess objectivity frequently omit all contextual information (Weber, 2004). Knowledge discovery results from the elimination of human bias. Both what is being seen and what is being seen have no bearing on the observer (Levers, 2013). According to the above-mentioned critical realism ontology and objectivist epistemology, objects are believed to contain essences that exist irrespective of human influence and that these essences can be discovered by impartial observation (Proctor, 1998; Salmieri, 2016). Knowledge is applicable to everyone because the object's substance does not change depending on who is studying it. Discovering the essences that disclose natural, universal truth principles is the goal of science (Levers, 2013; Nicholls, 2009). Finally, from an epistemological perspective, the purpose of knowledge is most frequently utilised in quantitative research and is most often used to describe, anticipate, and control (Dieronitou, 2014; Grant & Giddings, 2002).

The concept of subjectivism, which is inconsistently used in the current study, holds that knowledge is perceived through the prisms of language, gender, social class, race, and ethnicity (Denzin & Lincoln, 2005). Subjective epistemology acknowledges the value of knowledge while not discounting the presence of an objective world. There is no ability to have unaffected and universal knowledge of an external reality beyond personal reflections and interpretations (Levers, 2013). Both the observed and the observer have an impact on the observations (Schwartz & Schwartz,1955). There is no such thing as a right or wrong reality; individual realities and experiences vary. Subjective research seeks to deepen comprehension, increase moral and ethical awareness, and advance both political and personal liberty (Denzin & Lincoln, 2005).

Finding a theory that describes a fundamental social process is the aim of traditional grounded theory. The conventional strategy became simply one among many as more scholars turned to grounded theory. Charmaz (2006) developed grounded theory from a constructionist perspective as the field of study shifted toward critical multiplism (Letourneau & Allen, 2006). Although Charmaz (2000) takes the position that there are "many social realities," she draws reference to the real world. With Charmaz's adoption of grounded theory, there is a move away from the researcher's objective attitude and an acknowledgement of the researcher's part in creating the data and theory, even though the essential inductive grounded theory procedures are still intact (Mohamed, 2015). The current study followed the interpretivist paradigm, specifically constructionism that is followed in Corbin and Strauss' approach of Grounded theory and ultimately Charmaz (2000). Charmaz's approach to grounded theory is founded on the awareness of mutual knowledge development by the spectator and the seen, according to Charmaz (2000).

According to research based on the constructionist paradigm, truth or meaning emerges from our interactions with the reality of our world (Lee, 2012). Charmaz (2006) indicates that the seen exists outside of the viewers mind and that meaning is contingent on, or related to, the interaction of the viewer and the viewed by separating the viewer and the viewed and accepting that meaning originates from the interplay of the two.

The "constructivist" method of grounded theory advocated by Charmaz is congruent with the constructionist worldview. The constructionist paradigm and the post-positivist paradigm each have different perspectives on how emergence is seen (Hall et al., 2013). On the other side, having a subjectivist epistemology means that the researcher understands she cannot fully understand the facts from a strictly objective position, therefore she starts to create a theory that will reduce the complexity of the data (Cunliffe, 2011). Even though the researcher was actively developing the theory, she was not a constituent element of the emergence process in the sense that she did not recognise a cosmos outside of her mind.

Although she serves as a gateway for the constituent elements to arise, she is not one of them (Levers, 2013). The researcher is both internal to the emergence and external to the data since they are related to one another through the researcher (Gasson, 2004 & Yilmaz, 2013). The researcher's interpretation of the data was influenced by the emerging theory, which in turn had an impact on how the researcher constructed the theory. All of this was influenced by the study's context and societal structures (Charmaz, 2006). To distinguish emergence under the constructivist paradigm, the researcher must develop a theory that reduces the complexity of the data, has a nonlinear relationship with the data, and is an autonomous entity. Furthermore, the researcher acknowledged that the interpretation of the data and the emergent theory were both greatly influenced by how the researcher viewed the data (Charmaz, 2000). The use of grounded theory as a research methodology in the present study was well suited to the constructivism paradigm.

4.3.2 Grounded Theory as a research method

Grounded theory is a technique that has been widely applied in a number of social science areas and has its roots in the work of Glaser and Strauss (1967). A grounded theory is one that has been found, developed, and tentatively supported through methodical evidence gathering and analysis related to a specific occurrence (Strauss & Corbin, 1990).

Grounded theory (Strauss & Corbin, 1998) was chosen among a wide range of alternative qualitative methods, but this decision was not made at random; rather, it was made because the method has long dominated social research (Charmaz & Thornberg, 2021) and that its use is expanding in the research community. The growing body of literature that is either discursive on philosophy and application or methodologically rigorous serves as evidence for this (Hughes & Jones, 2003; Urquhart, 2006).

The primary characteristic that sets grounded theory apart from other qualitative research methods is its focus on theory formation (Strauss & Corbin, 1998). Theory is considered to be grounded when it derives from and develops explanations of relationships and events that reflect the lived experiences of the people and processes the researcher is attempting to understand (Charmaz & Smith, 2003). It also differs from other qualitative techniques in that conventional qualitative approaches gather data both before and after the researchers leave the study location for the analysis (Charmaz & Belgrave, 2012). While conducting fieldwork, grounded theory, on the other hand, uses developing theoretical categories to guide data collection (data collection and analysis occur simultaneously).

The researcher might focus on how people create their environment from the beginning by analysing data from the research participants' actual experiences (Cassidy et al., 2011). Grounded theory is based on the idea that developing theory at many levels is essential for gaining a comprehensive knowledge of social processes (Glaser & Strauss, 1967). It is necessary that the researcher exhibits theoretical sensitivity by having a solid foundation in technical literature as well as from their own and their employer's data gathering and analysis experiences (Strauss & Corbin, 1990). It encourages researchers to expand their thinking beyond the bounds of technical literature and steer clear of conventional ways of considering the data (Glaser, 1978). When extending generalisations from the study, the interaction between emergent theory and technical literature is brought to the fore either by incorporating supplementary or opposing analysis into the theory by including them as categories or conditions, or by criticising them in light of what has emerged (Strauss, 1987).

The current study, which explored the psychological resilience elements connected to the adjustments to climate change made by subsistence farmers in Maruleng Municipality, was very well suited for grounded theory. It was helpful for understanding contextual elements, which were the main subject of this study (Urquhart, 2007). The time-consuming nature of grounded theory and the amount of cognitive effort it requires of the researcher are two practical issues with it (Lawrence & Tar, 2013). On the other hand, the researcher thought that using grounded theory is a good approach, particularly when working with large volumes of semi-structured qualitative data, like those used in the current study (Lawrence & Tar, 2013). It has been demonstrated that utilising this approach, grounded theory is a viable tool for simultaneously collecting and interpreting qualitative data. Grounded theory is unique in that it is a general methodology for developing theories based on facts that have been deliberately collected and examined (Turner, 1981). The theory develops throughout the course of the study as a result of the ongoing interaction between data collection and analysis, with data analysis directing further data collection (Charmaz & Belgrave, 2012).

According to Strauss and Corbin (1990), there are many levels of analysis. In order to convey the data without interpretation or abstraction, participants tell their own stories and use the field to develop a rich and convincing descriptive narrative. Data collection and analysis are conducted simultaneously, categories and analytical codes are developed from data, pre-existing conceptualisations should be limited (this is known as theoretical sensitivity), theoretical sampling is used to refine categories, abstract categories are constructed inductively, social processes are discovered in the data, analytical memos are used between coding and writing, and categories are integrated into the writing process are all key characteristics of grounded theory (Noble & Mitchell, 2016). A theory that is based on your data will be created if you use grounded theory and stick to this as your research methodology. The researcher will be able to look for and conceptualise the hidden social and collective patterns and constructions in your area of interest by using a research approach that adheres to precise rules for data analysis (Noble & Mitchell, 2016).

4.3 Methods

4.3.1 Setting

Figure 3.1 Map of Maruleng Municipality

Maruleng Local Municipality is located in the Mopani District Municipality of Limpopo province, South Africa. The seat of Maruleng Local Municipality is Hoedspruit. The area is 3 244 km² and has 14 wards. Agriculture currently is, and is likely to remain a key economic sector and employment generator in Maruleng. Maruleng dominant economic activity is commercial agriculture. The region is the leading producer and exporters of mango and one of the largest producers of citrus. Other crops such as vegetables are increasingly becoming important. Citrus and mango require significant production levels in order to be profitable and there are concerns that these are not viable options for subsistence farmers unless structured through cooperatives. Potential exists to introduce sugar cane which would provide alternatives for smaller emerging. The types of products grown in the area vary between subsistence and commercial farming, with the latter relying on irrigation to produce variety of crops namely: Field crops such as maize; Produce crops such as citrus, mango, vegetables, tomatoes, avocados and onions. There are other agricultural activities such as live stock which focuses on cattle, goats and poultry, and game farms and marula (Maruleng Municipality, 2021).

4.3.2 Population and theoretical sampling

Population

Maruleng's population is youthful, with Sepedi being the main language. The following analogy provides an overview of the important demographic indicators of the Maruleng Municipality. It covers the population size, age distribution, unemployment, income generation, educational levels and services backlogs. The socio-economic profile of the Municipality provides an indication of poverty levels of and development prospectus.

The reconciled total population of Maruleng Municipality is as follows: (Maruleng Municipality, 2021)

RURAL	URBAN	FARMING	TOTAL POPULATION
95,162	2,494	9,591	107,247
88,73%	2,32%	8,94%	100%

Estimated Population by Age and Gender: (Maruleng Municipality, 2021)

	0 – 4		5 – 14		15 – 34		35 – 65		over 65		TOTAL
	No	% **	No	%	No	%	No	%	No	%	No
MALE	5673	5.75	13663	13.86	16425	17.96	8264	8.38	1429	1.45	45456
FEMALE	5762	5.84	13575	13.74	19184	21.77	11407	8.02	3163	3.20	53094
TOTAL	11435	11,59	27238	27,63	35609	39.73	19671	16.40	4593	4,65	98550

The sample for the study comprised of 15 subsistence farmers who were both male and female. The inclusion criterion in the present study was any subsistence farmer that resided within Maruleng Municipality. As previously defined, subsistence farmers farm predominately for their own consumption or livelihood and not for profit. The sample was drawn from two (2) villages in Tzaneen Maruleng Municipality namely: Lorraine and Gavaza. These two villages were chosen because of the high number of subsistence farming households.

Theoretical sampling

Sampling is the act, process, or technique of choosing an appropriate sample, or a representative portion of a population, in order to ascertain the parameters or characteristics of the entire population (Mugo, 2002). This current study used theoretical sampling as advised by the current research design grounded theory. Theoretical sampling as the process of data collection directed by evolving theory rather than by predetermined population dimensions (Babchuk, 1996), is a pivotal strategy in grounded theory methodology (Draucker et al., 2007). The term "theoretical sampling" refers to the process of comparing a developing theory to the world around it by selecting instances that might contradict or clarify any emerging assertions. Theoretical sampling is concerned with the improvement and, eventually, saturation of existing, and more analytic, categories, whereas the earliest phases of grounded theory require maximum openness and flexibility to find a wide range of primarily descriptive categories (Bryant, 2009).

Theoretical sampling, according to Breckenridge and Jones (2009), takes place when the researcher jointly gathers, codes, and analyses their data and chooses which data to gather next and where to look for them in order to develop their theory as it develops. The researcher is guided in "all avenues which look relevant and work" once data have been collected and coding has started. Initial sample decisions are based on a general sociological perspective and a general problem (Davoudi et al., 2017). Glaser made suggestions for data collection methods involving theoretical sampling, such as remaining flexible by switching interviewing techniques, locations, or participants; following up on recurrent patterns in participant data; and requesting additional information from significant participants on categories that appear to be crucial to the developing theory (Charmaz & Belgrave, 2012). As a basis for comparison analysis, Glaser also suggested sampling for new categories when it seemed in the field that an existing category had reached saturation and putting down ideas that guide data collecting (Draucker et al., 2007).

The stages of open sampling, relational and variational sampling, and discriminating sampling are defined by Strauss and Corbin (1998) and directly correspond to their stages of open, axial, and selective coding (Breckenridge & Jones, 2009). Although Glaser and Strauss developed grounded theory, the researcher for the current study concentrated more on Strauss and Corbin while utilising parts of Glaser and Strauss' original research methods. A theory that is "grounded" in the data from which it was formed is what is meant by the term "grounded theory," which refers to a broad technique (Glaser, 2002). Sampling is therefore conceptually oriented; rather than being used to construct a descriptive account, it is intended to generate and advance conceptual theory. It is constantly guided by the developing theory, pursuing leads as they appear in the data and gradually concentrating data collecting to improve and integrate the theory (Glaser & Strauss, 1967).

Although grounded theory has changed since its inception, the original definition of theoretical sampling—which refers to the process of gathering data to generate theory in which the researcher simultaneously codes and analyses the data by choosing what data to gather next and from where in order to develop the theory as it emerges—has remained unchallenged (Glaser & Strauss, 1967). Theoretical sampling, according to Strauss and Corbin (1998), is a strategy for increasing opportunities to identify differences among concepts and to densify categories in terms of their characteristics and dimensions. In addition, Charmaz (2006), despite adopting a different epistemological perspective, has similarly described theoretical sampling as a way to concentrate data collecting and raise the analytical abstraction of theory by highlighting variance and revealing holes that need to be filled. However, after giving it some thought, it seems that although authors initially seem to define theoretical sampling similarly, their resemblance to traditional grounded theory is only superficial at best (Breckenridge & Jones, 2009).

Theoretical sampling is open-ended at the start of a study and becomes more defined as it goes along. The theoretical sampling is founded on the ideas that confirm their theoretical compatibility with the evolving theory. In reality, conceptual direction is the driving force behind theoretical sampling (Morse & Clark, 2019). Data samples concepts, and people offer data that educate us about concepts. By selecting additional participants and using the codes and concepts from earlier individuals when interviewing the following participants, theoretical sampling in the current study enabled the researcher transition from early codes to more abstract concepts (Conlon et al., 2020). Therefore, in theoretical sampling, researchers make reference to places, people, and circumstances that offer data regarding their chosen concepts. The significance of theoretical sampling was also made clear by research in novel and unknown territory. Theoretical sampling is a hallmark of grounded theory methodology, but there is limited advice available for researchers on how to use this procedure. It enables researchers to explore, uncover, and profit from unintentional happenings (Davoudi et al., 2017).

It has been discovered that while many researchers claim to utilise theoretical sampling to select additional participants, alter interview questions, or add data sources as a study develops, very few explain how the methodology is used in reaction to unexpected results (Draucker et al, 2007). The evolving theory is clearly the driving force behind theoretical sampling, which is also concerned with where to sample next and for what theoretical reason. But for inexperienced researchers starting a grounded theory study, the most pressing practical issue may be where to begin (Glaser, 1978). Evidently, starting someplace is necessary yet cannot be avoided. It is important to keep in mind that the beginning point is only that, and the researcher should refrain from drawing any conclusions about how much these originally sampled features would influence theoretical variation until conducting further study (Breckenridge & Jones, 2009).

The researcher overcame this dilemma/problem by purposively sampling the first 3 participants and allowed the data to guide them to the following participants and which questions to ask.

The saturation of categories requires theoretical sampling throughout the entire process (Strauss & Corbin, 1998). Grounded theory analysis involves periodic reevaluation of concepts, themes, and categories in order to reach saturation (Cuban & Spiliopoulos, 2010). Theoretical sampling increases data coverage and increases category saturation while reducing sample bias (Wiesche et al., 2017). The process of data collection and analysis in grounded theory need to go on until theoretical saturation is attained. In other terms, the researcher continues collecting samples and categorising data until no new categories form and new occurrences of variance for pre-existing categories stop happening (LaRossa, 2005). Between the beginning of axial and the beginnings of selective coding, the current study reached saturation. Axial coding was completed without any new categories appearing that link to one another or, more crucially, to the main category, resilience.

4.3.3 Data collection instrument

In qualitative research, there are many different ways to gather data, such as through observations, textual or visual analysis (from books or videos, for example), and individual or group interviews (Polkinghorne, 2005). However, focus groups and interviews are the most often employed techniques. Qualitative data are "most often" gathered by researchers through interviews and questionnaires, as also mentioned by Libarkin and Kurdziel (2002). However, interviews are more effective than questionnaires at eliciting narrative data, which enables researchers to examine people's perspectives in greater detail (Legard et al., 2003). In a similar context, Cohen et al. (2007) add that conducting interviews is an effective way to examine how meanings are constructed and negotiated in a natural environment.

That is, the value of interviews comes from allowing participants to talk in their own voices and express their own thoughts and feelings as well as from creating a holistic portrait, analysing words, and reporting in-depth views of informants (Lune & Berg, 2017). Additionally, interviews and other qualitative techniques to social science research differ from quantitative approaches in that the analysis of the resultant data can take participants' social lives into account (Alshenqeeti, 2014).

An interview is a method of gathering data that entails asking respondents spoken questions, either one-on-one or in a group (Carter & Henderson, 2005). The responses to the questions asked during an interview can be written down (during the interview or right away after the interview), recorded on tape, or a combination of the two. Different levels of flexibility can be used when conducting interviews (Chaleunvong, 2009). Grounded theory research data have been (and some argue must be) obtained by a combination of methodologies, including observation and documentary materials, even though interviews seem to be the most commonly reported approach (Egan, 2002). However, the semi-structured interviews used in this study were the method of choice. A semi-structured interview consists of a few core questions that help define the areas to be examined, but also gives the interviewer or interviewee the freedom to veer off topic to delve deeper into an idea or response.

This method's flexibility, especially when compared to structured interviews, allowed the researcher to uncover or elaborate on data that participants valued but that the research's objectives may not have initially considered to be relevant (Gill et al., 2008). The goal of the semi-structured interview is to elicit subjective reactions from people about a certain event or occurrence they have encountered. When there is enough objective knowledge about an experience or phenomena but insufficient subjective knowledge, this method may be utilised. It makes use of a very extensive interview guide or timetable (Brinkmann, 2014). The researcher is permitted to go deeper into any responses given in response to these open-ended questions by the participants.

The semi-structured component of this method is made up of this framework and the adaptability of the responses. Because of how relevant the issue is while still being responsive to the participant, it stands out among interview techniques (McIntosh & Morse, 2015).

The interview guide of the current study has a total of 3 core questions and 7 follow up questions (see Appendix 1(a)). The first part of the interview was reserved to short questions about personal information like (demographics): participant number, gender, language, occupation and type of farmer. Personal questions are followed by introductory questions and then specific ones. The interviewer asked direct and even projective questions regarding notions of climate change and adaptation, psychological resilience factors influencing the farmers' adaptation to climate change and coping strategies. Where the essence of the answer has not been fully understood, the question has been rephrased and participants were also asked to elaborate on their responses through the technique of probing (Izvercian et al., 2016). The participants were interviewed separately in Sepedi and Xitsonga, and the interviews were audio taped. Participants were interviewed at their places of residence (homes) and at times convenient to them. The interviews were later transcribed before they were translated by an independent language expert into English to ensure the accuracy and substance of the data. The translated interviews were back translated and verified for accuracy. (Evans & Lewis, 2018).

The data was collected on the psychological resilience factors associated with climate change adaptations on climate change in Maruleng Municipality.

The main questions that were asked to participants were:

- I would like you to explain, according to your understanding and experiences, what climate change is?
- Looking at the condition of climate change, what are the psychological implications of the current situation?

- May you explain to me the psychological resilience factors that help with your adaptation?

Participants in the semi-structured interview were given complete freedom to express themselves and to further the discussion on resilience and climate change. This is necessary for the interviewer (researcher) and interviewee to have a positive working relationship (participants). The events that the subsistence farmers described during the interview are the outcome of a significant emotional impact. Open-ended, direct verbal inquiries are used to generate in-depth narratives and anecdotes during the semi-structured interview, which is intended to be a private and intimate conversation (Aleandri & Russo, 2015). The interviewer's role was to gather information while encouraging the participants to speak and listen (DiCicco et al., 2006). Face-to-face interviews were acceptable for the current study since it was primarily concerned with gaining insight and understanding and because depth of meaning was significant. This approach depended on the interviewer's interpersonal abilities, including his or her capacity to build rapport. (Aleandri & Russo, 2015).

4.3.4 Data collection process

Rich descriptive information has to be gathered by qualitative researchers in order to draw inferences and understand concepts that are based on the data itself rather than on preexisting beliefs. The details tell the story, not generalities. An developing, adaptable framework is utilized in this (Brucel, 2007). The current researcher used prescriptive coding systems of open, axial, and selective coding as well as code counts when collecting and analyzing data at the same time. These methods are all included in grounded theory (Norman, 2015). In the current study, the researcher examined the psychological resilience factors of 15 subsistence farmers, but the main goal of the study was to understand qualitatively the experiences of subsistence farmers and explore the factors influencing resilience in climate change adversity and why.

Of the fifteen (15) subsistence farmers (ages range = 30 to 65 years); 87% of them were Sepedi-speaking and 13% were Xitsonga speaking. 47% of the participants were male and 53% were female. The participants were from two villages in Tzaneen: Maruleng Municipality in Limpopo province (South Africa). These two villages were chosen for a higher incidences of subsistence farmers compared to neighbouring villages.

Four objectives drove the farmers' resilience study. They were:

- To investigate subsistence farmers' notions of climate change and adaptation.
- To determine the psychological resilience factors influencing the farmers' adaptation the climate change.
- To determine strategies that the farmers use to cope with climate change.
- Based on the farmers' notions of climate change and adaptation, and the associated resilience factors, develop a psychological explanatory model on climate change adaptation by subsistence farmers.

The simple event of one-to-one face interviews was used in the current study. All the interviews were done in person with the time and place convenient to the participants using Sepedi. The last three participants were Xitsonga speaking. The length of the interviews was usually in the 30- to 40-minute range, although two went over an hour, and a few were less than 30 minutes. With the participants' consent, the interviews were audio-taped in order to provide a reliable account of the conversation that could be replayed for analytical purposes. Anonymity was maintained throughout the recording process. Before the session began, participants were also reminded of their right to leave the study or end the interview at any moment.

The interview data was transcribed and analysed through coding and constant comparison process, keeping in view the constructivist grounded theory approach.

The main questions that were asked to participants were:

- I would like you to explain, according to your understanding and experiences, what climate change is?
- Looking at the condition of climate change, what are the psychological implications of the current situation?
- May you explain to me the psychological resilience factors that help with your adaptation?

Memo writing begins with the first interview and continues throughout the research process. They have a dual purpose: they ground the research while also keeping the researcher attentive. Memos allow for the generation and development of explanations for emerging concepts, as well as the identification of some of the interrelationships that exist between them. Lawrence and Tar (Lawrence & Tar, 2013). This is a crucial aspect of the grounded theory approach. Memos will also reveal shifts in the analytic process and developing viewpoints, as well as reflections on the research question's suitability. As a result, memos give information regarding both the research process and the study's substantive conclusions (Glaser & Strauss, 2011).

The researcher was able to collect in-depth data through the use of semi-structured interviews and memo-writing. There were initially two data collection phases for the study, however theoretical saturation was met before the second phase of data collection could commence. Two forms of data collection documents which were used were consent forms to be signed by participants and the interview guide which was used by the researcher.

This chapter discusses the interview guide and the quality criteria section, which make the data collecting procedures clear to the reader and satisfy the requirements of transferability and dependability proposed by Yardley (2008) and May and Pope (2020). So the next researcher might either (a) consider using a similar implementation sequence in another research setting or (b) use the tables as an example of reliable reporting practices, the collection methods are detailed in sufficient depth so that the reader can check the process.

4.3.5 Data collection and analysis as an interrelated process

The data analysis process in qualitative research involves working with data, organising it, decomposing it, synthesising it, detecting patterns, selecting what is crucial and what may be learned, and deciding what you will say to others (Taylor, 2014). Analysis, according to Lawrence and Tar (2013), is the rigorous evaluation of something to ascertain its constituent parts, their connections, and its relationship to the whole. Data analysis is a three-step process, according to Miles and Huberman (1994), whereas data reduction is the process of choosing, streamlining, abstracting, and transforming new case data. The brilliance of this work lies in its ability to provide detailed descriptions and interpretations of social life. At both the individual and communal levels, the challenge is working with vast amounts of empirical data as texts with various interpretations (Walker & Myrick, 2006). Qualitative data analysis is to organise and distill the information acquired into themes or essences that can then be used to create descriptions, models, or theories. In qualitative research, one method of investigating data bits and looking for patterns and contrasts within these bits to categorise and label the data is coding (Patton, 2002; Tutty et al., 1996; Walker & Myrick, 2006).

Data analysis in Grounded theory takes place concurrently with data collection (Hunter et al., 2011). The analysis began as soon as the first bit of data was collected. Here, analysis was necessary at the onset of the study because it directed the next interviews and observations (Wuest, 2012).

Instead of waiting until all the data had been collected before starting to analyse it, the researcher collected and analysed the data at the same time so that the results would inform future data collecting. This procedure required the researcher to gather data throughout the day and analyse it at night in order to have a sense of direction for the next participant the following day, which made data collecting particularly taxing for the researcher. Data collection and analysis must be related in order for grounded theory to work, hence the constant comparative approach was applied (Corbin & Strauss, 1990).

As the primary researcher, the researcher carried out the analysis. To use this technique, the researcher compared responses throughout the study to "create analytical distinctions," and she started data analysis after speaking with the first participant and continued after speaking with each additional participant (Tsonis et al., 2012). Constant comparative analysis comprises the "systematic selection and study of many comparison groups" and is an iterative process of concurrent data collecting and analysis (Glaser & Strauss, 1967).Comparative analysis was done to obtain accuracy of evidence in the conceptual category and to establish the generality of a fact.

To conduct data analysis, the researcher followed the following procedures by Strauss and Corbin (1990) below:

Step 1: Open coding (comparing incidents applicable to each category)

For both Glaser (1992) and Strauss, the first step in the coding process is known as "open coding" (Strauss & Corbin, 1990). According to Strauss and Corbin, it is only the first of the three phases. According to Glaser, the initial stage in comparison analysis is open coding (Walker & Myrick, 2006). It is "the interpretive procedure through which data are analytically broken down" (Corbin & Strauss, 1990). Open coding involves categorising the concepts associated with an incident, assigning conceptual labels to it, and comparing it to other incidents in terms of similarities and differences (Cho & Lee, 2014).

Line-by-line coding was used to apply open coding, which made it possible for the analysis to closely match the data and prevented the researcher from applying pre-existing assumptions to the data. For example, one participant stated, “my father was a farmer, he taught me how to farm.” This was labeled as passion for farming. Once concepts were labeled, they were grouped to form categories (Strauss & Corbin, 1990).

For instance, a broad idea called "passion for farming" was created by grouping codes like "born into farming" and "love for farming" as the reasons people continue farming in the face of climate change difficulty. The researcher identified new areas of inquiry by labeling the text of each interview during open coding, which then directed further data collection efforts (Glaser, 1992). Numerous codes were produced using open coding. Open coding and the writing of theoretical memoranda began practically simultaneously. Since memos are the theorising write-up of ideas about codes and their relationships as they strike the analyst while coding (Fernández, 2004), memos are produced continuously in grounded theory, from the beginning of the analysis process until reaching closure. This allows analysts to be recorded as they work because memos capture analysts' thoughts as they move through the work.

Step 2: Axial coding (integrating categories)

Axial coding is the second phase of Strauss and Corbin's (1990) three-phase methodology. In Glaser's version, it is absent, whereas in Strauss' it is a vital phase. Investigating the relationships between categories is done via axial coding (Cho & Lee, 2014). The researcher attempts to understand how categories and their subcategories relate to one another during axial coding (Walker & Myrick, 2006). Axial coding's objective is to reassemble fragmented data in creative ways by "building linkages between a category and its subcategory" (Strauss & Corbin, 1990).

This is achieved by using a coding paradigm that focuses on three elements of the phenomenon: the circumstances or contexts in which it occurs; the responses or interactions of individuals to the circumstances; and the results or effects of the responses or interactions, whether taken or not (Strauss & Corbin, 1998). As more codes and notes accumulated, the researcher began to recognise connections among them. By developing hypotheses for incorporation into a theory, this method conceptualised the interaction of substantive codes. Because of the fragmentation of open coding, theoretical codes and theoretical notes evolved, creating a new narrative (Fernández, 2004). The grounded integration of ideas is a flexible process that offers comprehensive images and fresh viewpoints. Theoretical codes cannot be empty abstractions, no matter how adaptable they are. The idea of flexibility involves theoretical sensitivity to several different coding paradigms, or coding families, while purposefully avoiding over-focusing on one explanation (Glaser, 1992).

Step 3: Selective coding (delimiting the theory)

The analyst's final responsibility is to integrate the data around a central theme, hypothesis, or tale in order to develop a theory. Glaser's (1992) integration is achieved using theoretical coding, which could be compared to axial coding (Walker & Myrick, 2006). Selective coding involves selecting one category as the core category and linking it to all other categories (Vollstedt & Rezat, 2019). The core category serves as the focal point around which all other categories in grounded theory are integrated (i.e., it describes how the primary issue is addressed or processed) (Strauss & Corbin, 1990). When pondering the questions, "What seems to be the purpose of all this action/interaction? ", "What is the analytical key notion that this study presents? The formation of a pattern, in this study's example the "passion for farming," signaled the start of selective coding (Corbin & Strauss, 1990). One of the many fundamental social phenomena or conditions found in the data was the subject of the study. Cost-effective theory is strengthened by limiting the investigation to significant categories that have an impact on the core category (Glaser & Strauss, 1967).

The existing literature plays a crucial role at this point in the process since researchers need to develop their awareness of and familiarity with grounded concepts. Therefore, the literature is viewed as a source of additional data that may be compared to already-existing grounded data. The impact of climate change, psychological resilience and climate change, coping mechanisms, climate change and culture, and management of climate change, for instance, elevated the theoretical level and enhanced construct definitions in the current study, as stated by (Eisenhardt, 1989). When the primary research question was taken into account, the researcher hit theoretical saturation, and further sampling failed to significantly advance the study by introducing new categories or features (Fernández, 2004).

4.3.6 The process of building Grounded Theory

Grounded "theory" is derived inductively from the study of the phenomenon it represents. That phenomenon was specifically established, discovered, and tentatively verified utilizing a methodical data collection and analysis approach. The three fields of data gathering, analysis, and theory should therefore complement one another. You don't develop a theory first, then provide evidence to support it. Instead, one should choose a topic of study and then let material relevant to that field to bubble to the surface (Strauss & Corbin, 1990). Grounded theory is the process for developing inductive theories. It includes guidelines and practices that outline how to create a theory from scratch. In order to create a more comprehensive set of "codes" by which the raw data might be categorized, the researcher went through the raw data numerous times (Sarker et al., 2000). Finally, these codes offer the vocabulary that will be used to develop the theory. The entire goal is to develop theory from unprocessed data in a methodical and verifiable way, as well as to observe how codes and categories actually arise and connect in the researcher's head as they work with the data.

The researcher will next contrast participant data with already-established ideas. As a result, the researcher will be better able to define and develop areas of relevance in the vast amount of data (Thornberg et a., 2014). The researcher then incorporates the categories or hypotheses that have been put out. Concepts emerge during data analysis, assisting the researcher in recognising and comprehending human experience and behavior. After conducting analysis, this allows the researcher to develop a theory, which in turn aids in understanding which literature to evaluate and compare (Strauss & Corbin, 1998). The occurrences, events, happenings are taken as, or evaluated as, potential markers of phenomena, which are then given conceptual names. In essence, theories cannot be developed with real incidences or activities as witnessed or recorded; that is, from "raw data" (Pandit, 1996).

For instance, if a participant tells the researcher that "Farming is what I know and I have to farm to put food on the table for my kids," the researcher might label this phenomenon as "livelihood." As the participant encounters other incidents, and when these appear to resemble the first incident after comparison, they will be labeled as "economic resilience." Grounded theory's inductive, contextual, and process-based features are its main benefits (Charmaz, 2006; Strauss & Corbin, 1990). For interpretive researchers, these qualities prove to be especially helpful. Grounded theory is not, however, a methodology that should only be used by interpretive researchers. According to Urquhart and Fernández (2006), it is a neutral analytical procedure that works well with either the positivist or interpretive approach.

Researchers engage in their prior knowledge, whether it comes from their prior experiences or the body of extant literature. It helps them develop a theoretical framework for how they will approach the topic they will be studying (Eisenhardt, 1989). Although some researchers might mistakenly believe that using grounded theory necessitates conducting fieldwork before reading the literature, this is a significant misinterpretation of the methodology (Urquhart, 2007).

The literature review informs the researchers' ideas and assists them in producing a preliminary theoretical framework that should be regarded as a "sensitising device," only which could be modified according to the actual findings; that could result in a serendipitous discovery. The literature review should not force the researchers to simply impose previous theories when analysing the data instead of generating original categories (Andrade, 2009). As previously mentioned, inductive research involved the building of inductive theories, in which the researcher first observed facets of social life before looking for patterns that would imply generally universal principles (Timmermans & Tavory, 2012). Using a set of actual findings as a starting point, the inductive technique then looked for patterns in those observations to theorire about. Along with the coding process, categorisation and conceptualisation were also used. The goal of analysis at this point was to abstract the information while also further reducing the original source material. The researcher was able to organise themes and codes by grouping them into categories and creating conceptualisations for them (Vaismoradi et al., 2016).

In order to accomplish this, the researcher must contextualise (thickly describe) their findings, take into account a larger context within which they make sense, compare them to theories and other findings discussed in the pertinent and existing literature, compare subgroups, observing whether explanations vary depending on the individuals involved, link and relate categories among themselves (generally following the criterion of grouping them according to similar characteristics), and use typology (Bazeley, 2009 & Bendassolli, 2013). Outliers, or units of empirical data that do not fit the hypothesis being developed, were also discussed by the researcher.

4.4 Quality criteria

The most common criticisms of qualitative research are that it is merely an ensemble of anecdotes and personal impressions, highly susceptible to researcher bias; second, that it lacks reproducibility because the research is so individualized to the researcher that there is no assurance that a different researcher would not draw radically different conclusions; and third, that it lacks generalizability (Gasson, 2004). The researcher of the current study provides recommendations for future research as well as quality criterion measures to address each of these complaints. According to some, qualitative approaches frequently produce a significant amount of in-depth data regarding a limited number of settings (Mays & Pope, 1995). Assuring the current study's quality through quality standards is one method available within qualitative research to guard against bias and improve the dependability of findings. This method is detailed at the end of this chapter.

As educational researchers attempt to address complex "improvement" issues and the larger education community demands assurances of credibility (that the study has internal reliability), transferability (that rich descriptions of data collection and analysis methods allow for potential application in other contexts), and dependability, the call for transparency and clarity for qualitative research methods (Creswell, 2002) has become more focused and urgent (that a clear audit trail is articulated for inspection by the reader). To satisfy these requirements for clarity and openness of procedures, thorough documentation and illustration are required (Bruce, 2007). For the current study, the researcher has addressed the request to lessen the marginalisation of qualitative research by taking the following actions:

4.4.1 Credibility

To enable the identification and validation of recurrent patterns, this requires sufficient immersion in the study environment. As a result, spending a significant amount of time with informants enables the researcher to evaluate viewpoints and gives the informants a chance to get to know the researcher.

The significance of active engagement in research discoveries is enhanced by close familiarity and the identification of hidden information (Krefting, 1991). By spending one month and three weeks with the study participants in order to gather pertinent data for the study, the researcher in the current study ensured the validity of the results. Although there were limits and guidelines established, the semi-structured interview guide allowed the researcher to ask many probing questions to elicit deep insight and recurrent themes from the participants. First and foremost, finding participants was crucial to the validity of the research findings. The researcher included both male and female subsistence farmers, people of various ages, and both livestock and vegetable growers despite the fact that participants agreed to be interviewed.

When it came to recruiting units for the study, the most variance was desired (White et al., 2012). Because of the study's geographical scope, interviews with diverse subsistence farmers were conducted at the same time, depending on their work schedules. Because of the ambiguity concerning data saturation, the researcher was afraid that this method would result in more interviews being done. Daily talks and preliminary analysis, however, indicated that, while similar aspects existed, data saturation had not been reached. The absence of theory saturation until later in the trial, as well as the variety in units and desired variability in participants, all contributed to the recruitment of additional people for the study (Brod et al., 2009). Secondly, for the research results to be credible, data collecting has to be consistent. The semistructured interview questions focused on components of the overarching study topics that led the interview process with the subsistence farmers, and they were done in two villages (Sandelowski, 2000; 2010).

4.4.2 Transferability

Transferability refers to when the research findings can fit into contexts outside the study situation and when its audience views its findings as meaningful and applicable in terms of their own experiences (El Hussein et al., 2015; Shenton, 2004). To facilitate transferability in the current study the researcher gave a clear description of the context, selection and characteristics of participants, data collection and process of analysis.

Enough information was provided for the reader to judge the applicability of the findings to their context. Data processing and cleaning involved consistency between audio files and transcriptions. The current researcher utilised a hardcopy book with notes form memo-writing and the data analysis steps for qualitative data storage, indexing, and theorising. The researcher double-checked the transcripts and compared them to audio files to ensure that they were accurate. Following the researcher's assessment, minor differences in the transcripts were discovered, such as spelling errors and acronym clarification.

The data analysis portion of the study required extensive, time-consuming, and multi-focused preparation. In data analysis, a staged approach was adopted (Binder & Edwards, 2010; O'Connor & Joffe, 2020), with coding and preliminary analysis completed before in-depth analysis. The categories and codes identified were not deemed static, as is typical of qualitative approaches. The framework and organisation went through several changes, especially during the researcher's early stages of coding and analysis (Bauer & Gaskell, 2000; Crofts & Bisman, 2010). The semantic links between resilience and climate change were given special consideration when creating the evolving theory. In order to account for coding disputes, a reference document was created that defines each code and shows where it falls in the conceptual structure's hierarchy. Multiple coders' analysis of the data set was made more reliable thanks to this procedure. An audit trail was created by maintaining records of the modifications and their justification (Lincoln & Guba, 1985).

4.4.3 Conformability

This refers to the situation in which the evidence produced and the researcher's interpretations of the data are internally consistent, and the study findings, conclusions, and recommendations are all supported by the data gathered (Brink et al., 2012). When reliability, transferability, and trustworthiness are attained, conformity is established. This was accomplished by safeguarding all data and making sure that the findings, conclusions, and recommendations were backed up by relevant literature.

Three crucial procedures like creating an audit trail, conducting an internal audit, and writing the final research report were used to assure the validity of study data (Johnson & Waterfield, 2004; Lincoln & Guba, 1981). An audit trail was used to undertake a thorough accounting of all data collection and analysis processes. As changes were made, they were reported along with the reasons for them (Ang et al., 2016). Professionals in qualitative research advocated keeping accurate records of the procedures followed by researchers in the study for data collection and analysis (Sandelowski, 2000).

Audit trails allowed the researcher to engage in reflective reasoning (on the concepts or categories selected, interpretations), as well as gave the reader a solid methodological reference as the investigation went on (Johnson & Waterfield, 2004; Ruona, 2005). Although grounded theory analysis starts with the first interview, internal audits of coding and comparison for the study were carried out at three different points (after 5, 10, and 15 interviews were coded) during the analysis of the study. These audits aimed to confirm inter-rater reliability as well as connections and interconnections between the main concepts and categories of the researcher. The final research report was written in a way that allowed for independent verification of the study's findings. The final research report was written in a way that made it possible to independently verify the research results. The article highlighted the study's shortcomings and made obvious comparisons between the study's findings and the participants' actual experiences (Guba, 1981). The study's limitations were also discussed, and participant quotes were used to emphasize ideas learned during the investigation.

4.4.4 Trustworthiness

In the present study the researcher engaged with the analysis as a faithful witness to the accounts in the data as guided by the grounded theory design. The researcher engaged herself in the facts, being forthright and cautious about her own viewpoint, prior views, and preexisting preconceptions (Gearing, 2004; Tufford & Newman, 2012).

In order to achieve the analytical goal of listening to the participant accounts with an open mind, grounded theory researchers engage in the self-reflective process of "bracketing," in which they acknowledge and set aside (but do not reject) their prior knowledge and assumptions (Gearing, 2004; Starks et al., 2007). The researcher followed the recommendations listed above to ensure reliability. To assure the reliability of the data, the current investigation faced a number of difficulties. These difficulties included gathering data from various participants, analying the data following each interview, coding the data and doing ongoing comparisons, as well as conducting a comprehensive in-depth examination of the data. Despite the difficulties in organising this qualitative data set, the researcher was able to present research findings that complied with the standards for reliable data.

4.5 Ethical considerations

4.5.1 Permission to conduct the study

Ethical clearance for the present study was obtained from the University of Limpopo's Research and Ethics Committee (see Appendix 4: Turfloop Research Ethics Committee Clearance Certificate). In addition to obtaining ethical clearance, the researcher also obtained gatekeeper's permission from the local tribal authorities in Maruleng Municipality in order to gain access and interview the subsistence farmers who participated in the study.

4.5.2 Informed consent

Respondents should give their informed consent in order to participate. In order to comply with the principle of informed consent, researchers must provide participants with enough information and assurances regarding their participation so they may understand the potential consequences and freely decide whether or not to participate, free from undue pressure or coercion. No one should ever feel pressured into taking part in a study (Tyldum, 2012).

This includes any form of deception or persuasion used to win someone's trust. According to informed consent, a person must expressly consent to participating in the study (Gupta, 2013). A consent form can be thought of as a contract of confidence between the participant and the researcher. In order to get permission, the following conditions must be met: it must be freely offered (voluntary), individuals must understand the request, and those engaged must be of legal age to give their consent. This indicates that in order to participate in a research study, a participant must be sufficiently informed about the research, understand the material, and have the freedom to choose whether to participate or not (Orb, et al., 2001)

Only after a comprehensive description of the research method was given to the participant did the participant consent to take part in the study (Arifin, 2018). Heron and Reason (1997) assert that study subjects have a right to complete disclosure of the rationale, objectives, and goals of an investigation. The present study's participants were made aware of the procedures that would be followed and what would happen to the acquired data. In accordance with this ethical guideline, the researcher presented the relevance, objective, and goal of the study before beginning it (see Appendix 2(a): Informed consent letter – English version, and Appendix 2(b): Informed consent letter – Sepedi version). After explaining the purpose of the research, the participants were given a consent form that was explained before it could be signed by both the participants and the researcher (See Appendix 3(a): Informed consent form – English version, and Appendix 3(b): Informed consent form – Sepedi version). All participants signed and provided a written informed consent.

The study's purposes and the procedure for gathering data were explained to each potential participant individually. They were given enough time to speak with everyone with questions or concerns. They were informed that because participation in the study was optional and that they could opt out at any time without affecting their care or ability to work at the relevant clinic.

4.5.3 Respect and dignity

The use of offensive, discriminatory, or other unacceptable language needs to be avoided in the formulation of questionnaire, Interview or focus group questions (Walton et al., 2013). The researcher ensured that research was commissioned and conducted with respect for, and awareness of, gender differences. The researcher also made sure that they acknowledge and take into consideration all groups in society, regardless of age, religion and culture.

4.5.4 Anonymity and confidentiality

The respondents' right to privacy and anonymity is crucial. Respect must be shown for the privacy of the data provided by study participants and the anonymity of respondents (Grinyer, 2002). Confidentiality can, however, occasionally be restricted. For instance, if a participant is in danger of being harmed, they must be safeguarded. Possibly requiring the disclosure of private information. Respect for the dignity and loyalty is directly related to the issue of confidentiality and anonymity (Fouka & Mantzorou, 2011). When the subject's identity cannot be connected to their personal comments, anonymity is safeguarded. In the event where anonymity cannot be guaranteed, the researcher must address confidentiality, which is the handling of personal data by the researcher in order to safeguard the subject's identity (Wiles et al., 2008).

Confidentiality refers to the freedom for people to disclose and withhold any information they choose to the person of their choice. The researcher has an extra-large duty of devotion to uphold confidentiality (Baez, 2002). The psychological and social effects that a violation of confidentiality may have on individuals must constantly be considered by researchers. Participants must be informed of their rights and all coding schemes that they deem appropriate in each circumstance in order to protect them (King, 2010). By assuring them that neither their real names nor their identities would be exposed in the research report, the researcher protected the participants' anonymity. It was urged to the participants not to use their true names when collecting the data.

4.5.5 Benefits and risks

The researcher informed the participants that there will be no immediate or direct benefit of the study to them. However, the study will benefit the community and eventually the world in the future from the knowledge gained from the participants.

4.5.6 Protection from harm and aftercare of participants

Researchers must take all reasonable precautions to safeguard study participants. A researcher must take into account all feasible study outcomes and balance risks and benefits in a reasonable ratio (Aluwihare-Samaranayake, 2012). The participants' value system, which values various harms, must also be evaluated, as well as the type, degree, and quantity of potential dangers (Emanuel et al., 2000). Finding the risk factors is the only way to attain the risk-benefit ratio. The trial should be changed if the dangers outweigh the benefits. Despite the researcher's best efforts, there is a chance that their interactions with the subjects could unintentionally hurt them (Kaplan et al., 2020).

According to O'Dea (2005) and Polonsky & Waller (2011), examples of this include psychological harm, financial harm, and social harm. When designing the study, it is the researcher's duty to take any potential harm into account and to make sure that appropriate safeguards are put in place to prevent it. Therefore, it is imperative that the researcher carefully consider the potential harm and make sure they (a) behave in accordance with appropriate ethical standards; (b) take into account how the research might negatively affect participants; and (c) protect the researcher, study supervisors, and the institution from being put in situations where people could make claims of inappropriate behavior, leading to public criticism or suspension (Becker-Blease & Freyd, 2006). Debriefing at the conclusion of a study should also be discussed. Debriefing is the process of describing the precise goal of the study and the limitations of the disclosure. Subjects should feel at ease and share their emotions as much as possible (Fouka & Mantzorou, 2011). Burns and Grove (2005) also recommend debriefing the subjects or, if required, referring them to professional care if they felt a lot of distress during the experiment.

The participants in the current study suffered no harm of any kind. The participant-friendly and secure location where the interviews were conducted was chosen by the researcher. The inquiries were made in a respectful and sympathetic way. At the end of the interview, the participants received a debriefing. The researcher must be considerate of the psychological welfare of subjects who can have negative emotional reactions as a result of participating in a study as part of good ethical conduct. The researcher also saw to the participants' psychological health by directing those who displayed negative emotional responses to psychologists and social workers at the nearby hospital for counseling. However, none of the study's participants required psychological counseling.

4.5.7 Data management

When conducting qualitative research, the researchers will also need to triangulate a variety of data to create solid proof that the phenomenon they are examining actually exists (Charmaz, 2006). Managing and analyzing qualitative data can be challenging, especially for inexperienced researchers who have a propensity to view their data from a singular viewpoint. However, there is never a lack of meanings in qualitative data (Ishak & Bakar, 2021). It is complex, abundant in natural beauty, unstructured, and occasionally overpowering because the researcher is given access to material that is outside the purview of the study. According to Bazeley (2009), if qualitative data are managed effectively, they can result in insightful findings. The data needed to be cleaned, divided into smaller meaningful pieces which then are simultaneously arranged into specific themes before it can be used for any kind of analysis (Miles & Huberman, 1994). (Miles & Huberman, 1994). The researcher undertook both data management and analysis on her own. First, the researcher created the interview guide document, which served as the tool for gathering data. Second, for better discussion, the researcher in the current study organized all the data in a folder, including all the literatures read both before and during the study.

Both interview audios and transcribed interviews were also manage and stored in a folder, together with the filed notes taken during memo-writing. This helped the researcher to go back and forth during analysis for verifications, the data analysis process was also documented and saved in a folder.

4.6 Concluding remarks

This chapter outlined quantitative and qualitative as two research approaches mostly used in conducting a scientific research. Qualitative approach was discussed as an approach of choice for the current studyThe philosophical foundations for using grounded theory as a research method and as a study design were also discussed. The processes in the research method were detailed, as well as the quality standards used in the study. The chapter concludes with a discussion of the ethical problems that influenced the researcher's decision to perform this study.

CHAPTER 5
PRESENTATION OF RESULTS

5.1 Introduction

This chapter will discuss the findings of this study which will include the demographic information of the participants and the codes, categories and the theory which emerged from the analysis. The demographic information of the participants is presented in the form of a table (see Table 1) and a narrative that describes the pertinent characteristics of the participants. The phenomenological accounts of the participants are presented in the form of objectives, and these include: a) To investigate subsistence farmers' notions of climate change and adaptation, b) To determine the psychological resilience factors influencing the farmers' adaptation the climate change, c) To determine strategies that the farmers use to cope with climate change, and ultimately d) Based on the farmers' notions of climate change and adaptation, and the associated resilience factors, develop a psychological explanatory model on climate change adaptation by subsistence farmers. From the concepts and categories, a model was created (see Diagram 1). This chapter will be concluded by a summary of the findings.

5.2 Participants and setting

The sample for the study comprised a convenience sample of fifteen (15) subsistence farmers (ages range = 30 to 65 years); the participants were reluctant to give their exact ages. The sample was drawn from two villages in Tzaneen: Maruleng Municipality in Limpopo province (South Africa). These two villages were chosen for a higher incidences of subsistence farmers compared to neighbouring villages. Most of the subsistence farmers relied on (80%) government grants and 20% on pension funds for survival. 87% of the participants were Sepedi-speaking and 13% were Xitsonga speaking. 47% of the participants were male and 53% were female, (see Table 1).

5.2.1 Demographic information of participants

Table 1

Participant NO	Gender	Language	Occupation	Residential Area	Type of Farmer
1	Male	Sepedi	Unemployed	Tzaneen	Subsistence Farmer
2	Male	Sepedi	Unemployed	Tzaneen	Subsistence Farmer
3	Male	Sepedi	Unemployed	Tzaneen	Subsistence Farmer
4	Male	Sepedi	Unemployed	Tzaneen	Subsistence Farmer
5	Male	Sepedi	Self-employed	Tzaneen	Subsistence Farmer
6	Female	Sepedi	Pensioner	Tzaneen	Subsistence Farmer
7	Male	Sepedi	Pensioner	Tzaneen	Subsistence Farmer
8	Male	Sepedi	Pensioner	Tzaneen	Subsistence Farmer
9	Female	Sepedi	Unemployed	Tzaneen	Subsistence Farmer
10	Female	Sepedi	Unemployed	Tzaneen	Subsistence Farmer
11	Female	Sepedi	Unemployed	Tzaneen	Subsistence Farmer
12	Female	Sepedi	Unemployed	Tzaneen	Subsistence Farmer
13	Female	Sepedi	Unemployed	Tzaneen	Subsistence Farmer
14	Female	Xitsonga	Unemployed	Tzaneen	Subsistence Farmer
15	Female	Xitsonga	Unemployed	Tzaneen	Subsistence Farmer

5.3 Role and biases of the researcher

One researcher was involved in this study. The research group consisted of myself, a PhD student (Kgopa, B), one main supervisor (Sodi, T) who oversaw the entire process and two co-supervisors who assisted in guiding the progress of my PhD thesis (Burman C, & Ayisi, K). An important concern with qualitative studies is the role of the researcher in relation to the participants of the research. The researcher focused mostly on the Straussian approach of Grounded theory which calls for a researcher to actively be engaged with participants as compared to the classic Glassian approach which calls for an independent relationship (Corbin & Strauss, 2008). Therefore, the researcher, for effectiveness, should be aware of their own biases and should take steps to mitigate them and should weigh the advantages and disadvantages in making use of an initial literature review.

It is important that I should acknowledge at the beginning the existence of my biases for my reading of the study area and my experience as a Psychology graduate and Lecturer. However, my biases were also limited at the onset given that the study area for my study was somewhat new as it included the areas of the natural sciences like subsistence farmers and climate change adaptations. This forced me to do an extensive reading on climate change adaptations and subsistence farmers. Although that was a new study area for me, moving from mental health to Environmental and Conservation Psychology, the challenge for me as a researcher was to avoid bias due to my experience as a Psychology graduate and Lecturer who recognises resilience factors on a daily basis and also my reading in the study area of resilience in relation to climate change. Glaser and Strauss (1967) suggested that the researcher should not allow a predetermined hypothesis to guide the research process.

Because "it is completely impossible to go to the field with no ideas at all" of either common or uncommon experience, the researcher minimised biases by following Corbin and Strauss (2008), who addressed the situation in which the researcher and participants "share a common culture" and asked, "Why not use my experience to good use?" because "it is completely impossible to go to the field with no ideas at all" of either common or uncommon experience. They proposed that the researcher's experience or ideas be utilised to "bring up various possibilities of meaning" or suggest "a different perspective or something new to think about that will push us to confront our assumptions about specific data. The key was to let the researcher's experience or ideas inform the research at a conceptual level rather than at the level of raw data (Pandit, 1996). Therefore the researcher used their experience and knowledge of the study area to give better-suited meaning to the responses from participants and help to help them understand the subject matter of the current study; climate change and resilience.

5.4 Presentation of results

5.4.1 The Objectives

This research study using in-depth interviews began with four objectives designed to open an exploration that would generate substantive theory regarding resilience factors associated with climate change adaptations among subsistence farmers in Maruleng Municipality.

1. To investigate subsistence farmers' notions of climate change and adaptation.
2. To determine the psychological resilience factors influencing the farmers' adaptation the climate change.
3. To determine strategies that the farmers use to cope with climate change.
4. Based on the farmers' notions of climate change and adaptation, and the associated resilience factors, develop a psychological explanatory model on climate change adaptation by subsistence farmers.

The fourth objective was to develop a psychological explanatory model on climate change adaptation by subsistence farmers based on the farmers' notions of climate change and adaptation, and the associated resilience factors. This last objective was based on all the findings which included concepts, categories and relationships between them. All these codes and categories were findings found from the above mentioned objectives. The discovered codes and categories were compared with one another to determine the relationships from the data. Through this process the researcher modified and finalised the categories.

Finally, the researcher developed the core category and relationships into a theory that explains the process and the pedagogy of climate change and the resilience factors by subsistence farmers. The core category for the current study was resilience. The subsistence farmers displayed a high level of resilience in response to the adversity of climate change. Therefore the theory which emerged was built around resilience. The process of finding the codes, categories, the relation between them and the core category is discussed below through the steps of analysis namely; open coding, axial coding and selective coding. At the end of the analysis, a theory, a set of theoretical propositions, was generated (Corbin & Strauss, 1990).

5.5 Grounded theory analysis steps

5.5.1 Open coding

The researcher started the study with open coding, which entails coding every piece of data in every conceivable way. This suggests that the process of coding, which symbolises the operations by which data are broken down and conceptualised, was involved in the data analysis for each interview transcript (Pandit, 1996). Line-by-line coding was used to apply open coding, which made it possible for the researcher to closely match the data and avoid applying preexisting assumptions to the data. The researcher was easily confused throughout this procedure because several descriptions for potential notions that frequently did not fit in the developing theory appeared.

Prior to being lost in open coding descriptions, careful attention to new notions was essential. Regardless of how fascinating the description was, this was crucial (Glaser, 2016). Open coding made it possible for the researcher to determine where she could focus her research so she could be more selective and conceptually focused on resilience characteristics. Once the researcher narrowed her attention and discovered the relevance of the new notions, excessive conceptual explanations were minimized. The researcher started by gathering markers for each transcript, including words, phrases, statements from the data, and observations. Table 2 provides an extensive list of initial codes and concepts collected from the 15 interviews. These concepts were generated from the responses of participants addressing all the research questions/objectives of the current study: a) notions of climate change, b) perception of climate change, c) adaptations of climate change, d) management of climate change.

Table 2: List of Initial Indicators and Concepts from Interviews

No rain	Doesn't affect us well	Responsibilities
Dry rivers	Causes drought	Strong winds
Less harvesting	Don't loose hope	Live by target
Lot of changes	It will get better	Born into farming
New diseases	Love for farming	No water, no farming
Too hot	Following old ways of living	Parents taught us farming
Way of living	Irrigating in the afternoon	Food comes from the soil
It is difficult	Tomorrow is unknown	We just farm
Forced to farm	Don't cut sacred trees	Hope for rain
We need food	God will help us	Farm and wait
Food is expensive	Push through	Use fertilisers
Unemployment	Be courageous	We will see
Costs money	We know where we want to be	Something good will happen
Farming needs water	We buy water	No other plan

No jobs	Use reservoirs	Always afraid
Pray	Work together	Have faith in God
Wait for rain	Get angry	We stay strong
Use boreholes	Live through farming	Farming is my gift
Only God knows	Believe in farming	Vision
Farmers feed the nation	Use organic ways	We get sad
Love for farming	Farming is in my blood	Irrigate in the afternoon
Cover plants	Get angry	Use organic ways
Follow culture	Born into farming	

From the initial codes, the researcher found eight (8) abstract notions. The idea of defining concepts was to use them to create categories. The first list was lengthy, and it took a great deal of work to combine and break down concepts so that the data could provide a set of categories with a similar level of abstraction and the ability to contain the most essential or widely dispersed indicators. Nonetheless, the concepts were developed in accordance with Glaser and Strauss' (1967) tests, which suggested that they should be analytic and sensitising. A concept is analytic if it can be broken down into properties or characteristics, and it is sensitising if it creates a picture that allows participants to grasp it through personal experience. The suggested themes provided a road map for farmers' entire experience with climate change and resilience.

The list of 8 identified concepts

1. Notions
2. Impact
3. Culture and climate change
4. Causes of climate change
5. Emotions
6. Adaptations
7. Resilience

8. Management

The analysis of the concept of notions

Notions	**Indicators**
	It's a problem
	Bad situation
	No rain
	Too hot
	Strong winds
	Dry rivers
	I don't know

The first objective was to find the farmers' notions on climate change and had more similar responses than varied. Most participants saw climate change as a problem. There were varied explanations of what kind of a problem climate change is. They saw it to be a bad situation they find themselves as subsistence farmers as they have limited resources or means to survive climate change. In broader and simpler terms, climate change was regarded as a situation with extreme weathers that included no rain and hot days. Some participants even associated climate change with death, citing that these extreme weathers only meant death to them and their communities.

One participant could not explain what exactly climate change is when asked to do so. However, he could describe how the weather has changed in the previous years.

Examples of transcripts

> *"Climate change is a lot of changes, I can give an example by farming. Even the rain is no longer frequent than previous times. It no longer rains at times s we know it to rain… [Participant 1, male]*
>
> *"I don't really know what it is"… [Participant 7, male]*

"According to me this climate change is the changes which occur… [Participant 4, male]

I don't know how to explain it. It is something that changes from time to time. An example could be when it used to rain in September but now we get rain in December"… [Participant 2, male]

So when there is no rain it means death. We are dying. Those at school (scientists) are saying 90% of a human cell is water… [Participant 8, male]

… the weather changes, it gets hot and there are strong winds…[Participant 5, male]

The analysis of the concept of impact

Impact	**Indicators**
	Lots of changes
	New diseases
	Causes drought
	Less harvesting
	Different seasons
	New insects/fruitfly
	No water, no farming
	Farming costs money these days

The participants of this study outlined several changes that are caused by climate change. According to them, climate change caused changes that they never had in their previous years of living. The participants of this study were mostly elderly people in their 60's, which made it easy for them to make comparisons of the current climate with the previous climate in their period of living and as farmers.

The changes included illnesses they never knew before. Some participants mentioned that they recently had to take large amounts of medication that they never had to before and they attributed that to the extreme weathers they experience lately. The participants have started to see new insects in their farms or yards that destroyed their plants and fruits.

They asked other farmers about the insects and its name is a “fruit-fly”. In a way climate change is helping them learn more about farming with the changes that it brings. Some participants indicated changes in seasons in terms of their onset and period. They mentioned that they the seasons either lasts shorter or longer than they normally do, especially summer and winter. As a result, this affect their harvesting time as well. Their harvesting time and quantity has also changed. They don’t harvest as much as they did, with one participant indicating that they only had few bags of nuts as compared to previous years. Another participant also indicated that they used to get mangoes in June but now they get them in November. With the extreme weathers including drought, farming costs them a lot of money as they have to buy water to irrigate their plants and crops. Their fear is that without water then they cannot farm.

Examples of transcripts

“It doesn’t affect me well at all because it causes drought… [Participant 2, male]

When there are strong winds there is less harvesting… [Participant 5, male]

Sometimes we used to get mangos during a certain month. So last year we had mangos in June whereas we know mangos to be there in November or December… [Participant 4,male]

Harvesting is no longer as much as before. We even start to see diseases that we never knew before”… [Participant 1,male]

*“I just associate it with climate change because we never used to have it times before. Yes fruits would get rotten but this “fruit fly” causes everything to rot: marula, mango. Figs, tomato, guavas and everything**”…** [Participant 1, male]*

“When it doesn’t rain we loose money. I farmed for three years without rain and this is the fourth… [Participant 6, female]

The analysis of the concept of culture and climate change

Culture and climate change	**Indicators**
	Following old ways
	Don’t cut sacred trees
	Follow culture
	Don’t cut sacred trees
	IKS

From the first participant, they mentioned how things used to be done in the olden days. Probing for this statement outlined that the participants in some ways attributed climate change to culture. They indicated that as they go to the rivers nowadays, they don’t find the trees that used to be there in the rivers. According to them this is what caused climate change because those sacred trees stored water in their roots. As a result, the rivers are also dry because of the absence of those trees. Some participants indicated that the youth don’t follow the olden ways or culture and do not listen when told not to cut those sacred trees. They also mentioned that the other people who cut those sacred trees are foreigners as they don’t know their indigenous uses. Unemployment also came up as reason why people cut those sacred tress because they sell them for timber. That makes it difficult for them to inform the youth and foreigners not cut the trees because they are also fending for themselves just like they are trying to do as farmers.

Examples of transcripts

*“There are certain trees in the river that we are not supposed to cut but now we are cutting them and that is why there is no longer rain**”…** [Participant 2, male]*

“You see things are changing. In the olden days we were taught not to cut certain trees at the river. Now the youth and foreigners are cutting those trees and those trees stored the water at their roots. Even the rivers are dry they don’t have water. That is why there is climate change and it is hot”... [Participant 3, male]

“When we were growing up there was a moon and two stars called “dithota”. When these two starts are on the other side we know that there will be rain, if they are on the other side then there won’t be rain. When we wake up in the morning we check the sky if there will be rain or not…” [Participant 3, male]

The analysis of the concept of causes of climate change

Causes	**Indicators**
	Unemployment
	No jobs
	Littering
	Air pollution
	Skills scarcity

Some participants did not know exactly what causes climate change but others associated it to their lifestyle these days in which youth cut sacred trees in the rivers, littering and deforestation which is linked to unemployment. Some participants indicated that in relation to not following culture by cutting the sacred trees, man-made problems caused climate change. They mentioned that the ways of living now such as littering everywhere caused climate change. One participant indicated that people throw babies’ nappies everywhere and that is damaging the environment.

He further alluded that he wished there could be strict laws against littering in the future. Other participants indicated that apart from cutting the sacred trees in the rivers, people were cutting trees everywhere and that caused deforestation. It was cited by the participants that unemployment and skills scarcity are the main reason people cut the tress which ultimately is related to climate change.

Examples of transcripts

"I will start from when I was still young. When I was growing up there was no pollution in the environment. First thing is pollution… There are types of littering; people throw these 2 litre plastic bottles everywhere, glass bottles are broken everywhere, baby nappies are thrown there and there. All these things don't merge together with climate in my view. If we can clean our environment that air will be pure…" [Participant 8, male]

"It is us human beings with manmade impacts causing climate change. Deforestation. People are killing those tress that stores water, rivers are dry…" [Participant 8, male]

"When we were growing up there was a certain tree in the river called "maokana". So nowadays because of poverty people have cut those trees, there is no water in the rivers because of that…" [Participant 7, male]

"From the firms. When you drive from here to Johannesburg via Malepisi. All you see is smoke everywhere in the sky. I just think it is because of that, I don't know…" [Participant 6, female]

The analysis of the concept of emotions

Emotions	**Indicators**
	Doesn't affect us well
	Get angry
	We get sad
	Always afraid

	It is difficult
	Confusing

The researcher asked the participants how climate change affect them as subsistence farmers. The specific question asked was how does this whole climate change situation make you feel? This question was difficult to get the response for it as it mentioned above that the participants of this study are mostly elderly people, therefore they were reluctant to share their feelings and emotions about this situation. However, as they slowly opened up it was evident that a lot of participants were saddened, angered and mostly scared by climate change as they have mentioned the changes it brings, are mostly unknown and they also don't know when it will get better.

Some participants notably mentioned how they are angered about the changes brought by climate change. One participant indicated that she was so angry with the less harvest she did that year as compared to amount of work and time she put when she was "sawing". The other one explained that climate change makes them angry and wished that the government could also assist them like they assist smallholder farmers. The other reason that brought about anger is that farming for them costs money as they have to buy water, so they loose money as well and also because the sun is very hot.

Examples of transcripts

"I get sad when there is no rain"… [Participant 2,male]

"So I am always afraid. Anything can happen anytime…" [Participant 8,male]

"Eish it affects us badly. The thing is we don't know where we will go or do…" [Participant 7,male]

"It doesn't affect me well at all. I am even angry now. We don't have ditloo it is very hot and the cows grazed our plants. It's like I dint even plant anything, it is just soil…" [Participant 6,female]

The analysis of the concept of adaptations

Adaptations	Indicators
	Use reservoirs
	Use organic ways
	Cover plants/Mulching
	We buy water
	Work together
	Irrigate in the morning and in the afternoon
	Use fertilisers
	Use boreholes
	Be innovative
	Plant fruits that need less water

This concept is related directly to the adaptations that the farmers used in response to climate change. Most participants used strategies like mulching, irrigating in the morning and in the afternoon and also the use of boreholes. They also indicated planting fruits that did not need a lot of water for survival. Although these are more agricultural adaptations, they indicated that it is how they cope with climate change. The researcher then probed deeper to find out the psychological coping strategies they use to cope. Some participants have accepted the situations and believe that it is the way it is, there's nothing that they can do. They indicated that "all is well", which the researcher saw as tolerance to the situation. Although they farm in their own individual yards, they work together by checking on each other by talking about climate change and the possibilities for the future. They also talk about their harvests. This shows that they give each other emotional support. However they have bought reservoirs and boreholes that they use as a substitute to rain. This helps the cope as they found a solution to the problem they face of climate change. In this regard they do not loose a lot of harvests and this relieves their stress levels.

Examples of transcripts

"We use a furrow that gets water from the river the borehole we use and the mulching way of putting grass..." [Participant 4,male]

"These days of climate change we started irrigating around 4 and 5 in the afternoon because it is not hot. When you irrigate during the day the soil doesn't stay wet for longer periods because the sun is hot… So the ways we use to irrigate in the morning and in the afternoon helps a lot with this climate change…" [Participant 3, male]

"We plant fruits that do not need a lot of water line sweet potatoes and beans..." [Participant 2, male]

"There is no plan. We don't even have tractors, they (government) always say the need to be signed off so we use donkeys to farm. Maybe boreholes will help…" [Participant 5, male]

"What can we do? We will farm again. "Lehu la bontshi ga le babe"…" [Participant 6, male]

"Communication and working together amongst farmers is the first one. To be innovative as well because in my culture we say "kgomo go tsoswa ye e itsosang"…" [Participant 1, male]

"It is cooperation. We need to work together as farmers so that we can buy a reservoir to help us…" [Participant 4, male]

"We buy water from other houses who have boreholes but we hope to have boreholes and taps from the government…" [Participant 13, female]

The analysis of the concept of resilience

Resilience	**Indicators**
	Love for farming
	Born into farming
	No other plan

	Have faith in God
	Farming is a gift
	Pray
	Farm and wait for rain
	Something good will come up
	Only God knows
	We stay strong
	Farming is in my blood
	Be courageous
	Hope for rain
	Push through
	Responsibilities
	God will help us
	Tomorrow is unknown
	Don’t loose hope
	It will get better
	It’s our livelihood
	Perseverance
	Enthusiasm
	Acceptance/tolerance

The core objective was to find out the resilience factors influencing the farmers’ adaptations to climate change. With the adversity of climate change, it was evident by these farmers that they are still farming. The participants had a variety of resilience factors as a response to the climate change. The majority of participants keep on farming as it is their passion for farming. When asked why they keep on farming even though there is no rain; the participants responded that it is their love for farming. Passion for farming became the most recurring response as to how do they keep on farming each year. One participant smiled before they can respond to the question posed at them, and indicated that farming is their life; “I grew up farming”.

They also indicated the enthusiasm that keeps them from feeling helpless. Maruleng municipality comprises of rural areas. This means that most of the people residing there are pensioners and unemployed, including the participants of the current study. They are resilient because farming is their livelihood, they farm to feed their families and for survival. One participants indicated that if they don't farm then it means they will starve and they have to feed their families. Another participant indicated that farming is like rearing a baby, therefore the love one gives a baby is the same love they give to farming. Although the participants did not know when the situation will changes: as to when there will be rain, they keep on hoping that the next day it will be better and maybe there will be rain, even if it is just some drizzle. They indicated that tomorrow is unknown, therefore they will not stop farming in case there is rain.

Most of the participants are elderly citizens who lived for a longer time and have lived in the times before climate change. Although this is a serious change, they have learned to adapt. They have successfully adapted through courage which helps them to wake up in the morning to farm at the same dry areas with the hope of a better outcome. The participants had different belief systems which included Christianity and cultural beliefs. As they farm without rain or any sign of rain, they pray to God for mercy. They indicated although tomorrow is unknown, God knows all and they trust in him to change the situation. One participant with a sense of humour indicated that God will feel sorry for his animals and provide rain and in turn, the farmers will benefit from that rain as well. From their notions, they indicated that the youth and foreign nationals are cutting "sacred" trees in the river. Their cultural beliefs sustain them in a way that preserving cultural ways in terms of living like the old days keeps them strong. They also make use of the Indigenous knowledge system by looking at the stars to see when there will be rain. This method sustain them and indicate to them when they can farm in larger quantities for greater harvesting.

Examples of transcripts

"It is difficult. To be honest, we are just forcing ourselves because we love farming. It causes a lot of damage…" [Participant 1, male]

"We just think that it will get better one day. The other thing is that farming is my passion. It is the love for farming…" [Participant 2, male]

"We pray but God answers us after a long period and in different ways. What gives courage is that I was born in a farming family, my parents taught me how to farm and that food comes from the soil (farming). I know farming and love it…" [Participant 5, male]

I just hope to get 6 bags at least…" [Participant 6, female]

"I am forced by responsibilities and the enthusiasm in this climate change. We strongly believe in farming but if the government can help it will be better…" [Participant 4, male]

" … Maybe God will help us and make it better…" [Participant 6, female]

"The only thing we can do is just look above and say God is watching at his animals. I was telling someone a few days ago as cows were dying, I was telling that you know the rain which will come will not be for us human beings but for the animals because us human beings have messed up this earth with our pollutions. So God just thought he will not punish the animals because of our wrong doings…" [Participant 8, male]

"We should not cut those trees in the river because these trees store water. Youth cut these tress and leave it as a desert…" [Participant 3, male]

It can change if people come up with other ways to make money instead of cutting natural/indigenous trees. Those indigenous trees we grew up knowing and seeing are no longer there and the water is no longer there…" [Participant 7, male]

"We are pushed or encouraged by starvation. We are trying to fight starvation…" [Participant 5, male]

"The thing you can't just sit and say there is no rain and do nothing. One day you will stop and say there is no rain then it rains. You just farm and hope that this year there will be rain…" [Participant 7, male]

“I cannot just sit down and say climate change is here and it has changed things. I am forced because I have to come up with other ways. I have to come up with other plans so that I can go on because we live through farming...” [Participant 4, male]

“We pray because when you need something you pray and say “God help us”. Forward we go…” [Participant 3,male]

“What keeps us going and strong is that a farmer doesn’t give up. One always have to be courageous. Even if you only harvest one tomato you must have hope that next time it will be better…” [Participant 10, female]

“The other reason is food because even if we stop the problem is when the sun set, our tummies have to be full. That is the other reason that forces us to farm because we do not want to starve. We have to eat…” [Participant 1, male]

“We just have to adapt with the changing times because farming is not easy. It needs perseverance…” [Participant 1, male]

“There are challenges everywhere, so we won’t stop, we have to be strong. You have to have a vison of what you want to do and then a mission of where you have to be or attain. When you want to win in this hunger you have to use your hands. We take it each day as it comes, some day it goes well and some days it doesn’t but we remain courageous in this situation…” [Participant 8, male]

We will never stop farming because we want to eat and live, you see we have oranges there…we just harvest by the Grace of God, one will get better…” [Participant 13, female]

We are people who farm, we just farm, farming is our thing, even when there is no rain we farm…” [Participant 13, female]

The analysis of the concept of management

Management	**Indicators**
	Do not cut sacred trees
	Encourage youth to farm

	Get help from the government
	Educate youth about farming
	Working together

The last question the researcher asked the participants was how do they think climate change can be managed? It was a difficult question to answer given that they really didn't know how they can help reduce the impacts of climate change. However they thought that if the youth were educated about their culture and farming that would create awareness. They strongly believed that climate change is caused by people cutting the sacred trees, therefore if people stopped that help manage the impacts of it. They also alluded that most youth in the community do not find farming appealing and if they could be encouraged to farm, they can also minimise the cause of climate change such as littering and deforestation. The common problem that the subsistence farmers faced is lack of water, therefore they believed that if they can work together and help each other in terms of tractors and reservoirs it will make a huge difference. One participant indicated that in the olden days, they use to have organisations which had strict rules on cutting trees and he wished that those organisations would be brought back to help with the alleviation of deforestation. He also urged the researcher to pass on the message to the University to assist in that regard. Lastly they indicated that some help form the government will make a huge difference as well as they do not get any funding from the government because of their small scale as subsistence farmers.

Example of transcripts

"Communication and working together amongst farmers is the first one. To be innovative as well because in my culture we say "kgomo go tsoswa ye e itsosang"…" [Participant 1,male]

"We should not cut those trees in the river because these trees store water. Youth cut these tress and leave it as a desert…" [Participant 3, male]

It can change if people come up with other ways to make money instead of cutting natural/indigenous trees. Those indigenous trees we grew up knowing and seeing are no longer there and the water is no longer there…" [Participant 11, female]

5.5.2 Axial coding

Finding connections between the open codes is the task of axial coding. What links exist between the codes? The next step was reducing the number of codes and gathering them together in a way that demonstrates a relationship between them through systematic analysis and ongoing data comparison. The categories connect the ideas and make the "gestaltian" theory of the phenomenon apparent (Goulding, 1999; Moghaddam, 2006). According to Strauss (1987), axial coding is a process of conceptualisation that becomes progressively dense and in which links between categories ultimately result in the identification of the core. It is continuously necessary to compare and contrast concepts, categories, and subcategories in order to identify the primary category and its connections to other categories.

Compared to the concepts they represent, categories are on a higher level and are more abstract. They are created using the same analytical procedure as producing lower level concepts, which involves comparisons to reveal similarities and differences. The "cornerstones" of evolving theory are categories. They provide the tools necessary for integrating the theory. While coding, the researcher noticed that, although these concepts are different in form, they seem to represent activities directed toward a similar process: the love for farming. As an example, the researcher generated the concepts of "love for farming," "born into farming," and "farming is my gift." According to LaRossa (2005), the core category corresponds to the "primary story" of the research study. They could be categorised under a more amorphous heading, the category: "Passion for farming."

Resilience to climate change is the "primary story" of the current study. He clarified that the category or variable having the most and the strongest links to the other categories is the core category. Additionally, it is the theoretically developed and strategically important category (Feeler, 2012). The focus for developing the current idea turned out to be "resilience" as a response to climate change. As more data are looked at using axial coding, researchers must constantly change and rearrange their conceptual framework. Ideally, it leads to the creation of action models that include contingencies and capture important conceptual qualities that explain who, what, where, when, why, and how identified phenomena occur (Corbin, & Strauss, 2008).

The axial coding framework includes actions or interactional techniques used to handle the phenomena, as well as causative and intervening micro and macro structural, sociopolitical aspects of the setting, and outcomes of interactions and actions conducted (Charmaz, 2006). Through extensive axial coding, the researcher came up with the following categories below which are related to each other on one way or the other. The following categories emerged from the axial coding where relationships were formed. These categories answers the core issue of the study which is resilience, the why of the study, which is the livelihood which is the reason why the stay resilient and continue to farm. The categories also answers the how of the study, which how most of the farmers manage to stay resilient. The famers are from a community which cares for its members and they support each other through the adversity of climate change. The psychological resilience factors are the actions that they farmers take throughout to reach or foster their resilience. Starvation came up as a category that will be the consequence of these farmers lack all of the mentioned categories. Since farming is their livelihood, should they not remain or be resilient, their families will starve as they depend on farming.

5.5.2.1 Categories that emerged from axial coding are the following:

1. **Resilience-**the core category around which everything else revolves (the “what” of the study)
2. **Livelihood-**(Why of the study: which translates to why the farmers are resilient and still farming)
3. **Resources/Social support-**(the “how” of the study: the condition that enables resilience.)
4. **Psychological resilience factors-**(actions/Interactions)
5. **Starvation-**(Consequences)

5.5.2.1.1 Resilience

The core category which emerged from the analysis is resilience. This category also answers the “what” of the study, which is the phenomenon under study. This became the center of the study in the sense that, although the farmers were faced with climate change impacts, they were still farming. Their yards were full of plants and trees that they continue looking after throughout and despite of the adversity they faced. When asked why they still farm, the participants asked what else could they do. Giving up was never an option for them. The participants chose to be resilient over anything. They had various ways in which help them stay resilient. For the purpose of this current study, the researcher categorised resilience in three namely; natural resilience, adaptive resilience and restored resilience.

5.5.2.1.2 Livelihood

This category emerged as the researcher asked participants about the reason to keep farming and strive for resilience. Livelihood emerged as a category which explained the why of the study. Why be resilient. Majority of the participants are pensioners and others are unemployed, therefore putting them at an economic disadvantage. Their resources are limited and they solely depend on farming for survival.

Farming is their livelihood. They have to keep on farming to survive the other adversity of food insecurities. Some participants mentioned that they have responsibilities, they have children at home who depend on them. One participant mentioned that they cannot stop farming because there is no rain and then go home to their children empty handed. They are forced by their responsibilities. This category was also accompanied by the problems faced in the community like unemployment and skills scarcity. Farming is what they know, what they love and they also alluded that food comes from the soil, thus farming is their livelihood.

5.5.2.1.3 Resources (Social support)

This category answers the “how” of the study. This is the category that enables resilience. It also characterises the special set of conditions in which action/interaction strategies take place to overcome, handle or react to resilience. This intervening strategy serves as a condition that influences action and interaction strategies. From the literature these strategies comprise, for instance, time, space, culture, socioeconomic status, technological status, career, history, and individual biography. In the current study, the strategy that emerged to help sustain resilience is social support. Although the participants didn’t use the exact words “social support”, they explained that talking to fellow farmers help them in being resilient. The participants know each other throughout the community and they share the problems that is brought about climate change and how they can overcome them. Some participants mentioned that it would help if they come together and buy a reservoir which will help all the farmers in the community. They also take turns in using the tractor to farm. Throughout these encounters, they talk about climate change and to know that they are not the only ones, that makes them feel better, be resilient and to keep on farming.

5.5.2.1.4 Psychological resilience factors

Strategies for interaction or action are aimed at the phenomenon. Whether the research is focused on people, organisations, or collectives, the phenomena is always the focus of action or interaction in order to manage or conquer it, perform it, or respond to it. The situation or context in which the phenomena always manifests itself. The resilience of subsistence farmers is developed in this work to combat climate change. The performing person's self and other interactions are both a part of the interactional component. This category is a continuation of the "*what"* of this study. It gives the actual ways that the subsistence farmers use to overcome the adversity of climate change and be resilient. The participants had different ways in which they stayed resilient throughput the climate change. They hoped for better days in the sense that they believed that the situation will change and they will get rain in the near future. They also had to adapt and build up courage to carry on.

They also believed in God and pray that God will change the situation as He is the one who knows everything. Although some believed in God, others kept strong cultural beliefs that teaching the youth and preserving the sacred trees kept them going. Most of the participants' resilience came naturally for them, it is something that they just do in that sense that there is nothing else they can do. They are enthusiastic about life and what their farming life can do in the future. Passion about farming keeps them resilient. They enjoy farming and they know it better than anything. They also mentioned that when there is no farming then they will die. Farming is their livelihood. They have no choice but to keep on farming no matter what. One participant mentioned that farming feeds the nation.

5.5.2.1.5 Starvation

As a response to or a means of overcoming a phenomenon, action and engagement, whether taken or, on the other hand, not taken, have an impact and have repercussions. Results and consequences follow an action or interaction by default, even if they are rarely anticipated or planned. Consequences might be real or hypothetical in the present or in the future. In the current study, starvation served as a category which answered what are the consequences in this phenomenon under study. The participants mentioned that farming is their livelihood. If they do not farm then there will have no food. Therefore, the consequences of not farming is starvation for the farmers and their families. Hence they have no choice but to be resilient and keep on farming to survive.

5.5.3 Selective Coding

The practice of selecting one category as the core category and connecting it to all other categories is known as selective coding. In order to describe how the primary concern is addressed or handled, the core category serves as the focal phenomenon around which all other categories are interwoven (Strauss & Corbin, 1990). The researcher was then able to move on to selective coding, which is a more restricted and focused type of coding, after determining the core category. This method of coding, according to Strauss (1987), entails systematic and coordinated coding for the primary category. The core category serves as the focal point of the researcher's study and a guide for subsequent theoretical sampling and data collection. Selective coding takes control as research advances and the process goes toward theory formation (Feeler, 2012). Resilience served as the core category for the current study and the foundation for the theory's development.

Description of the emergent theory and resilience factors

From this stage, propositions were derived that showed generalised links between discrete categories and their concepts (1996). Glaser and Strauss originally referred to propositions as "hypotheses" (1967). Since, as Whetten (1989) properly notes, propositions entail conceptual relationships while hypotheses call for measured relationships, it is believed that the name "propositions" is more appropriate. The term propositions was chosen over hypothesis because the goal of the current investigation was to produce conceptual linkages rather than quantitative ones. Iterative processes are used to create and develop concepts, categories, and propositions.

The idea was inductively developed from research on the resilience phenomenon it represented. It was discovered, created, and tentatively verified through methodical data gathering and analysis of data related to resilience. As a result, the processes of gathering evidence, analyzing it, and developing a theory were mutually dependent. Although in theory this method should have been simple, it was arduous and required patience, strict focus, and time. You don't start with a theory and then support it with evidence. Instead, one starts with a field of study and then lets the information that is pertinent to that field come to the surface (Strauss & Corbin, 1990). Resilience was a core category where the emergent theory is built upon. However the researcher labelled the resilience factors into three categories: Natural resilience, Adaptive resilience and Restored resilience which have their own sub-categories. The links from the core category included categories which the researcher labelled: Mental concepts, Emotional concepts and Behavioural concepts which also had sub categories.

The researcher decided on the step of labelling by borrowing from Glaser's step of Theoretical concepts when developing the model. These theoretical concepts were the ones included in the model. The model for the current study was labelled "Subsistence farmers resilience model", see Diagram 1. An overarching concept for this concepts was labelled the Psychosocial facets (mental, emotional and behavioural concepts) of subsistence farmers. This was important to include in the model to show and discuss how subsistence farmers in Maruleng municipality process climate change.

Mental concepts: Every participants explained their own notions of climate change from their own understanding and experiences during the interviews. For many, the understanding of climate change was linked to a problem that they are facing. This was a type of problem that was explained as bad, causing a lot damages and included a lot of changes in their lives. As re-iterated by one participant who said that the way the climate change is bad, it only meant death to them as subsistence farmers since they survive through their harvests. It caused a lot of damage by ruining their plants with extreme weathers. One participants mentioned that one can easily collapse from the extremely hot sun. They also experienced a lot of changes like diseases they never knew before and insects (fruit fly) that also damages their crops, vegetables and fruits.

Emotional concepts: The problem that the subsistence farmers experienced that caused a lot of damage and changes affected them emotionally. Most of the participants gave a deep and overwhelmed sigh when explaining the climate change adversity in a nutshell during the interview sessions. It was evident that the problem that they faced weighed heavily on them. They mentioned that it made them sad as they basically live through farming and climate change as a problem affects them in a negative way. They feared for their future as they didn't know when the situation will change for the better. With the current situation of less rain and no rain at all, they experienced fear on a daily basis. With sadness and fear, anger was also mentioned as an emotion that was experienced by the subsistence farmers.

One participant mentioned that she was extremely angry every time she looks at the few bags of harvests that she had that year compared to the previous years.

Behavioural concepts: The participants explained the ways in which they cope with climate change when they feel sad, scared and angry. The coping strategies that emerged were: Prayer, Tolerance, Innovation, Determination and Culture preservation. Most participants mentioned that they put their trust in God to see them through this climate change. They prayed to God for mercy to give them rain. They have also used tolerance as a way of coping, with other participants explaining that they just farm irrespective of the climate change. However some participants also mentioned that they have come up with ways of coping by being innovative. They used boreholes, mulching and irrigating in the morning and in the afternoon to avoid extreme hot weathers during the day. They also mentioned preserving culture as a way of coping: looking at the stars to see if there will be rain before they plant any seeds; and also to stop cutting sacred trees that store water from their roots in the rivers. All the participants have mentioned that they have learned to remain determined throughout.

Core Category: Resilience: Natural resilience, Adaptive resilience and Restored resilience

Natural resilience: In this study, the core category was identified as resilience to climate change adaptations. This phenomenon described how subsistence farmers stay resilient in the adversity of climate change. From their notions of climate change being a problem that they face, being affected negatively emotionally and also coming up with ways to cope, they still continued to farm and did not stop. However bad the situation got and how uncertain they were about their future in the presence of climate change, they remained resilient and continued to farm every year. The participant showed natural resilience through their passion for farming citing how they love farming.

They mentioned that farming is their livelihood and they know nothing except for farming, hence they still farm no matter the extreme weathers. Being enthusiastic also helped them through climate change. Natural resilience is the kind of resilience you possess naturally and from birth. Your human nature and life energy reside in this. People who are naturally resilient are excited by life's adventures and eager to discover new things. In spite of being pushed down and diverted off one's course, someone with natural resilience can continue and accomplish their best.

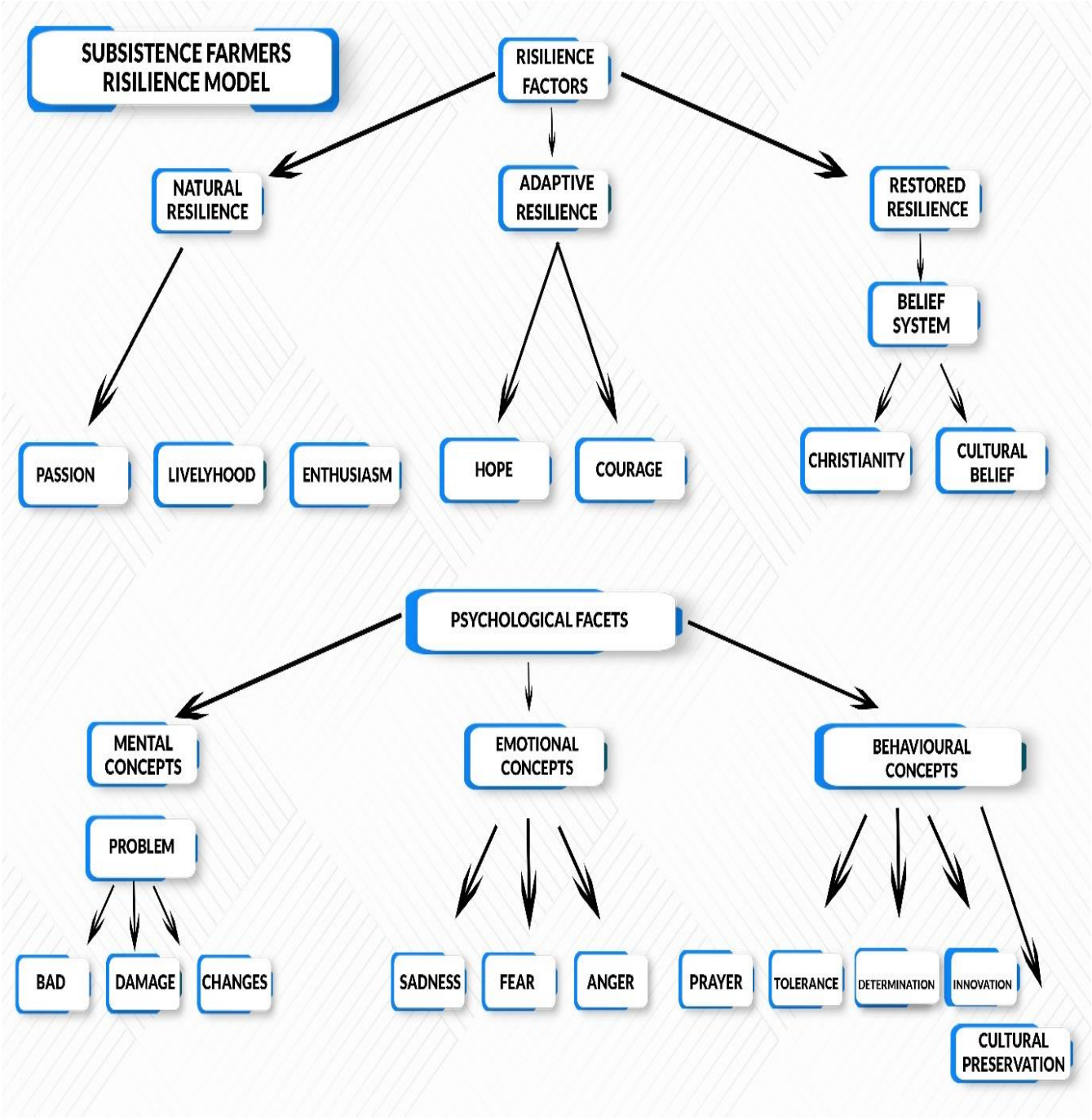
Adaptive resilience: Psychological resilience refers to the phenomenon that many people are able to adapt to the challenges of life and maintain mental health despite exposure to adversity. Specifically, adaptive resilience is the ability to recover from adversity, adapt and thrive. When difficult circumstances compel you to learn, adjust, and adapt, this is also known as "trial by fire." One participant said, "Learning how to roll with life's punches can help you gain resilience and grow stronger as a result." The subsistence farmers mentioned that they had to adapt with the current situation. They used farm with no problems of no rain or less rain throughout the year. However as time went by they had to develop resilience by being hopeful. Hope was mentioned as an adaptive reliance since they never had to hope for rain or a better harvest as subsistence farmers before climate change. They only planted seeds in their yards and had pleasant harvests without worrying or hoping for the best. Being hopeful was in correlation with having a strong will so not to despair. They had to show courage all the time.

Restored resilience: This is often referred to as acquired resilience. Restoring the inherent resilience one has as a child is possible by learning practices that promote resilience. One can deal with past, current, and future traumas in a healthier way by doing this. Some resilience came naturally for some participants, others had to adapt and the rest had to learn to be resilient. The participants mentioned a variety of belief systems that they had including Christianity and cultural beliefs.

Restored resilience is explained to be resilient which is learned by individuals as they experience adversities, however this type of resilience was adapted to the context of the current study in the sense that the subsistence farmers had to restore their beliefs by using their Christianity and cultural beliefs to survive the climate change. They used their Christianity by believing their God and praying to Him to see them through and also give them rain. Other participants indicated that they used their indigenous knowledge system to understand, cope and ultimately stay resilient to climate change. Their cultural belief helped them as they now had restore their old ways of predicting situations being climate change.

They mentioned that they wake up in the morning to watch stars and the moon to see if there will be rain or not, they stayed resilient in that manner as they believe and trust in that knowledge. Although they revealed different outcomes every day, that did not stop them from farming as the stars can change at any day. The other participants mentioned that preserving culture by not cutting the sacred trees in the river helped them stay resilient as the trees store water in their roots, hence they can use the water from the rivers as well. Although the youth and foreign nationals cut some of the trees with lack of knowledge, the ones which are still there serve the purpose and they hoped to keep them preserved.

5.6 Presentation of the subsistence farmers' resilience factors model



The model above explains how the subsistence farmers understand climate change, how it makes them feel and how they ultimately react to it. This first cycle is in relation or answers the current study's objectives. The main aim was to find their resilience factors to climate change which is the core category that emerged from the study and develop a model based on the responses from the objectives. The model has 2 major pillars/levels which include the psychological facets (mental concepts, emotional concepts and behavioural concepts) of subsistence farmers and three categories of resilience factors (natural resilience, adaptive resilience and restored resilience) which are explained as to how the subsistence farmers survive the adversity of climate change. To understand the model or the psychology of subsistence farmers around climate change, one should read and interpret the model from the pillar below and going to the above pillar.

The first (below) pillar/level explains the psychological facets of subsistence farmers which include the mental concepts, emotional concepts and behavioural concepts. Mental concepts: this concept explains how the subsistence farmers conceptualise climate change. Their notions of climate change stated that is a problem that they face in their lives. They thought of climate change as a negative impact that causes a lot of damage and brings about a lot of new changes. As they navigate through the changes brought by climate change, they are affected emotionally. The emotional concepts include sadness, anger and fear. The subsistence farmers noted that climate change makes them sad, they get angry as they lose significantly and ultimately fear for the future of farming. The emotional experience leads them to react to all the emotions they feel. Their behavioural concepts are prayer, tolerance, determination, innovation and cultural preservation. In reacting and responding to their emotions, the subsistence farmers tend to pray for better outcomes.

They indicated that determination is what they have to do in order to not give up. Since most of them understood that there will not be any immediate solution to climate change, it is better to endure its impacts. However, it was noted that being innovative by using organic and new strategies to adapt proved to be worthwhile. From their notions, the subsistence farmers indicated that one of the causes of climate change is cutting indigenous trees in the rivers by the young generation and foreign nationals due to lack of knowledge of the importance of the trees. Therefore, preserving culture by not cutting those trees is one of their ways to help minimise the occurrence of dry seasons.

The second pillar or level explains the psychological resilience factors by the subsistence farmers in Maruleng Municipality. For the purpose of this study, the resilience factors were categorised into natural resilience, adaptive resilience and restored resilience. In relation to the below pillar/level, the resilience factors followed the sequence and logic of the psychological facets. The natural resilience is in relation to the metal concepts. The adaptive resilience is in relation to the emotional concepts and the restored resilience is in relation to the behavioural concepts. Natural resilience: in this category, the subsistence farmers indicated a passion for farming as one of their resilience factors. Their love for farming keeps them strong and helps them proceed with farming. They also indicated that farming is their life and there is nothing they know more than farming. They mentioned livelihood as one of their natural resilience factors. Lastly, enthusiasm was mentioned as one of their natural resilience factors.

The second category is adaptive resilience factors and it is in relation with the emotional concepts. The subsistence farmers indicated that what keeps them going and strong is through hope and courage. The climate change adversities has left them feeling sad, angry and fearful. To overcome those emotions they had to adapt and cope be hoping for better outcomes. Although it takes longer periods without rain, they keep on farming with the hope that someday it will rain and they will get better outcomes. Some participants mentioned that farming needs one not to give up easily and be courageous. Having courage is one of the other resilience factors that help them “bounce back”.

The last category of is the restored resilience factors and it is in relation with the behavioural concepts. It was mentioned by the subsistence farmers that they sometimes they feel that climate change is beyond their human control and there is nothing they can do to physically change it. Although they use a variety of adaptation methods to limit the effects of climate change, they cannot do anything to stop the actual event of climate. However, they are not prepared to give up and stop farming as it is their livelihood. The subsistence farmers had different belief systems that they follow. Some follow Christianity and others follow their culture. They even use their beliefs to predict the weather and maintain the possible causes of climate change. The subsistence farmers mentioned that prayer helps them to stay strong and keep on farming. They also mentioned that God knows all and will someday feel sorry for them and answer their prayers with rain. The other participants mentioned that they follow their culture by preserving sacred trees that store water in the rivers. By doing so, it helps them in proceeding with the farming and they believe that the rivers will not run dry. That makes them to stay resilient.

5.6.1 Implications for the theory: Michael Ungar's social ecological resilience theory

The researcher used Michael Ungar's social ecological theory as a lens through which to understand the current study's findings. The theory is based on the concept that humans are a part of and not separate from nature (Ungar, 2011). Four concepts were presented to assist guide both research and theory development in resilience as a social ecologically dependent concept: decentrality, complexity, atypicality, and cultural relativity. Individual attributes linked with coping under adversity are engaged within this framework to the extent that social and physical ecologies have the capacity to assist processes that protect against risk and promote positive growth (Ungar, 2011).

Decentrality

The concept of resilience could be understood by looking at the interaction between individuals and the environment (Ungar, 2013). Understanding the environmental factors surrounding individuals and how these influence developments as individuals interact with these environments is of high importance. Such research implies that in high-risk contexts, individual factors are less important than the availability and accessibility of culturally relevant resources. The findings of the current study is in support of this concept as subsistence farmers indicated that some of their resilience is depended on the resources in their environment. They indicated that it would be much easier to be resilient if they had tractors, boreholes and some funds from the government. The major problem they faced was that the felt neglected by the government as they are less regarded in terms of funding as compared to small-scale farmers and commercial farmers. However, some NGO's have assisted with few funds previously which helped them to buy a tractor that they use amongst themselves through a controlled roster.

Complexity

Equifinality and the complexity principle are compatible. Many diverse processes that are relevant to various ecologies can begin with many different starting points and lead to many distinct but equally acceptable conclusions (Ungar, 2011). Complexity highlights the fact that building resilience is not an easy task. Instead, it involves the dynamic and intricate relationship that exists between a person and their social environment (Ungar, 2011). Due to the complexity of resilience, what supports healthy adjustment in one situation or stage of development might not encourage resilience in the process of another person.The farmers in the current study indicated more similar emotions, behavioural ways and resilient factors than different. The principle of complexity proved to be even complex for the interpretation of the current study's findings. The farmers in the current study live in the same rural community with the same problem of lack of resources to foster resilience and they are faced with the same adversity of climate change. However, they indicated a variety of resilience factors that include passion, livelihood, enthusiasm, hope, courage and following their belief systems.

The principle of complexity can also be applied in the sense that although the farmers are faced with the same problem, they indicated different resilient factors that were fostered by different factors from how they conceptualised climate change, how they felt about it and eventually how they reacted (behaved) to it.

Atypicality

The principle of atypicality can be used to suggest that resilience can appear in ways that we don't wish to promote but that are required for individuals to survive in their social ecologies. Long term, one would hope that environmental changes would encourage people to employ other, more socially acceptable coping mechanisms (Ungar, 2011; 2013). However, such decisions will most likely be influenced by the state of the environment rather than human characteristics. Atypicality argues that resilience is a context-specific process and depend on either cultural or sub-cultural contexts Ungar (2011).

The findings of the current study indicated that the farmers' resilience manifested in ways that are accepted or promoted by the community as argued by Ungar. The principle of atypicality was supported by the current study's findings for the main reason that most of the farmers are elderly people who follow their norms, values and cultural and Christian beliefs. However, it is noteworthy to mention that farmers indicated that the youth and foreign nationals do not follow their cultural ways by cutting indigenous tress in the rivers and that affect how they stay resilient as cultural preservation helps foster their resilience. They believed that if the youth and foreign nationals would adhere to their cultural ways that will help them in the future and help them with staying resilient.

Cultural relativity

Positive growth processes under stress are culturally and chronologically (and so historically) ingrained (Ungar, 2008). Although the need to adequately account for cultural relativity is not unique to the study of resilience, culture as a constructive factor for psychological health is notable for the contribution it contributes to resilience-related processes (Ungar, 2013). Individuals and communities express a set of common values, beliefs, language, and conventions through their daily actions, which are referred to as culture (Wong, Wong, & Scott, 2006). The competing truth claims of the crossing cultures in which individuals' lives are lived must be accounted for in order to recognise resilience as a complex construct with varying results. The current study's finding are correlated to this principle as farmers indicated that they use their belief systems to foster their resilience. Their belief systems were relative to their context as they indicated two different systems that they used. Some participants mentioned that their use their cultural belief systems to stay resilient through climate change. They believed that preserving their culture helped them in staying resilient and continue to far. They mentioned that by not cutting trees that stares water in their roots in the rivers helped them stay resilient. They believed that helped to prevent rivers from running dry.

They also used the indigenous knowledge systems for weather forecast. They read the starts to help them know when it will rain so that they can proceed with the planting/sewing season. Contrary to the cultural beliefs, other farmers believed that their Christianity belief helped them to stay resilient. They believed that only God will help them out of this adverse situation. They also indicated that they do not know if this situation will change or not as climate change "things" are only known to God. Therefore, they will pray for help to God. Praying helped them to stay resilient and continue to farm. They believed that God will feel pity for them and the animals and provide them with rain. The community of Maruleng believed in two contrasting belief systems that they both practice in different contexts to overcome the same problem of climate change.

CHAPTER 6
DISCUSSION OF RESULTS

6.1 Introduction

The previous chapter presented the findings of the present study. In this chapter, the study findings will be discussed in relation to the literature review and other sources of information. The discussion was further informed by the concepts and categories that were presented in the previous chapter.

6.2 Notions of climate change

The current study results revealed that the farmers are aware of the current situation of climate change and that their notions of climate change had more similar responses than varied. Most participants saw climate change as a problem. There were varied explanations of what kind of a problem climate change is. These findings yielded support to the literature on the perceptions of climate change and its threats to rural communities as being among the major challenges faced by farmers and associated communities. It was also evident from the findings that that the participating communities are aware of change in climatic conditions during recent years and the associated impacts on people's livelihoods (Tirivangasi & Nyahunda, 2019).

The findings indicated that the types of climate change experienced in the M Muni included: are changes in rainfall patterns; unusually hot days accompanied by strong winds resulting in dry rivers. This was mostly how the participants of the current study explained climate change. Shameem et al. (2015) indicate similar findings from a study undertaken in Bangladesh in which rural communities' perceptions of climate change are centered on variations in temperature and rainfall patterns manifested as rising temperature trends and scarce rainfall. Concurrently, analysed small scale farmers' adaptation practices in a study in northern Burkina Faso found findings that suggest that farmers had quite elaborate knowledge of climate-related factors, such as wind, rainfall, and heat, and their impact on crops (Below et al., 2010).

This study not only support the current study on the knowledge of climate change but also relates with it in the sense that it was undertaken from a rural context as with the current. Climate change was even associated with death, citing that with these extreme weathers it only meant death to them and their communities. The participants indicated that without the main resouces for human survival like water and food meant that they will die from hunger. This was also a major threat for their livestock as well as indicated some of the participants who herd goats and chickens.

6.3 Impact of climate change on farming

The participants of this study outlined several unique changes related to farming practices that they associated with climate change. The changes included human illnesses and new insects (fruit-fly) they never knew before. It was reported that the extreme weather events associated with climate change had changed how subsistence farmers view farming in this era (It is no longer a happy event they looked forward to), ultimately threatening their livelihood as they survive through farming. In support of these findings, subsistence farmers are reported to be most vulnerable to any shocks to their agricultural system which is the sole source of their livelihoods (Wheeler & Von Braun, 2013). These farmers are frequently exposed to extreme weather events, which cause significant crop and income losses and aggravate food insecurity (Chauvin et al., 2012; Harvey at al., 2014).

SSA's current agricultural productivity is low, and there have been many attempts to get agriculture moving due to the same extreme weather conditions, despite the fact that agricultural growth has been the catalyst for the acceleration of industrial growth in a number of emerging economies like China, Brazil, and India (Chauvin et al., 2012). Another problem noted by Dumenu and Obeng (2016) and Mwavu et al. (2018) is that depending primarily on subsistence farming for household income puts livelihood security at risk, especially during periods of low crop production, which has an adverse impact on the quantity of food produced and sold for the household's well-being.

The rural population is exposed to unfavourable climatic changes and fluctuation due to its heavy reliance on rain-fed agriculture (Eriksen & O'brien, 2007). Because they depend almost entirely on rain-fed agriculture for their livelihood, rural communities in the Sudan and Guinea Savanna zones are extremely vulnerable to climate change (Dumenu & Obeng, 2016). They are consequently extremely susceptible to the effects of climate change. The participants of the current study also reported new insects (Fruit-fly) in their farms/yards that destroyed their plants and fruits. They asked other farmers about the insects and its name is a “fruit-fly”. In a way, climate change is helping them learn more about farming with the changes that it brings. This is consistent with research by (Skendžić et al., 2021) and Altieri et al. (2015), which indicated that climate is a key driver of pest population dynamics since temperature has a significant and direct impact on insect growth, reproduction, and survival. For instance, milder winters may potentially allow larvae to overwinter in regions where they are now constrained by cold, leading to a significant infestation during the next crop season (Karuppaiah & Sujayanad ,2012).

It is possible for new pests to spread to new places as temperature and humidity conditions change. Pests, for instance, may migrate to higher latitudes from lower ones. Changes in wind patterns may also impact the spread of bacteria and fungi that cause several crop diseases, as well as wind-borne insect pests and pestilential weeds (Coakley et al. 1999). As a result of anticipated climatic changes, invasive species, which can be parasites or disease vectors and include agricultural, forestry, residential, and structural pests, are projected to increase their ranges (Ward & Masters, 2007). This is especially true of insects, which can harm natural biodiversity in addition to significantly reducing crop yields (Altieri et al., 2015).

The results of the current study indicated changes in seasons in terms of their onset and period. They mentioned that the seasons either last shorter or longer than they normally do, especially summer and winter. As a result, this affects their harvesting time as well. Their harvesting time and quantity has also changed. They don’t harvest as much as they did, with one participant indicating that they only had a few bags of nuts as compared to previous years.

They also indicated that they used to get mangoes in June but now they get them in November. With the extreme weathers including drought, farming costs them a lot of money as they have to buy water to irrigate their plants and crops. Their fear is that without water then they cannot farm. Concurrently, Climate change consequences are linked to unpredictable rainfall, extended drought, shifts in cropping seasons, and agricultural yield decline, according to Dumenu and Obeng (2016). These consequences are the outcome of irregular weather patterns caused by climate system changes and variability. The commencement and duration of rainy and dry seasons are affected by erratic weather patterns, which leads to a shift in cropping season. They discovered that the rainy season used to begin in April and end in late September or early October. However, in recent years, the rainy season has begun in June or July, with very heavy rains in September or October, and on rare occasions, November (Shukla et al., 2021).

This was an unexpected event because the dry season typically starts in nations like Ghana in October or November, and there is rarely a period of rainfall during the dry season. Such unpredictability in the weather has an impact on the timing of the seasons, which has an impact on the planting and harvesting/cropping seasons (Dumenu & Obeng, 2016; Shukla et al., 2021). Similarly, Agriculture-related livelihood activities in the communities, according to Yaro (2013), include crop cultivation and dry season gardening. According to the current study, climate change not only had a negative physical influence on farming, but it also affected them emotionally, affecting their mental health. In the current study Climate change has upset, enraged, and worried a lot of participants since the changes it brings are generally unknown, and they don't know when things will get better.

Some participants expressed their displeasure with the changes brought on by climate change. One participant indicated that she was so angry with the less harvest she did

that year as compared to the amount of work and time she put in when she was “sewing”. They also indicated that they get sad over the changes that are brought about by climate change. Not knowing when it will rain and the extreme hot days always scares them. They live in fear of not having enough food on the table or losing more that they put in with no harvests. They also indicated that there is nothing they can do about the situation as it is beyond their control. Despair results as a form of not knowing when things will get better. In a study by (Swim et al., 2011) indicated while there has been a growing focus on the physical health implications of climate change and related environmental changes, the psychological and mental health consequences have just lately been addressed.

Previous research have found that both short-term and long-term climatic and environmental changes have a variety of negative consequences on mental health (Fritze et al., 2008; Bourque & Willox, 2014). Strong emotional reactions like despair, fear, helplessness, and suicidal ideation are examples of these changes, as are a decreased sense of self and identity as a result of loss of place and grief reactions. Other examples include higher rates of violence and conflicts, acute stress reactions, and post-traumatic stress disorders, as well as anxiety and mood disorders, acute stress reactions, and post-traumatic stress disorders (Bourque & Willox, 2014). According to the APA Task Force on the Interface between Psychology and Climate Change and the Intergovernmental Panel on Climate Change's Fifth Assessment Report, people with pre-existing mental illnesses, marginalised populations, communities dependent on local ecosystems, and areas most vulnerable to climate change are expected to experience climate change-related mental health impacts the most severely (Doherty & Clayton, 2011; Cunsolo Willox et al., 2015; Smith et al., 2014).

These findings give support to the current study in the sense that most of the participants in the current study were elderly people with pre-existing medical conditions because of their age. It is only evident that with the constant fear and despair among other emotional distress, they are most likely to suffer more mental disorders in the future like anxiety. This poses an important point brought out by the participants about needing assistance from the government as they cannot help the situation on their own.

They explained that climate change makes them angry and wished that the government could also assist them like they assist smallholder farmers. The other reason that brought about anger is that farming for them costs money as they have to buy water, so they loose money as well and also because the sun is very hot.

6.4 Climate change and human adaptation

The concept of adaptation was related directly to the adaptations that the farmers used in response to climate change. The results of the current study revealed numerous types of adaptations to climate change. They included mulching, using boreholes, reservoirs, planting dry fruits/vegetables, irrigating in the morning and the afternoon, using organic ways among others. In terms of covering plants which they termed mulching, it was the most used adaptation as the setting of the current study is situated in one of the hottest area of Limpopo Province. They indicated that they cover their plants to prevent the sun form ruining them and also to help store the water in the soil much longer.

In support of this, Altieri et al. (2015) found that some late-spring brassica and tomato plantings perform exceptionally well as well as the ability to direct-sow some large-seeded crops, such maize and beans, into cover crop leftovers. Because mulching keeps soil moisture in place, cover crops planted in no-till fields have the potential to both fix nitrogen in the short term and alleviate the consequences of drought over time. By encouraging deep macropores in the soil, cover crops increase soil water holding capacity. More water can permeate throughout the winter because to these deep macro-pores (Altieri et al. 2011).

In Nigeria (Boon & Ahenkan, 2012) and Ghana (Boon & Ahenkan, 2012), rain water collection has also been seen as a common coping method among rural people (Ajani et al., 2013). The volume of storage tanks that families install determines the performance and long-term viability of rainwater gathering techniques. Most farmers found it difficult to implement this method effectively due to widespread poverty in their communities. The farmers either built modest storage tanks or didn't have any at all.

They were reliant on a few huge containers they had on hand. These farmers saved enough water to last a few days as a result of this endeavor (Ofoegbu et al., 2016). These studies support the findings of the current study as it revealed that watertanks (boreholes) are normally used to substitute the absence of rain. The water is used to irrigate sparingly and that still does not help much and it cost them a lot of money as they have to buy the water. This is a result of dry rivers that they cannot fetch water from.

Farmers' acceptance of climatic forecasts in Ceará, northern Brazil, was also determined by access to water storage facilities for irrigation and other technology, according to Lemos et al. (2002). Farmers' assets, resources, and ability to choose among alternative strategies for responding to climate change were also presented (Below et al., 2010). They don't have any water storage capacity for irrigation, for example. In contrast, Ziervogel (2004) claims that subsistence farmers in Lesotho have a variety of alternatives for responding to forecasts, despite having little resources.

Farmers highlighted a variety of adaptation measures they employ, including reducing field crop density, growing drought-resistant crops, and sowing fewer maize and wheat (Below et al., 2010). Planting fruit and vegetables that do not need a lot of water emerged in the current study findings. The participants of the current study indicated that planting fruits/vegetables which can survive in dry seasons helped with the adversities of climate change. These findings were also supported by a study done by Perlis (2009) and indicated that planting drought-resistant crops like watermelons and irrigating using dug-out wells were two of the tactics employed to deal with unpredictable rainfall, according to the study.

Similar findings from research on risks like excessive or insufficient rainfall, drought, and crop failure in rural people were presented in the Chad Republic by Perlis (2009). As a precaution to protect farmers' livelihoods, crops resistant to erratic rainfall and drought problems are grown (Shiferaw et al., 2014; Ofoegbu et al., 2016). Research organizations are promoting a number of enhanced early-maturing or drought-tolerant crop varieties to assist farmers in the area in coping with the region's shortened growing season and frequent dry periods (Fisher et al., 2015).

Tambo (2016) also discovered that shifting planting dates is the most popular adaptation measure, which is used by 95 percent of the sample families. Most farmers have modified their planting schedules to react to climate change problems. Planting dates are routinely varied to avoid vital stages of crop growth colliding with periods of unpredictably high climatic risk. (Tambo, 2016; Nhemachena & Hassan, 2007). Most of the farmers in the current study have adopted this adaptation strategy partly because it is a cheap practice compared to other available adaptation measures. Although this was not mentioned as a definite adaptation strategy in the current study, the participants have indicated that the rain seasons have changed and they wait for the rain first before they can start with their planting. This could be a useful adaptation for the subsistence farmers in the future for Maruleng Municipality.

Participants in the current study used reservoirs as an adaptation strategy as well. They use water from adjacent rivers to fill the reservoirs. They said that this approach has limitations because a lack of rainfall causes the rivers to dry up. Tambo (2016) discovered that the development of water harvesting systems and the usage of irrigation were both part of the same adaptive technique. Farmers in the study region are supported in their production of dry season vegetables by two enormous irrigation dams (Tono and Vea) and a number of smaller reservoirs. A few farmers have also created devices for groundwater irrigation to collect water for supplemental irrigation or dry-season irrigation (Tambo, 2016).

The current study also indicated that being innovative and using organic ways to respond to the climate change proved to be helpful. The participants are passionate about farming so much that they are prepared to do anything to help themselves, no matter how time consuming it takes. One participant indicated that doing things the way it was one in the past is helping. Going organic helped. For example, they indicated that using cow dung as manure helped with soil fertility. According to a multi-country study conducted between 2007 and 2010, farmers' adaptation strategies to climate change include (a) enhancing soil fertility with green manures and organic residues, (b) preserving water and soil, (c) creating mechanisms for the establishment and maintenance of local strategic food reserves, and (d) preserving indigenous fruit trees and other locally adapted crop varieties (Mapfumo et al., 2013).

According to Tambo (2016), farmers adopted a range of coping mechanisms and adaptation strategies, such as seasonal and permanent migrations, new crop varieties, and irrigation techniques, to adapt to climate change. They must, however, increase their capacity to react appropriately to the increasing frequency of shocks in light of the quickly transforming climate. Given that farmers are still working out how to deal with climate change and which strategies work best, this suggestion was also made in the current study. According to Williams et al. (2019), improving farmers' resilience and adaptability is essential for tackling the problems that farmers face as a result of climate change. This is so that resilient farmers can better prepare for, fend off, manage, and recover from shocks.

6.5 Climate change and psychological resilience

With the adversity of climate change, it was evident by the participants of the current study that they are still farming. The participants had a variety of resilience factors as a response to the climate change. The majority of participants kept on farming as it is their passion. When asked why they keep on farming even though there is no rain; the participants responded that it is their love for farming. Passion for farming became the most recurring response as to how do they keep on farming each year despite the adversity of climate change. Another participant indicated that farming is like rearing a baby, therefore the love one gives a baby is the same love they give to farming. Edwards et al. (2009) outlined

the same reasons as to why farmers in their study kept on farming. They indicated that farming families are under increasing pressure because the impact of the drought on farm sustainability. It is was indicated for many farmers, a farm serves as an income, a lifestyle, and a home; however, the only training farmers have is on how to efficiently and effectively run a farm. Conclusions can be made that farming is a whole livelihood for a lo of subsistence farmers.

The participants of the current study reside in a rural area of Maruleng Municipality with limited resources, like educational opportunities, job opportunities and ultimately, the residents stick to one thing that they know how to do well, which in this case was farming. They indicated that there is nothing they know more except for farming as they grew up farming and it was a generational wealth for them. These findings were backed up by a study that found that additional education levels in rural farming communities are low, posing a barrier to youth seeking jobs outside of the farm. Farms are typically passed down through years and serve as a legacy for future generations, so the possibility of losing one causes a lot of anxiety for all members of agricultural families (Caldwell & Boyd, 2009; Bezu & Holden, 2014).

Although the participants did not know when the situation will change: as to when there will be rain, they kept on hoping that the next day will be better and maybe there will be rain, even if it is just some drizzle. They indicated that tomorrow is unknown, therefore they will not stop farming in case there is rain. The Asian Cities Climate Change Resilience Network highlights the significance of flexibility at a personal, organisational, and systemic level, with each level able to respond and contribute to any circumstance, as well as to shifting and unforeseen situations' in this example (Taylor, 2013). In this case, resilience thinking would urge practitioners and planners of adaptation to make plans based on anticipated climate changes as well as failure scenarios and redundancy. Although this study does not necessarily indicate hope as a resilience factors, the mention of flexibility and consideration of failed scenarios assist the farmers in preparing them for any outcome they receive.

Either there will be no rain or there will be rain on days when they can cultivate. This aids in not completely ceasing farming, but in being resilient enough to hope for the best while preparing for the worst. Most of the participants are elderly citizens who lived for a longer time and have lived in the times before the current climate change. Although this is a serious change, they have learned to cope. They have successfully adapted through courage which helps them to wake up in the morning to farm at the same dry areas with the hope of a better outcome. Most of the participants were enthusiastic about what each day will hold for them. Their enthusiasm has built into perseverance as to they refuse to abandon the passion for farming. These traits or resilience factors could be attributed to the fact that most participants are elderly people and have indicated that although they have experienced worse in their lifetime, it is better to have a positive outlook on life and the future. Mancini and Bonanno (2011) previous research found that a variety of person-centered traits (such as a child's temperament, personality, and coping mechanisms), demographic factors (such as male gender, older age, and higher levels of education), and socio-contextual factors (such as supportive relationships and community resources) all play a role in fostering resilience.

In a study, Smith et al. (2012) investigated at people's perceived resilience to shifting environmental conditions. They suggested that knowledge about localized threats posed by climate change, a readiness to learn about and make plans for the likely effects of changing environmental conditions, and broad assessments of human adaptive abilities make up an individual's resilience. A person's capacity to endure adversity and flourish over the long term has also been linked to personality traits including modesty, humility, and psychological fortitude (Caldwell & Boyd, 2009). To achieve a decent work-life balance in an environment where job and home life cannot be separated, positive coping techniques must be adopted (Leipert & Reutter, 2005).

In the current study, acceptance was mentioned as one of the resilience factors that helped the farmers to cope and adapt to climate change. They mentioned that they have accepted that climate change exists and is negatively affecting their livelihood. However, accepting the situation helps them with minimising the traumatic effects of climate change. As participants answered and explained their responses, acceptance overlapped to tolerance. The overlap was explained when participants indicated that there was physically nothing that the can do that can subside climate change immediately, therefore tolerating the situation is how they can move forward. Farmers' ability to accept as a resilient element and use climate prediction information is determined by farm characteristics on the one hand, and by the individual farmer's temperament on the other, according to Below et al. (2010). There is a paucity of research on the elements that influence acceptance. In a case study in Burkina Faso, Roncoli (2006) and Roncoli et al. (2009) discovered that farmers' perceptions of the potential of climate events, as well as their capacity to use climate forecasts, are influenced by their experiences. However, Archer (2003) discovered that gender is a determinant in farmers' ability to accept climatic forecasts in South Africa.

In their study, (Oyo & Kalema, 2016) reinforced the issue of tolerance by stating that subsistence farming has always been a susceptible enterprise due to a variety of factors. Farmers must persevere as a result of their resilience and a variety of coping techniques as these circumstances spiral. The most important aspect is that for successful subsistence farming to occur, government and non-governmental organizations (NGOs) should provide external assistance to farmers' self-provisioning projects. As a result, the type of external assistance provided varies each farming community (Oyo et al., 2018). The participants of the current study are in a well cooperative community and exist closely with each other. This sense of community help them to give support to each other during tough times. This support comes helpful in the climate change times as they talk about the effects of climate change on their lives and their farming.

They discuss adaptation measures like contributing to be able to use boreholes and sharing a tractor to farm. Being able to talk about their loss of harvests have been helpful in that it helps them to not give up. (Ofoegbu et al., 2016) supported this findings when they also found that there was a significant association between assistance from neighbours and expression of difficulty in coping with climate variability and change.

Neighbours and other social support networks play a crucial role in helping farmers adapt to the problems posed by climate change in their communities. The characteristics of people's social networks and their socio-psychological reliance on neighborhood resources can have an impact on their resilience, according to (Smith et al., 2012). By gaining a greater knowledge of how people's social networks and social-psychological interdependence affect how they perceive their ability to adapt to shifting environmental conditions, decision-makers can examine policy alternatives that improve social resilience (Smith, 2011). The resilience factor of social support was also acknowledged by Boucher (2018), who claimed that in rural areas like Maruleng Municipality, characteristics like a positive outlook, independence, the development of local resources, knowledge, and social support help farmers adapt to their circumstances. The resources currently accessible to rural farming communities are increased by external resources like friends and family.

When dealing with stress, several studies show that rural communities rely more on community values, collective coping mechanisms, and social unity than urban inhabitants, who rely more on individualistic values and coping strategies (Caldwell & Boyd, 2009; Sherrieb et al., 2010). Social networks and support; a positive attitude; learning; early experiences; the environment and lifestyle; infrastructure and support services; welcoming differences; beliefs; and leadership are among these. In the process of establishing resilience, these components include interactions between persons, communities, infrastructure, the environment, and the economy.

These findings corroborate current study findings by recognising environmental elements, infrastructure, and support services as factors that enhance resilience, and they add to the inadequate evidence base for those desiring to increase community resilience (Buikstra et al., 2010). The participants also mentioned that they are resilient because farming is their livelihood, they farm to feed their families and for survival. One participants indicated that if they don't farm then it means they will starve and they have to feed their families. Morton (2007) discovered that subsistence farmers, especially pastoralists, held crucial resilience qualities such as indigenous knowledge as a means of maintaining their resources and a long-term view of farming as a source of income.

The participants had different belief systems which included Christianity and cultural beliefs. As they farm without rain or any sign of rain, they pray to God for mercy. They indicated although tomorrow is unknown, God knows all and they trust in him to change the situation. One participants with a sense of humour indicated that God will feel sorry for his animals and provide rain and in turn the farmers will benefit from that rain as well. From their notions they indicated that the youth and foreign nationals are cutting "sacred" trees in the river. Their cultural beliefs sustain them in a way that preserving cultural ways in terms of living like the old days keeps them strong. They also make use of Indigenous knowledge system by looking at the stars to see when there will be rain. This method sustain them and indicate to them when they can farm in larger quantities for greater harvesting. Similar to this, Douglas and Wildavsky (1982) stated that cultures with similar values and beliefs create their own skewed perception of the natural world, which affects how people perceive and react to risk.

According to Adger et al. (2013), farmers in the South Pacific integrate existing knowledge about culture with scientific information about climate change in ways that hinder adaptation. Local customs and expertise can help communities gradually adapt to climate change, but they may have little value when civilisations experience abrupt or nonlinear changes (Adger et al., 2013).

6.6 Culture and climate change

From the first participant, they mentioned how things used to be done in the olden days by following their culture. Probing for this statement outlined that the participants in some ways attributed climate change to culture. They indicated that as they go to the rivers nowadays, they don't find the trees that used to be there in the rivers. According to them this is what caused climate change because those sacred trees stored water in their roots. As a result, the rivers are also dry because of the absence of those trees. Some participants indicated that the youth don't follow the olden ways or culture and do not listen when told not to cut those sacred trees. They also mentioned that the other people who cut those sacred trees are foreigners as they don't know their indigenous uses. The participants also mentioned they use their indigenous knowledge in checking when they will get rain by looking at which side of the moon the stars are mostly located. These findings were supported by the following previous studies in the literature:

According to Ajani et al. (2013), there is a wealth of local knowledge based on weather and climate prediction. Farmers in Sub-Saharan Africa have a plethora of expertise, according to a research. These farmers have created complex weather-gathering, forecast, interpretation, and decision-making systems. Farmers benefit greatly from these climate forecasting tools in terms of managing their risk. Farmers are known for making decisions based on local climate forecasts and planting schedules based on complicated cultural weather models (Ajani et al., 2013). According to (Ajani et al., 2013), the value of indigenous knowledge has been acknowledged in the planning and execution of sustainable development initiatives, but little has been done to formally incorporate it into a climate change adaptation strategy. Indigenous knowledge is frequently the most important factor in decision-making in rural areas. Indigenous knowledge is essential for improving the lives of rural people in addition to the culture in which it occurs (Nyong et al., 2007).

The knowledge set is impacted by the observations and experiments of previous generations, and it gives an innate connection to one's surroundings and environment. As a result, indigenous knowledge is transportable, and it helps farmers connect with their environments and the changes that occur within them, such as climate change (Guthiga & Newsham, 2011). Culture is also significant in comprehending climate change mitigation and adaptation, according to (Adger et al., 2013). It also plays a role in framing climate change as a societal problem.

The idea of climate change has an impact on cultures since they are dynamic and reflective. Understanding the origins, implications, and impacts of climate change on people is essential (Adger et al., 2013; Hulme, 2015). Cultural perspectives can be used to explain why different populations have different reactions to the same environmental problems. According to earlier research, not all cultures and worldviews are equally receptive to knowledge on climate change (Adger et al., 2013; Persson et al., 2015). The Pueblo Indians may have used a variety of measures to adapt to drought, but as droughts grew longer and more severe, these tactics proved ineffective, leading to famine, social unrest, and an increase in migration. For the St'át'imc people of British Columbia, fluctuations in the timing, quantity, and quality of sockeye salmon are so significant that, despite traditional knowledge, there doesn't seem to be an effective adaptation to manage the effects of these changes on St'át'imc culture (Jacob et al., 2010).

6.7 Concluding remarks

The main aim of this study was to explore the psychological resilience factors of subsistence farmers in Maruleng Municipality. The study was undertaken around four objectives which were:

- To investigate subsistence farmers' notions of climate change and adaptation.
- To determine the psychological resilience factors influencing the farmers' adaptation the climate change.
- To determine strategies that the farmers use to cope with climate change.

- Based on the farmers' notions of climate change and adaptation, and the associated resilience factors, develop a psychological explanatory model on climate change adaptation by subsistence farmers.

In order to achieve this objective the current study utilised a qualitative approach through grounded theory as an overall research method, specifically using semi-structured interviews to obtain data on psychological resilience factors form the subsistence farmers of Maruleng Municipality. The results of the current study were presented and discussed looking at adaptations, psychological resilience factors and culture in relating to climate change. Furthermore these four pillars explained the subsistence farmers' notions of climate change, their thoughts on causes of climate change, how they feel about climate change and how they adapt to and cope with climate change. The results also indicated that the farmers have limited knowledge on what climate change is and what causes it. Most of their responses were non-scientific but sensible enough to know what they are dealing with.

In order to enhance the understanding of and the extend of the impact of climate change better, the researcher asked the farmers the impacts they are seeing and experiencing from climate change. They mentioned, extreme weathers which include hot days and less rainfall and changes in seasons. The findings also showed that the farmers were affected emotionally due to the adversities of climate change, therefore they have learned to adapt through several adaptation strategies including mulching, changes in irrigation time slots and being innovative. The resilience factors that emerged from the study were passion for farming, hope, enthusiasm, courage, acceptance or tolerance, livelihood and their belief systems. The results in this study therefore offer support to the current literature on agreeing that climate change is one of the most world problems that exists and unfortunately farmers are most vulnerable to climate change adversities. With those adversities, the farmers had to adapt and develop resilience factors to overcome the adversity. It is worth noting that this study is not without caveats.

Overall, some of the weakness include a small sample size which will result in non generalisation of the results to a larger scope even though the aim of the study was not to generalise the results but offer a blueprint or guide for future research and a model which will help assist the policy makers in understanding climate change and resilience factors in a rural context.

Significantly limited access to climate change information in the ecological zones of Maruleng Municipality proved to be a limitation. However, the researcher take comfort in the fact that the participants of the current study lived long enough to make comparisons of the past and current climate. Their lived experience of climate change provided sufficient data for the study. At the local level (households, rural communities, districts), few studies have addressed the social dimensions of climate change consequences, susceptibility, and adaptation methods (Gentle & Maraseni, 2012). The current study needed to look at the social components of climate change susceptibility, as well as the underlying socio-economic factors that influence how farmers react to and cope with climate change impacts in their communities. Assessing community impacts, vulnerability, and adaptation is critical for developing policy measures that address specific community needs while avoiding one-size-fits-all solutions that are often the product of national scale climate change assessments (Antwi-Agyei, 2012; Dumenu & Obeng, 2016). This came as a recommendation from the current study as it was observed form the participants that they felt neglected by the government and policy makers as they are small scale farmers and are not included like commercial farmers.

Looking at the socio-economic factors of the local farmers like the current study setting is of paramount importance as the results indicated the role or lack of thereof of the government in assisting the subsistence farmers. Understanding what the local farmers are going through in terms of resources, adaptation and resilience factors will assist in the future research and ultimately policy makers. Lastly and most importantly, the researcher acknowledges the uncertainty of climate change projections in the current literature that remain as limitations in the current study in the following ways.

Most importantly, it is likely that future temperatures will differ from those that are now anticipated; in order to achieve a variety of plausible climatic scenarios, one must use multiple models, which only serve to advance understanding but do not yield precise forecasts (Kurukulasuriya et al., 2006).

CHAPTER 7
SUMMARY, LIMITATIONS AND CONCLUSIONS

7.1 Introduction

This chapter will conclude the study by summarising the chapters discussed in this document. The summary will include the key research findings in relation to the research aims and questions and discussing the value and contribution thereof. Throughout this chapter, the researcher will reflect on each chapter, discuss implications and also make recommendations. It will also review the limitations of the study and conclude the study.

7.2 Summary

7.2.1 Chapter 1: Introduction

The aim of the present study was to explore psychological resilience factors associated with climate change adaptation by subsistence farmers in a rural farming community in Maruleng Municipality. The objectives of the study were:

- To investigate subsistence farmers' notions of climate change and adaptation.
- To determine the psychological resilience factors influencing the farmers' adaptation the climate change.
- To determine strategies that the farmers use to cope with climate change.
- Based on the farmers' notions of climate change and adaptation, and the associated resilience factors, develop a psychological explanatory model on climate change adaptation by subsistence farmers.

Chapter 1 also discussed the background to the study, outlined the research problem, defined concepts and also gave a road map of the study in terms of the number of chapters discussed. Although chapter 1, which is the introduction, gave a road map to the study, the researcher rewrote this chapter last amongst all the chapters as a lot has changed since the proposal stage.

The other reason was that as the literature was reviewed and results were presented, the gap in the research area became clearer to the researcher which resulted in rewriting the research problem and also giving a sound background to the study as a lot was found from previous studies. The researcher thought the chapter will take a few hours to complete, however with going back and forth with guidelines on how to structure a good introduction and comments from the supervisor, this chapter took a lot more time than anticipated. The researcher appreciated the supervisor's comments, specifically on the background to the study and the research problem in the sense that the scope of writing them expanded by critically engaging the previous studies in relation to what the current study aimed at finding out.

7.2.2 Chapter 2: Literature review

The purpose of this chapter discussed relevant literature guided by the following topics: notions of climate change, the impact of climate change on farming and culture and climate. An overview of climate change and human adaptation and climate change and psychological resilience factors were also discussed. The research reviewed indicated that the notions of climate change by farmers in general had a variety and wide understanding. Some notions are informed by the culture the farmers are part of, which in turn also have an impact in how they adapt to climate change with the resources or lack of thereof. Along with this, it was also clear that the field of psychological resilience factors on climate change is still limited, and continues to be problematic. It is therefore in this regard that psychological resilience factors by subsistence farmers still needs to be studied further and more.

Chapter 2 has always been the least favourite chapter to write for the researcher as the researcher's weakness is to be too brief when writing. However reading previous studies not only helped in getting relevant data for the study, but also helped in the best ways to structure the literature review per each topic. The researcher also followed the most important principles when discussing literature review which are always emphasised by the researcher's supervisor.

The principles include critical review of the literature, consistency and coherence. In the famous phrases that the researcher's supervisor always use "let the paragraphs speak to each other" and "let's hear the researcher's voice in the review", the researcher tried her best to apply these principles during the discussion of the literature review.

7.2.3 Chapter 3: Theoretical Framework

This chapter outlined the theoretical framework, specifically the Social Ecological Theory of Resilience, as well as the relevance of the theory to the present study. Four concepts were presented to assist guide both research and theory development in resilience as a social ecologically dependent concept: decentrality, complexity, atypicality, and cultural relativity. Individual attributes linked with coping under adversity are engaged within this framework to the extent that social and physical ecologies have the capacity to assist processes that protect against risk and promote positive growth. Paying attention to these four principles could also explain a lot of the variation in why some farmers thrive while others fail. The researcher identified this theory during the proposal stage, however less was known by this theory at that stage. The researcher did more reading on the theory from previous studies but still lacked understanding. The original document of the theory was the one which gave more clarity on what Michael Ungar's theory is about and why it was relevant for the current study. The broader relevance of the theory to the current is because the study touches on the less researched discipline of psychology called environmental or conservation psychology. This discipline emphasises that what happens in the environment affects human being psychologically, either positively or negatively. This is in support with Ungar when he outlines that with the relevant resources or lackof thereof, individuals can overcome ant adversities.

7.2.4 Chapter 4: Methodology

This chapter outlined quantitative and qualitative as two research approaches mostly used in conducting a scientific research. Qualitative approach was discussed as an approach of choice for the current study. The philosophical foundations for using grounded theory as a research method and as a study design were also discussed. The processes in the research method were detailed, as well as the quality standards used in the study. The chapter concludes with a discussion of the ethical problems that influenced the researcher's decision to perform this study. This chapter took the most time to write as compared to all the chapters. Firstly, the choice of the research method was new to the researcher, which resulted in an in-depth reading and analysis of the research method. Grounded theory as both the research method and the research design was too complex for the researcher to understand and discuss. Secondly, the researcher was not initially aware that there are different “types” of grounded theory. During intensive reading of grounded theory, the researcher discovered that there is the “Glassian classical grounded theory”, the “Straussian grounded theory” and “Charmaz grounded theory”. It was a difficult choice to make amongst these three versions as they seemed to be more confusing with every article read. One important point the researcher learned with this chapter was to read as much books on the methodology as compared to reading articles.

The researcher initially read more articles than books on the methodology and the confusion came from the adaptation made in each article as authors were adapting the grounded theory to their own studies. Although this was a disadvantage at first, it helped later on when the researcher also adapted grounded theory to her own study after choosing to use mostly Straussian and Charmaz grounded theory. The researcher also borrowed few principles from the Glassian classical grounded theory. The methodology not only had to be well written but the researcher had to thoroughly understand it in order to be able to apply it in the field. One of the most important principle of grounded theory is collecting data and analysing it simultaneously.

In practice, this meant that after one interview, the researcher had to analyse that data so that the analysis can inform the next participant. However, memo writing as the other important principle of grounded theory helped in ensuring that data was collected and analysed simultaneously. This needed the researcher to be both attentive and quick in making initial analysis during and after each interview. This was also a challenge for the researcher as she had limited time in the field and was staying far from the participants. However this was addressed by booking a guest house closer to the villages of the participants. One of the disadvantages of being a sole researcher is that field work can be lonely as one can be based in a foreign area for certain periods of time. However the time alone was more than important in completing the data collection process. The researcher appreciated that lessons learned during the writing and application of this chapter.

7.2.5 Chapter 5: Presentation of results

This chapter outlined the findings of the study on psychological resilience factors associated with climate change adaptations in Maruleng Municipality. Based on a qualitative analysis, it was concluded that subsistence farmers in a rural context possess several resilience factors to overcome the adversity of climate change. The resilience factors included from the findings are passion, hope, enthusiasm, courage, livelihood, Christianity and cultural beliefs. The results also indicated that although the farmers are resilient, the adaptation strategies serve as foundation to foster and maintain that resilience. These adaptation strategies are also influenced by the resources in their environment. The presentation of results were presented by following the data analysis steps. This chapter was both stressful and interesting as the researcher struggled with how to present the results. Although the researcher was following the steps of grounded theory analysis (open, axial and selective coding), it was not as easy to follow the same sequence when presenting the results.

The researcher wanted to give a clear and more understandable presentation of the results to give the reader a “narrative” of how each result came about. This also added more time on this chapter as it included a lot of back and forth from between the analysis “rough work” and the methodology chapter to make sense of everything. Again, as the researcher’s supervisor always say: the methodology and results chapter should talk to each other and are the core of the study. The researcher strived to have flowing story between the two chapters.

7.2.6 Chapter 6: Discussion of results

This chapter discussed the study findings in relation to the existing climate change literature. The rsearcher discussed the previous studies that were either in agreement or disagreement with the results of the current study. The researcher made discussions looking at the notions of the climate change by subsistence farmers, the impact of climate change, culture and climate change, adaptations and psychological resilience factors. Most studies agrred with the current study’s findings with a slight difference. This chapter was an intersresting chapter as the researcher saw similarities and differences between the current study and the existing literature. It gave the researcher as small sense of validation when the current study had some similar results as the literature and also new findings that emerged from the current study. That helped with closing the small gap identified in the topic area and will also help with reccommendations for future research in the field.

7.2.7 Chapter: Conclusions

This chapter summarised the current study and included the limitations, contributions by the cyrrent study and recommendations. The researcher also included reflections with every summay of each chapter.

7.3 Implications of the study

The findings of this study indicate that strengthening agricultural families' adaptive capacities and psychological coping mechanisms is necessary to boost their resilience in the face of climate change. Both an individual and a community should do this. Governments should think about how to invest in rural communities' social capital and recognize it as a potential resource that can help agricultural families adapt to and endure the effects of climate change. Farmers may benefit more from financial support for current community initiatives (such as organic farming and the dissemination of indigenous knowledge) and collective coping mechanisms (such as social support groups and the purchase of trucks for use by the farming families) than from giving individual farming families insufficient funding.

7.4 Recommendations of the study

- Since the socioeconomic status of the farmers was very low, improving the access of support measures to be available for farmers would be of great assistance in improving adaptation measures.
- Counseling for the farmers is important for improvement of their mental health status and to get relief from the distress of climate change. Training the farmers about the methods of farming in difficult climatic circumstances will serve as a long-term remedy to increase the difficulties among farmers.
- Based on the findings of this study, further research is needed to better understand subsistence farmers' reasons, motivations, and change processes farmers go through in their daily farm management to progressively build resilience.
- The agricultural sector is facing an increasingly uncertain and changing context, as well as new challenges due to climate change.

Psychological resilience models such as this one, potentially combined with other approaches (like resources from the government), could help identify factors that will allow farmers to continue their agricultural activity over the long term successfully. Thus, for resilience, it is not so much about what a farmer can do to enhance their resilience only, but about under which conditions a farmer can do anything to enhance it.

- Future research might focus on how to better understand the pathways of resilience, identify the reliable predictors, and offer suitable treatments to the most vulnerable farmers and communities in order to comprehend the consequences of these findings. The study of resilience in the face of natural disasters has a bright future, despite the fact that there may be some inquiries from other researchers (such as the one the researcher asked, "Why climate change in psychology field").
- Ultimately, this study recommend a collaboration for a holistic view between natural and social scientists in studying natural disasters like climate change as they are experience by human beings, especially subsistence farmers in this case.

7.5 Contributions of the study

7.5.1 Contributions to the field of Psychology

The current study was exploring psychological resilience factors by subsistence farmers in response to climate change. Two disciplines covered in this study are psychology (conservation/ environmental) and natural sciences (agriculture). Although climate change is predominately researched in the natural science spectrum, psychology as a discipline cuts across many other disciplines. Human beings are either affect or are affected by the environment. In this current study, farmers have an impact on the rise of climate change and they are also affected the impacts of climate. Ultimately they have to come up with solutions (adaptations) to deal (cope) with climate change. As the world is experiencing climate change which results in many effects such as increasingly unstable weather, human being’s mental health is at risk.

Psychologists indicate that stress, anxiety, depression and post-traumatic stress disorder will increase as climate change's physical impacts accelerate, as many scientists predict. This study can assist in understanding the interactions of farmers with the world around them. It will also contribute in areas as interesting as human responses to natural disasters, conservation, environmental perception and cognition to stress. This study could contribute in to the field of psychology by conducting research on areas that motivate people to change their behavior, make awareness on environmental solutions, uncover why people may not adopt positive behaviors and help individuals to live sustainable lives. This study can help other farmers (or future farmers) to assess the resilience of their farms (or desired farms), which is crucial for their daily management choices and for achieving their goals.

7.6 Limitations and strengths of the study

Several limitations in the methodology to manage the qualitative data for this study were identified.

- Firstly getting the envisaged number of participants of 30 was the limitation encountered when conducting this study.

The researcher initially wanted to have 30 participants as she thought it will be a more acceptable number for a PhD study and to also be able to answer and successfully address the main objective of the study which was to develop an explanatory model. The present study used theoretical sampling technique which made it difficult to get the envisaged number as theoretical saturation was reached at the 15th participant. However, in following this technique, the credibility of the data was adhered to and the data was sufficient to develop the model. The sample size for the present study was small but it is an acceptable size for a qualitative research.

Related to this, participants were all from the same rural area of Maruleng Municipality, Limpopo Province. Due to the diversity of rural populations, the outcomes found in this study are not generalisable to other rural communities. Therefore, further research is required to explore the issues of subsistence farmers in other areas of Limpopo Province.

- Secondly the inability to simultaneously analyse the data in an iterative manner to inform the interview process and time constraints that limit the methodology.

It was difficult to simultaneously collect and analyse the data with the limited time per day in the field, also looking at the availability of the participants. Timelines were also difficult to manage given the magnitude of the study. Memo writing and expanding data collection period assisted in making this process less difficult.

- Finally translating the interview data from Sepedi to English

The translation of the interview data from Sepedi to English also has limitations since oftentimes the participants' true meaning and emotions are lost, especially when talking about sentiments and emotions. Nevertheless, hiring a language specialist allowed us to get over this restriction.

Several strengths of this study which were noteworthy are intuitive appeal, fostering creativity and potential to conceptualise. This study as it used grounded theory, had an intuitive appeal in the sense that it permitted the researcher to be immersed in the data as a novice researcher to know more about the research area and the methodology on how to get the relevant data needed. Grounded theory, according to Charmaz (2006), gives beginning researchers like myself the necessary guidelines and "heuristic devices" to "get started, stay involved, and finish the study." The second strength enabled the researcher to be imaginative throughout the study, particularly when gathering data, analysing it, and presenting the findings. In essence, it permitted the researcher to use imaginative, inductive methods to generate meaning from the data and analysis. It enables new discoveries to be drawn from the data (Jones, Kriflik & Zanko, 2005).

The last strength of this study was the potential for the researcher to conceptualise. This strength was practiced especially on the development and presentation of the theory (model). Making meaning from the data through codes and categories is a major strength of any research, especially with grounded theory as construction of analytic codes and categories are from the data and not from preconceived logical literature. This specific approach to theory development is derived from the “continuous interplay between data collection and data analysis (El Hussein et al, 2014).

7.7 Conclusion

From this study, the participants have shown that they take action to increase their personal resilience, whereby an individual benefits from what they have and use as a support base in difficult circumstances. They have demonstrated their ability to cope with life experiences. They have skills which have enabled them to respond flexibly and effectively to life’s challenges over the years. One of the key external sources of resilience is the network of relationships. The participants in this study highlighted how their fellow subsistence farmers have been helpful by just discussing the current climate difficulties together and sharing about their harvest losses. The findings of this study also necessitate policy action to improve the lives of subsistence farmers of this community by providing basic resources like running water.

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APPENDICES

Appendix 1(a): Interview guide (English version)

Objective	**Interview questions**
1. To investigate subsistence farmers' notions of climate change and adaptation	a) I would like you to explain, according to your understanding and experiences, what climate change is?
	b) As a subsistence farmer, I would like you to share with me your understanding of events and factors that could have led to climate change?
	c) I would also like you to share with me your perception of climate change?
2. To determine the psychological resilience factors influencing the	d) Looking at the condition of climate change, what are the psychological implications of the current situation?

farmers' adaptation the climate change	e). May you explain to me the psychological resilience factors that help with your adaptation?
3. To determine coping strategies	f) Please share with me the ways in which you cope with climate change
	g) Please tell me how you think climate change could be managed?

Appendix 1(b): Potšišo Tlhahli (Sepedi Version)

Maikemišetšo	**Dipotšišo**
1. Go nyakišiša ka phetogo ya leratadima go balemi ba dijo tšeo di lekanetšego	a) Hlalosa gape, go ya ka kewšišo le maitemogelo a lena gore phetogo ya leratadima ke eng?
	b) Bjale ka molemi wa dijo tšeo di lekanego, le ka ntlhalosetša kwešišo ya lena ka dilo tšeo di ka tlišago phetogo ya leratadima?
	c) Le ka hlalosa kwešišo ya lena le ka mokgwa wo le bonago phetogo ya leratadima ka gona?
2. Go hwetša dikokwane tšeo di huetšago kamano le kgotlelelo ya monagago ya balemi mo phetogong ya tša leratadima	d) Ge re lebeletše maemo a leratadima le phetogo ya lona, dikhuetšo tša monagano tsa go tsea sepheto ge o lebetse seemo ga bjale?
	e) Le ka ntlhalosetša ka kgotlelelo tša dikokwane tšeo di ka go thušago mo go kgotleleleng le go tieng monagano?
3. Go hetšwa tharollo ya sebakanyana	f) Ka kgopela abelana le nna ka ditsela tseo o kgonago ka tsona ka phetogo ya leratadima?

	g) Ka kgopelo mpotse ka mokgwa wo o naganago gore phetogo ya leratadima e ka laolwa ka gona?

Appendix 2(a): Participant consent letter (English version)

Department of Psychology

University of Limpopo (Turfloop Campus)

Private Bag X1106

Sovenga, 0727

Date: _____

Dear participant

Thank you for demonstrating interest in this study that focuses on the Psychological resilience factors associated with climate change adaptation in a rural community in Maruleng, Limpopo Province.

Your responses to this individual interview/focus group interview will remain strictly confidential. The researcher will not attempt to identify you with your responses to the interview questions or to disclose your name as a participant in the study. Please be advised that participating in this study is voluntary and that you have the right to withdraw your participation at any time.

Kindly answer all the questions and reflect your true reaction .Your participation in this research is very important .Thank you for your time

Sincerely _____ _____

Kgopa Bontle PhD Student Date

_____ _____

Prof T Sodi Supervisor Date

Appendix 2(b): Participants consent letter (Sepedi version)

Depatemente ya Psychology

Unibesithi ya Limpopo (Turfloop campus)

Private Bag X1106

Sovenga

0727

Letšatšikgwedi _____

Dumela motšea karolo nyakišišong

Ke leboga ge o bontšhitše kgahlego go tšea karolo nyakišišong ye e lego Dikokwane tšeo di amanago le kgotlelelo ya monagano le phetogo ya leratadima meetseng ya magaeng, masepaleng wa Maruleng profenseng ya Limpopo.

Diphetolo tša gago mo go nyakišišo ye di bolokegile. Monyakišiši a ka se leke go go lebanya le diphetolo tša gago le dipotšišo tša nyakišišo goba a tšwetša leina la gago nyanyeng bjalo ka motšea karalo mo nyakišiong e. Le lemošwa gore go tšea karolo mo nyakišišong e ke boikgethelo ebile le nale tokelo ya go tlogela go tšea karolo nako efe goba efe.

Araba dipotšišo ka nnete yeo e phatlaletšego. Dikarabo tša gago di bohlokwa ebile di bolokegile.

Ke leboga nako ya gago

Wa gago ka mehla

…… …….

Kgopa Bontle

Morutwana wa PhD Letšatšikgwedi

……. ……..

Prof. T. Sodi

Mohlahli Letšatšikgwedi

Appendix 3(a): Consent form (English version)

CONSENT FORM

I _____ hereby agree to participate in a PhD research project that focuses Psychological resilience factors associated with climate change adaptation in a rural farming community in Maruleng Municipality, Limpopo Province.

The purpose of the study has been fully explained to me. I further understand that I am participating freely and without being forced in any way to do so. I also understand that I can withdraw my participation in this study at any point should I not want to continue and that this decision will not in any way affect me negatively.

I understand that this is a research project, whose purpose is not necessarily to benefit me personally. I understand that my details as they appear in this consent form will not be linked to the interview schedule, and that my answers will remain confidential.

Signature: _____

Date: _____

Appendix 3(b): Participants consent form (Sepedi version)

Letlakala la tumelelano leo le swanetšwe ke go saenwa ke motšea karolo nyakišišong

Nna _____ ke dumela go tšea karolo Porojekeng ya nyakišišo ya PhD: Dikokwane tšeo di amanago le kgotlelelo ya monagano le phetogo ya leratadima meetseng ya magaeng ya temo , masepaleng wa Maruleng profenseng ya Limpopo.

Ke hlaloseditšwe go tlala seatla ka ga maikemišetšo magolo a nyakišišo ye. Go tšea karolo ga ka ke boithaopo nyakišišong ye, ka fao nka tlogela nako efe kappa efe. Ke kwešiša gore se ke nyakišišo dithutong, ebile gago seo ke se humanago go tšea karolo nyakišišong ye. Ke kwešiša gape gore seo ke se bolelago mo, se tla šomišwa fela ke bao ba dirago nyakišišo ye fela, ebile tsebo yaka e bohlokwa. Nyakišišo ye e tloga e bolokegile.

Mosaeno: …….

Letšatšikgwedi: ……..

Appendix 4: Ethical clearance certificate

University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email: anastasia.ngobe@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE CLEARANCE CERTIFICATE

MEETING:	**27 November 2018**
PROJECT NUMBER:	**TREC/213/2018: PG**
PROJECT:	
Title:	An exploratory study of psychological resilience factors associated with climate change adaptation by subsistence farmers in a rural community in Maruleng, Limpopo Province.
Researcher:	BP Kgopa
Supervisor:	Prof T Sodi
Co-Supervisor/s:	Dr C Burman
	Prof K Ayisi
School:	Social Sciences
Degree:	PhD Psychology

PROF TAB MASHEGO
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:
i) **Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee.**
ii) **The budget for the research will be considered separately from the protocol.**
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

Finding solutions for Africa

Appendix 5: Language editor certificate

ShazzRams
Translation and Transcribing
CK No: 2017/264649/07
Tax Reference No: 9478609184
079 602 2628 | 072 303 1640
shazzshamain@gmail.com
A58 Cabrief Section
Glen Cowie, Limpopo
1085

TO/FOR: Bontle Kgopa

01 March 2022

Dear Sir/Madam

SUBJECT: EDITING OF THESIS

This is to certify that the thesis entitled ' An exploratory study of psychological resilience factorsassociated with climate change adaptation by subsistence farmers in a rural community in maruleng, limpopo province' by Bontle Kgopa has been copy-edited, and that unless further tampered with, I am content with the quality of the thesis in terms of its adherence to editorial principles of cohesion, clarity of thought and precision.

Kind regards,

Mmagonkahloleng Makua