Cost Implication of Drought on Operations of Commercial Farm Businesses in Cape Winelands District, Western Cape

By

AKHONA NTSHEYIYA

Thesis submitted in fulfilment of the requirements for the degree.

Master of Management Accounting
in the Faculty of Business and Management Sciences
at the Cape Peninsula University of Technology

Supervisor: Dr H Benedict
Co-supervisor: Prof J. Dubihlela

District Six, Cape Town
August 2023

DECLARATION

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

Signed **Date**

ABSTRACT

In Africa, agriculture is the main source of food as well as livelihoods. Among the factors that affect the agriculture industry is drought which is a widely known and is a costly natural hazard caused by the climatic change. Unlike other natural hazards that are climate related, droughts are usually long in duration and may cover a large geographical region. In South Africa, the Western Cape is one of the provinces which is prone to droughts. This is of concern as commercial farming is the greatest source of food for the Western Cape population.

Drought severely affects commercial farming, resulting in a substantial production decrease. This crisis also triggered heightened demand and elevated prices for goods, a decline in exports, increased unemployment due to job losses, and the shutdown of unprofitable businesses. One of the key reasons for commercial farms being so drastically affected is the lack of strategies on how to deal with drought effectively. Stemming from the foregoing, the problem statement of this research is "The drought has drastically affected commercial farms due to inadequate strategies to mitigate the negative cost effects of draught on operations of commercial farms in Cape Winelands District, Western Cape".

This study aimed to explore the effects of drought with regards to the cost implications and operations of commercial farms in Cape Winelands District, Western Cape. These are the objectives:

- To assess the production cost effects of drought on commercial farms in the Cape Winelands District, Western Cape.
- To assess the significance of drought on commercial farmer's yielding outputs in the Cape Winelands District, Western Cape.
- To evaluate the strategies and costing tools used by commercial farmers in Cape Winelands District, Western Cape to encounter the effects of drought.

A qualitative approach was used in this study from designing the study up to the data analysis stages. In so doing, semi-structured interviews were conducted with the representatives of registered commercial farmers, to pilot the study. Interviews were conducted with 12 respondents who either managed or owned a commercial farm in Cape Winelands District, Western Cape.

The major findings of the study were, i) All respondents revealed that they experienced drought, although it was at varying magnitudes between the period of 2015 and 2018, ii)The study revealed the production losses of up to 70% signifying a concerning loss due to drought, iii) The costing tools and strategies that commercial farmers had established to maintain cost control during the drought period were available, but they were not adhered to or implemented as intended.

For future studies, the following studies are suggested, i) Future research could focus on comparing the drought costing tools and strategies used by commercial farmers between South African provinces or other countries to reduce the impact of drought. ii) Comparing the impacts of drought between provinces in South Africa to document if drought is having a similar or different impact in South Africa.

The study provides insight to other businesses and countries facing similar drought challenges and economic downturns. It offers ways in which it can better prepare for future drought to achieve operational efficiencies and sustainable results. This study serves as an additional source of information regarding the effectiveness of commercial farm businesses in the Western Cape. Furthermore, the findings of this study are of importance to everyone affected by drought especially commercial farm businesses.

Keywords: commercial farmers, cost implications, drought preparedness, crops, resilience.

ACKNOWLEDGEMENTS

Embarking on this research journey has been a transformative experience, and its realisation has been made possible through the collective efforts of numerous individuals and institutions. I extend my heartfelt gratitude to all those who have been instrumental in shaping this academic endeavour into a reality.

I am deeply indebted to my principal supervisor, Dr Olumide Benedict, whose unwavering guidance, expert insights, and continuous support have been the cornerstone of this research. Your mentorship has not only enriched the quality of my work but also expanded my horizons as a researcher. I am truly privileged to have had you as my guiding light.

I extend my sincere appreciation to my co-supervisor, Prof Job Dubihlela, for your valuable input, constructive critiques, and scholarly direction throughout this research process. Your expertise has been invaluable in refining the methodologies and interpretations, leading to a more comprehensive outcome. Your collaborative spirit has been deeply inspiring.

My gratitude extends to the participants of this study, who generously shared their time and experiences, providing the essential groundwork upon which this research stands. Your contributions have brought depth and authenticity to the findings, and I am genuinely thankful for your involvement.

I would like to acknowledge the support and resources provided by Cape Peninsula University of Technology, which have been pivotal in facilitating the logistical aspects of this research project. The access to facilities, libraries, and research databases has been crucial in navigating the academic landscape.

I am grateful for the enriching discussions and valuable insights shared by my colleagues and peers. The exchange of ideas within our academic community has been instrumental in shaping the trajectory of this research and has contributed to my intellectual growth.

Lastly, I want to express my heartfelt gratitude to my friends and family for their constant encouragement and understanding. Your unwavering belief in my abilities has been a driving force throughout this journey.

While I have attempted to acknowledge all those who have contributed to this research, any inadvertent omissions are purely unintentional. Please recognise that your involvement, whether explicitly mentioned here or not, has left an indelible mark on this work.

With profound appreciation.

DEDICATION

To the cherished memory of my late grandmother, whose stories and wisdom ignited the flames of curiosity within me from a young age. Your nurturing presence and love for learning guided me throughout this academic journey. Though you are no longer here, your influence lives on in every word of this thesis.

In loving memory of my late mother, whose unwavering belief in my dreams continues to inspire me every day. You instilled in me the values of perseverance and dedication, and it is your resilience that has driven me to reach this milestone. This achievement is a tribute to your enduring legacy.

To my family, whose unyielding support has been my anchor through the challenges and triumphs of this journey. Your sacrifices and encouragement have allowed me to pursue my passions wholeheartedly.

To my mentors, whose guidance and insights have shaped the way I approach knowledge and research. Your dedication to nurturing my academic growth has been invaluable, and I am grateful for the wisdom you have shared.

To my friends and colleagues, for the lively discussions, shared discoveries, and unwavering camaraderie. Your diverse perspectives have enriched my understanding and reminded me of the collaborative nature of learning.

This work is dedicated to the memory of those who have left an indelible mark on my life. May their influence live on in the pursuit of knowledge and the quest for understanding.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

CHAPTER 1
INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 INTRODUCTION

The sector of agriculture plays a crucial role in South Africa, Western Cape economy, with commercial farms being the backbone of this sector. However, in recent years, the region has experienced severe drought conditions, posing significant challenges and imposing substantial financial burdens on commercial farm businesses ((Meza, Eyshi Rezaei, Siebert, Ghazaryan, Nouri, Dubovyk, Gerdener, Herbert, Kusche, Popat, Rhyner, Jordaan, Walz and Hagenlocher, 2021). The purpose of this research is to examine the cost implications of drought on the operations of commercial farm businesses in Western Cape, Cape Winelands District. Drought, as an extreme weather event, has the ability to cause significant harm to crops, livestock, and overall agricultural productivity (Schreiner, Mungatana and Baleta, 2018). With limited or no access to sufficient water resources, commercial farmers are faced with the daunting task of ensuring sustainable operations while dealing with depleted water supplies. This has led to an increased reliance on expensive alternatives such as drilling boreholes, accessing groundwater, purchasing water, or implementing costly irrigation systems to mitigate drought's impact on crop output and livestock production (Meza et al., 2021).

The research sought to comprehend the effects of drought on operations of commercial farm businesses in the Western Cape as well as to discover ways on how commercial farmers can better prepare for future drought to sustain their businesses as they are the most important part to the economy (Fanadzo, Ncube, French and Belete, 2021). The cost implications of these measures are wide-ranging and encompass various aspects of commercial farm operations. This research project will encompass a comprehensive analysis of the financial strains faced by commercial farm businesses in Western Cape due to drought, including increased costs for acquiring water, implementing water-saving technologies, maintaining, and repairing infrastructure, purchasing additional animal feed, and managing potential crop failures. Additionally, the project will assess the economic impact of these costs on overall profitability, sustainability, and future planning for commercial farms in the region. By understanding the financial consequences of drought on commercial farm businesses in Western Cape, this research project aims to contribute to the development of effective strategies and policies that can assist farmers in managing the challenges posed by recurring drought conditions. The findings of this study will not only benefit farmers but also policymakers, industry stakeholders, and researchers interested in

enhancing the resilience and sustainability of the agricultural sector in the face of climate change and extreme weather events.

The research study investigates cost implications of drought on operations of commercial farms in Cape Winelands District, Western Cape. The first part of this chapter provides an outline of the study's structured background. The second part of this study provides the research statement. The research statement gives a brief background of the problem as well as the problem statement of the study.

1.2 BACKGROUND OF THE STUDY

South Africa encounters a below-average period of precipitation (drought), which led to a rise in sustained scarcity of water supply (Water Research Commission Drought, 2015; Baudoin et al., 2017; Schreiner, Mungatana and Baleta, 2018). Over the past few years, the country experienced a severe drought which led to a serious impact on economic sectors of the country. South Africa's yearly precipitation dropped to lower than 500mm, which happens to be below the yearly standard precipitation; this got lower by recurrent droughts (Water Research Commission Drought Factsheet 1, 2015). Temperature prediction reveals a continued rise, and decrease in yearly precipitation (Jooste, 2016). According to Zwane (2019), climate change has become an important issue in the reduction of production level which is leading to a decrease in Gross Domestic Product (GDP) of the country (Zwane, 2019; Tshikovhi & van Wyk, 2021). The climate change has a significant influence on economic sectors more especially in the farming sector (Talanow, Topp, Loos & Martín-López, 2021). The powerlessness of farming to climate change has grown to be an imperative issue of reduced productivity of crops from adversary changes, particularly in South Africa (Botai et al., 2017). Commercial farmers struggle to stay afloat by adapting to changing conditions; prices are likely to rise and be passed on to consumers. The agricultural sector is perceived to be the most vulnerable sector to climate risks since its sector relies on water. Climate changes are likely to affect the region in the reduction of water assets within the country, they are anticipated to have a noteworthy impact on all divisions of the economy (Tshikovhi & van Wyk, 2021). Thus, farmers should adopt certain practices to ensure sustainability in the agricultural sector.

Drought is a major constraint to the economy of the country and has an impact on poverty levels in South Africa. Critical droughts result in suffering or death due to lack of food, caused by water scarcity, amongst the affected residents. However, the effects of drought in the Western Cape are not only the issue of loss in production but also the issue of the

human collision. For poverty-stricken people, this results in a decrease in the level of employment, inflation, income, food nutrition, and health.

Commercial farming is the greatest source of food for the Western Cape population (Bureau for Food and Agricultural Policy, 2018). Commercial farming also contributes significantly to the economy through the food supply trading activities (Talanow et al., 2021). Notwithstanding the above, the effect of drought on commercial farming has extreme implications for all regions but more specifically in the regions that are dependent on Western Cape as it is a major source of food. A decrease of agricultural productivity in Western Cape affects citizens of neighbouring countries, as they import an important quantity of nourishment from Western Cape (Baudoin et al., 2017). For instance, more than 50% of agricultural, forestry and fisheries exports of the country is produced and managed in Western Cape Province (Western Cape Agricultural profile, 2021).

Drought generally causes less precipitation which results in dryer conditions and more fires (Marengo et al., 2021; Water Research Commission Drought, 2015). It is therefore no surprise that farms are being demolished, estates are being razed down, plantation and trees are being burned; as a result, farmers face these challenges and lose money based on those drought effects. The occurrence of drought events culminates in a marked reduction in agricultural yield, subsequently giving rise to a restricted availability of essential sustenance within commercial domains, consequently precipitating an escalation in the costs of food commodities. This amalgamated effect ultimately leads to a diminution in the extent of prevailing food security within the impacted geographic region. Drought occurrences lead to a contraction in production, thereby resulting in a limited accessibility of indispensable nourishment within marketplaces, coupled with an elevation in food expenses. This sequence of events culminates in a decline in levels of food security within the region in question (Begna, 2023). This perspective is also corroborated by Mariem et al. (2021), who highlight that the threat to food security is progressively exacerbated due to the conjoined influences emanating from climate change’s impact on agricultural systems, concomitant with the ongoing expansion of the global population.

The implications of climate change have already become apparent through an observable deceleration in the pace of global agricultural productivity growth. Recent scholarly investigations indicate that human-induced climate change has led to a reduction of approximately 21% in global agricultural total factor productivity since the inception of 1961. (Mariem, Soba, Zhou, Loladze, Morales, and Aranjuelo, 2021). This impact is more pronounced in warmer regions, exemplified by a substantial reduction of 34% in productivity

within regions such as Africa, as compared to cooler regions like Europe and Central Asia, where the reduction stands at 7.1% (Mariem et al., 2021). The occurrence of drought garners the government's focal interest due to the escalating expenses associated with mitigation efforts (Graw et al., 2017; Nembilwi Chikoore, Kori, Munyai and Manyanya, 2021). Recognising the paramount significance of agriculture to the economy, the government has consequently undertaken diverse measures to aid farmers in upholding the continuity of their agricultural enterprises (Baudoin et al., 2017; Beckman & Countryman, 2021).

The population of South Africa and neighbouring countries increases from year to year. The low level of production makes it impossible to meet the population's demand, thus increases the cost of products and the rate of unemployment as commercial farms are not able to sustain both the farming and pay the employees. This negatively affects the competitive advantage of exports as well as other businesses interlinked on farming but not directly involved in farming production (Salami et al., 2009; Meissner et al., 2014; Meyer et al., 2016; Baudoin et al., 2017; Zwane, 2019; Graw et al., 2017). According to Boretti (2022), South Africa's worst water shortage in 23 years has resulted in a decrease in production output of farming, which has lowered the GDP and caused increase in price of the food, During the years of crop failure, there is inevitably a loss of production which indirectly results in human misery. Farmers spend more money to irrigate crops and supply animal farms and ranches with water for livestock. Additional expenditures amongst other things are the costs to drill new wells or buy water from distant places in tankers. Drought has serious adverse effects, with significant impacts on financial hardship and degradation experiences in commercial farms which have confirmed that the recent droughts has decreased sustainability and put farmers in a trash economic condition (Winkler et al., 2017).

Farmers have deployed various coping strategies, of which they are largely unable to stop a decline in income and consumption in South Africa's rain fed regions. Due to the aforesaid, it is perceived that many people fall back into poverty during drought period. This aims to investigate the cost effects of drought on operations of commercial farms in the Cape Winelands District, Western Cape.

Drought, essentially in Western Cape, is widely recognised as playing an important role in adding to the threat of commercial farming (Baudoin et al., 2017; Pienaar & Boonzaaier, 2018). However, predictions project a rise in temperatures and a decrease in yearly precipitation for the upcoming years (Zwane, 2015). Therefore, the country is advised to follow intelligent practices to plan for this natural phenomenon and to ensure the

sustainability of the agricultural industry as it is the core of the economy (Water Research Commission Drought Factsheet 1, 2015; Jooste, 2016). Commercial farming is critically important to the economic development in South Africa. Despite the prevalence of drought in South Africa over the years, there is very little work done on the effect of drought on the production and sustainability of commercial farms. Therefore, it is important to explore the effects of drought with regards to the cost implications and operations of commercial farms in Cape Winelands District, Western Cape. This research will focus on the cost implications of drought on operations of commercial farm businesses in Cape Winelands District, Western Cape.

1.3 PROBLEM STATEMENT

The province of Western Cape is experiencing rapid urbanisation, population growth and increasing economic activities which altogether put pressure on commercial farms to produce in proportion to the increased demand regardless of the resources (such as water supplies, etc.) not necessarily increasing (Green Cape, 2017). This challenge amongst commercial farms in Western Cape has been worsened by the drastic drought that affected the region over the past few years (Water Research Commission Drought Factsheet 1, 2015; Zwane, 2019). As mentioned earlier, the drought just like any other crisis causes disruption in the operations of commercial farms which lead to a decline in a production output of about 44 per cent (or R194 million if expressed in money), increase in both demand and price of goods due to limited supply capabilities, decline in exports, high unemployment rate due to loss of jobs and closure of business activities due to business being unprofitable during drought period (Araujo et al., Abiodun & Crespo, 2014). One of the key reasons why drought affects commercial farms so drastically is due to business entities lacking strategies on how to deal with drought effectively. Yet, there seems to be less literature in existence that explore the cost implications of drought on the operations of commercial farms drought. Hence, this study is necessary to identify the cost implications of drought and provide grounds on how drought's cost effects can be mitigated. Stemming from the foregoing, the problem statement of this research study is *"The drought is drastically affecting commercial farms due to inadequate strategies to mitigate the negative cost effects of drought on operations of commercial farms in Cape Winelands District, Western Cape".*

The following section provides the aim and objectives of the study. It focuses on research questions of the study, developed to achieve the objectives of the research project.

1.4 AIM AND OBJECTIVES OF RESEARCH

1.4.1 Aim of research

To address the research problem, the primary objective of this study is to investigate the effects of drought with regards to the cost implications and operations of commercial farms in Cape Winelands District, Western Cape. Based on the primary research objective, the research objectives were developed and identified in the following subsection:

1.4.2 Objectives of research

- To assess the production cost effects of drought on commercial farms in the Cape Winelands District, Western Cape.
- To assess the significance of drought on commercial farmer's yielding outputs in the Cape Winelands District, Western Cape.
- To evaluate the strategies and costing tools used by commercial farmers in Cape Winelands District, Western Cape to encounter the effects of drought.

1.5 RESEARCH QUESTIONS

To achieve the research objectives mentioned above in 1.4.2., the following research questions were formed. These research questions are designed to align with the research objectives, but the last research objective RO3 was split into two separate research questions, RQ3 and RQ4. This division was done to provide a more detailed and focused exploration of different aspects of the research objective. Below is the list of research questions:

- What is the estimated production cost effects of drought on commercial farms in the Cape Winelands District, Western Cape?
- What are the cost implications of drought on commercial farmer's yielding outputs in the Cape Winelands District, Western Cape?
- What are the strategies used by commercial farmers in the Cape Winelands District, Western Cape to encounter the effects of drought differ?
- What costing tools are in place to keep the cost under control from the effects of drought in Cape Winelands District, Western Cape?

1.6 SIGNIFICANCE OF THIS STUDY

This research adds to the knowledge base and improves the understanding and solving of the research problem identified in this research. The purpose of this research is to investigate the cost effects of drought on operations of commercial farm businesses with

the aim to find ways to minimise these cost effects of drought in commercial farms to their minimum level. The research provides the important lesson to other companies facing drought and economic downturns; in general, how they can implement various planning and management approaches to achieve operational efficiencies and sustainable results.

This study holds substantial significance as it contributes to the expanding reservoir of knowledge in the realm of cost and management accounting as well as agribusiness, particularly in the context of the Cape Winelands District, Western Cape. By delving into the intricate dynamics of the cost implications stemming from drought conditions on the operational aspects of commercial farm businesses, this research advances understanding of a critical issue that directly impacts both the agricultural sector and the broader economy.

At its core, this study is driven by the imperative to unravel the multifaceted dimensions of the research problem – the detrimental impacts of drought on commercial farm operations. By meticulously exploring this issue, the study not only enriches our understanding of its complexities but also endeavours to devise strategies that mitigate the adverse cost effects associated with drought. This, in turn, has the potential to catalyse a transformative shift in the operational paradigms of commercial farms, steering them towards enhanced resilience and sustainability. A pivotal facet of the study's significance lies in its potential to serve as a beacon of insight for a diverse array of stakeholders, extending beyond the agricultural sector. The research's findings offer valuable lessons that transcend industries, equipping companies grappling with drought and economic downturns with a compendium of planning and management approaches. These approaches, when adopted and tailored to specific contexts, can usher in operational efficiencies and sustainable outcomes – a beacon of hope in challenging times. Furthermore, this study elevates its significance by functioning as a repository of comprehensive information pertinent to the efficacy of commercial farm businesses within the Western Cape. The insights garnered here not only facilitate the refinement of commercial farm performance but also wield the power to bolster the larger economic landscape of the country. By optimising commercial farm operations, this research aligns with broader developmental goals, fostering economic growth and stability.

The implications of this research reverberate beyond immediate applications. It unravels the intricate tapestry of how drought impacts the fundamental fabric of commercial farming, elucidating the nuances and repercussions that shape decisions and outcomes. In doing so, it engenders a proactive approach to preparing for future drought occurrences. The strategies unearthed in this study empower commercial farmers and policymakers alike to

make informed choices, crafting strategies that not only mitigate risks but also foster long-term sustainability.

Contribution to the Study

This research contributes to the existing body of knowledge by filling a significant gap in the literature regarding the cost implications of drought on commercial farming operations in the Cape Winelands District. It offers new empirical data and insights into how drought affects cost structures and production processes, thus enriching the theoretical framework of cost and management accounting in agribusiness. Additionally, the study proposes practical strategies for mitigating drought-related costs, providing a valuable reference for future research and practical applications in both the agricultural sector and other industries facing environmental challenges.

Empirical Significance of the Study

The empirical significance of this study is demonstrated through its detailed analysis of the cost impacts of drought on commercial farm businesses. By collecting and analyzing data from farms in the Cape Winelands District, the research provides concrete evidence of how drought conditions affect variable and fixed costs, production levels, and overall economic sustainability. These findings offer practical, data-driven recommendations for improving drought resilience, which can be directly applied by commercial farmers and policymakers. The empirical results also contribute to a deeper understanding of the specific challenges and opportunities within the agricultural sector in the Western Cape, paving the way for informed decision-making and strategic planning.

In summation, the significance of this study is far-reaching and multi-faceted. It not only augments the reservoir of knowledge but also contributes actionable insights that have the potential to catalyse transformative change in commercial farm operations. By inspiring resilience, efficiency, and sustainability, this research amplifies its impact to encompass broader economic and societal dimensions, ultimately serving as a cornerstone in the edifice of informed decision-making and strategic planning.

1.7 RESEARCH METHODOLOGY

Research methodology plays a crucial role in guiding the researcher’s choices regarding the collection and analysis of data. This ensures that the study's findings effectively address the primary research question. (Sileyew, 2020). Additionally, research methodology outlines

the process of shaping the research problem and objectives, as well as how the results derived from the collected data are presented. As a result, this section explores the specific research approaches utilised throughout the research journey.

1.7.1 Paradigm

This research adheres to the interpretivism analysis paradigm, which delineates the researcher's perspective and acknowledges that social reality is not a singular, objective construct but rather a product of human experiences and social contexts (ontological standpoint). Consequently, it posits that the most suitable approach to study this reality is by considering its socio-historic context and by reconciling the subjective interpretations of the individuals involved (epistemological standpoint). Interpretive researchers assert that social reality is deeply intertwined with and inseparable from its social surroundings. Therefore, the researcher approaches the study by engaging in a process of "sense-making" rather than traditional hypothesis testing, as outlined by Pervin and Mokhtar (2022)

1.7.2 Research approach

Development of research methods is an integral part of the research design, which defines specific data collection and analysis procedures (Stokes, 2017). Furthermore, research methods are defined as the tools that are used to do research. These tools can be either qualitative, quantitative, or mixed (Chu & Ke, 2017). For this study, qualitative research technique is adopted to answer the main research question. The researcher employs qualitative research method because they excel at providing detailed descriptions and explanations of complex phenomena; monitoring unexpected or unique events; and shedding light on how events are experienced and understood, they hold greater significance (Beins, 2019). Qualitative research method is used in this research to seek views or perception on cost effects of drought in commercial farming, therefore, in-depth interviews were conducted to understand faming drought condition, experience, and proceedings from farmers' personal perspective.

1.7.3 Research design

Research design constitutes a comprehensive and meticulous approach within the research process. It empowers researchers to refine research methods that align with the subject matter, thereby establishing a solid foundation for the success of their studies (Harris, 2019). The primary purpose of a research design is to guarantee that the acquired evidence enables the researcher to address the research problem with maximum clarity and precision. The researcher adopted a case study research design to align with the selected qualitative approach. Creswell and Poth (2016) provide a definition of case study research

as design in which the researcher investigates a specific and well-defined system or multiple such systems, spanning a period of time This investigation involves in-depth data collection from various sources, including observations, interviews, audio-visual materials, documents, and reports.

The purpose of employing the qualitative case design in this study was to address the primary research questions. In pursuit of this objective, semi-structured interviews were conducted to registered commercial farmers' representatives as an initial step. The central concern was the cost effects of drought experienced by commercial farmers situated in the Cape Winelands District of the Western Cape. The primary data was sourced directly from commercial farmers within the Western Cape's Cape Winelands District, while secondary data was obtained from the Western Cape Department of Agriculture.

1.7.4 Target population and sampling procedures

The population refers to the total group of individuals from which a statistical sample is selected from by the researcher, for the study (Rahman, Tabash, Salamzadeh, Abduli, and Rahaman, 2022). The target population in this research is commercial farms in Western Cape. Research by Pienaar and Boonzaaier (2018), describe Western Cape as one of the largest commercial's with ±6653 producers with an additional 9480 farmers. Nonetheless, for the scope of this research, the researcher's primarily concentration was mainly on Cape Winelands district, commercial farms.

A sample is composed of individuals selected from the target population or a subset extracted from the specific population, with the intention to maintain its representativeness (Bhardwaj, 2019.). Essentially, a sample represents a selection taken from a target population (Sibley, 2021). The researcher selected purposive sampling as the appropriate method for this study. This approach involves deliberately choosing a specific group of respondents who are deemed to possess comprehensive knowledge and expertise about the topic under investigation, ensuring that in-depth information can be obtained (Bhardwaj, 2019). The selection of a purposive sampling approach is rationalized on the basis that, when employed effectively, it offers a more efficient use of resources compared to a random-sampling method. Additionally, with purposive sampling, the analysis of results is constrained to the specific population being investigated (Sibley, 2021; Rahman et al., 2022). This method is the most appropriate as it enables the researcher to collect qualitative responses, facilitating a deeper understanding and yielding more accurate research findings. Moreover, the researcher gathered data from the most suitable respondents, ensuring that the outcomes are pertinent to the research context. The researcher carefully determined which elements to include and exclude from the sample, as specified by

Rahman et al. (2022). The selection of respondents is primarily based on their significant involvement in the data collection process due to their key roles.

This sampling methodology ensures that each element of the sample contributes to the analysis because every element aligns with the population parameters of the research. The 2nd sampling method employed is convenience sampling, which is often regarded as the most straightforward approach, as it involves selecting respondents based on their accessibility and willingness to participate. Convenience sampling is a commonly used non-probability sampling method, primarily designed to gather information from readily accessible respondents. In this approach, respondents are not randomly selected based on defined criteria, like demographic characteristics. Instead, researchers subjectively choose individuals who are conveniently available and willing to engage in the research process. Convenience sampling is most effectively used for preliminary hypothesis development, gaining an initial understanding of opinions, or as an initial pilot phase before more extensive research is conducted.

Primary data is collected directly from targeted farms; secondary data is collected from Western Cape Department of Agriculture (published reports). The current study initially targeted Western Cape commercial farms situated in Cape Winelands district, to be used as the research sample.

1.7.5 Data collection tool

A research interview serves as a data collection instrument in qualitative research, aiming to investigate the perspectives, experiences, beliefs, and motivations of individuals regarding specific subjects (Sharma, 2022). In this study, the semi-structured interview method is utilized, wherein the researcher pre-arranges a set of both closed and open-ended questions in advance. The semi-structured interview questions are prepared in a manner that allow correspondents and the researcher to explore for more discussion. As stated by Magaldi and Berler (2020), semi-structured interviews include a set of fundamental questions that serve to outline the areas for exploration. However, they also grant the interviewer and interviewee the flexibility to veer off into more in-depth discussions of ideas or responses. Moreover, the adaptability of this approach facilitates the revelation and elaboration of information that is significant to the respondents but may not have been initially perceived as relevant by the research team (Adeoye-Olatunde & Olenik, 2021). The researcher chose this data collection tool (interviews) to gather data extensively and intensively. Primary data was collected directly from commercial farmers, situated in Western Cape, Cape Winelands District in the format of semi-structured Interviews. Semi-

structured interviews were carried out on Microsoft teams. Secondary data was collected from Western Cape Department of Agriculture through published reports.

1.7.6 Data coding and analysis

Thematic analyses (TA) were used to analyses data collected before it was coded. Braun, Clarke, Hayfield, and Terry (2018) describe TA as a systematic approach used to identify, organize, and provide insights into patterns of meaning within a dataset. This method helps in recognizing commonalities in the way a particular topic is discussed or written about and allows for the interpretation of these shared characteristics. TA is a versatile method that provides the researcher with various avenues to examine and extract insights from the data.

ATLAS.ti software programme was used to code to ensure that data are organised and sorted. Coding involves the process of structuring and categorizing qualitative data; it is the second step in data analysis (Soratto, Pires and Friese, 2020). Codes are typically employed to retrieve and classify data with shared meanings, allowing the researcher to efficiently locate and group segments that are related to each other. Additionally, as suggested by Afriansyah, Puspitasari, Luritawaty, Mardiani, and Sundayana (2019), coding involves the process of disassembling data into smaller components and subsequently reassembling these components to uncover and investigate relationships, thus revealing new connections.

1.7.7 Delimitation of the study

To ensure the collection of valid response, respondents should adhere to the following delineation criteria to be consistent with requirements acceptable response:

- A farm should be a registered commercial farm.
- A farm should be in Western Cape, Cape Winelands district.

Primary data was gathered directly from Cape Winelands district, Western Cape commercial farm owners and managers. Secondary data was gathered from the reports published by the Western Cape Department of Agriculture.

1.8 ETHICAL CONSIDERATIONS

Ethical concerns in research hold significant importance for the academic and research institutions. To address these concerns, it is imperative to adhere to an ethics policy that guides and enforces ethical conduct in research. According to Resnik (2021), ethics

encompass the "norms for conduct," delineating what is considered acceptable and unacceptable behaviour, thereby influencing how research activities are carried out. Consequently, the research is subjected to evaluation and approval by the research ethics panel at the Cape Town University of Technology (CPUT). Ethical clearance in research is designed to ensure that throughout the research process, the researcher refrains from engaging in activities that could potentially harm any party involved in the research, whether intentionally or unintentionally (Mbabe, Ajayi, Bagula, Leenen, and Schoeman, 2021).

The rights of all members concerned during the analysis were respected and therefore the responses are treated with confidentiality. All participants in this research are provided with prior information regarding the research's objectives before giving their consent to take part in the study. The research also considers voluntary participation through which allows respondents to voluntarily opt to participate in the study and withdraw from it if they no longer wished to do so. Respondents are assured that every response given as part of the study is treated with confidentiality, and they are allowed to remain anonymous if they wish and that is reported as such. Impact on respondents on how the data is analysed and reported was considered. Respondents were assured that the research is mainly for academic purposes and not to harm them or the company in any way. If it happened to be so, the reasons have been fully disclosed, thus allowing them to make an informed decision.

1.9 LIMITATIONS OF THE RESEARCH

According to Ross and Zaidi, (2019), limitations are often delineated as constraints or limits in analysis research that are out of management, like time, monetary resources, get right of entry to information, and so on. The analysis of this research focused solely on commercial farms in Cape Winelands, Western Cape only. The impact of drought may vary in different regions of South Africa, making it challenging to generalize the findings from this study to other parts of the country. Consequently, this limitation is noteworthy in this research. The study's drawbacks are outlined as follows:

- Due to the challenges of data availability the researcher had to limit the research study method to qualitative research method.
- Due to the challenges of data availability in Stellenbosch, Western Cape commercial farmers, the research sample was expanded to Cape Winelands District, Western Cape.

1.10 OUTLINE OF THE DISSERTATION

The remaining parts of the thesis are structured as follows:

Chapter two – definitions and theoretical framework: In this chapter, the researcher examines the precise definitions of key concepts used in this research, exploring relevant theories that underpin the study, presenting the conceptual framework that is guiding the investigation, and offering a summary of the chapter's content.

Chapter three – Cape Winelands district commercial farms and Western Cape water crisis: In this chapter, the researcher explores the comprehensive and up-to-date understanding of the topic. Furthermore, issues related to Cape Winelands District commercial farms in the context of the Western Cape water crisis are addressed.

Chapter four – research design and methodology: This chapter describes the strategy of answering the research questions and testing the hypotheses.

Chapter five – data presentation and discussion of findings: This chapter presents data, interprets the analyses, and discusses the findings.

Chapter six – conclusion and recommendations: This chapter articulates the conclusion reached in the study.

CHAPTER 2
DEFINITION OF TERMS AND THEORETICAL FRAMEWORK

2.1 INTRODUCTION

The preceding chapter delved into the background, study objectives, research questions, problem identification, and the methodology employed for data collection and analysis. This chapter provides a definition of key concepts, brief contextual overview, and description of relevant terms, introduce the conceptual framework, and outline the theoretical framework. The goal of this chapter is 1) to provide clear definitions of the terminology and concepts used in the research to enhance reader comprehension, 2) to elucidate the research's trajectory and firmly establish its foundations, 3) to delineate the research's boundaries, 4) facilitate and enhance the meaningfulness and acceptability of research findings within the theoretical constructs of the research field, thereby ensuring generalizability.

2.2 DEFINITION OF KEY TERMS

This section of the chapter provides definitions of the critical concepts relevant to the research topic. These definitions are contextualized within the framework of the research, and the associated literature is included to provide additional context and understanding.

2.2.1 Farming

The meaning of the term “farming” is derived from Latin word “firma” which signifies a fixed agreement or contract (Diamond, 2003). The location where farming practices are carried out are commonly referred to as a farm. Farming is a fundamental component of agriculture, encompassing the practical implementation of agricultural activities. It can range from small-scale cultivation, primarily for personal consumption, to large-scale operations involving mechanization and intensive farming practices. There are various forms of farming including collective farming, factory farming and organic farming, intensive farming, and protected culture farming. Farming techniques involve a wide range of activities, such as transplanting, pruning, tilling, crop rotation, selective harvesting, and more. Plantations are examples of extensive farms within the realm of farming. Within the realm of farming, certain aspects overlap with horticulture, such as vineyards or orchards, which fall into the farming category. Farming plays a crucial role in the economies of many countries. Many farms incorporate structures known as farm buildings, which may include the farmhouse, silos, and barns.

Mellor and Malik define farming as the process of implementing agricultural activities and practice of breeding animals or growing crops for food or clothes (Mellor & Malik, 2017). In the context of this research farming is described as an as the process of cultivating the soil, sowing seeds, and nurturing edible plants, or it refers to a piece of land primarily dedicated to agricultural activities with the main goal of generating food and various crops. Essentially, farming represents the fundamental practice of food production (Kling & Mackie, 2019).

2.2.2 Crop farming

Crop farming involves the growing of plants for the production of food, animal feed, or other commercial uses. According to Nix (1980), the broadest definition of crops is the desired product from a managed parcel of land. In the context of this research, crop farming is characterized as the practice of cultivating plants or agricultural products like grains, vegetables, or fruits, which are grown and harvested on a significant scale for purposes including food, commercial activities, profit, or subsistence (MacDonald et al., 2013; About Mechanics, 2023).

2.2.3 Commercial Farms

Commercial farming is defined as the extensive cultivation of crops with the purpose of selling them on a large scale, targeting broad distribution to either wholesalers or retail establishments (Jooste, 2016). Additionally, commercial farms are primarily profit-driven enterprises, where food production is frequently carried out using advanced technological methods for sale in the market (Mellor & Malik, 2017). For this research commercial farming is defined as the large-scale farming method in which plants and livestock production is practiced with the intention of widespread distribution to wholesalers or retail outlets (Portal, 2021).

2.2.4 Drought

The definition of drought lacks universal consensus, and it can vary depending on the specific area or scope of research (Nyatuame & Agodzo, 2017). Drought is a phenomenon with numerous specific definitions, but in a general climatic context, it is characterized as an extended and abnormal period of reduced rainfall, resulting in a scarcity of water (Sharma & Sharma, 2023). For the purposes of this research, drought is delineated as a weather-related natural disaster characterized by an abnormal, below-average precipitation pattern that results in a deficiency of soil moisture and, subsequently, a scarcity of water resources. This condition has wide-reaching impacts on agricultural farming, food production, and the economic performance of extensive regions or even entire countries (Bhunia, Das, and Maiti, 2020).

2.2.5 Drought as a natural hazard

Drought represents a significant peril to the well-being of individuals and socioeconomic progress, even though it occurs less frequently than other natural hazards. When drought does occur, its impact is felt over an extensive geographical area for an extended duration (Almasi & Tavakkoli, 2019). Consequently, a larger proportion of the population is affected by drought compared to other types of disasters. The vulnerability to drought disasters varies across regions, and each country has its own level of preparedness and response capabilities in dealing with drought-related consequences. Thus, the number of people impacted by drought and the nature of the consequences experienced differ from one region to another.

As previously mentioned, the absence of a universally agreed-upon definition of drought gives rise to debates concerning the existence of drought and its severity. According to SafarianZengir, Sobhani, and Asghari (2020), drought is defined in relation to geographic conditions. Drought, unlike most natural disasters, doesn't typically have immediate physical impacts; it affects extensive regions and results in a range of economic, environmental, and social consequences. Additionally, de Freitas (1994) highlights that droughts exhibit differences from other natural disasters, despite their categorization as a natural hazard. Drought is characterized as a slow-onset hazard, often referred to as a gradual phenomenon, which makes it challenging to predict when it may occur (Rivera et al., 2015).

2.2.6 Drought Risk Management

Risk management for droughts is characterized as the procedure of recognizing and comprehending the pertinent elements of drought risk and scrutinizing different approaches to mitigate that risk (Wilhite, Sivakumar, and Pulwarty, 2014). Moreover, risk management encompasses the systematic application of decision-making tools and the development of management strategies that address uncertainty and the perception of risk (Assessment of Large Seed Banks Requirement for Drought Risk Management in South Asia, 2017). Risk management utilizes the data obtained through risk assessments to offer improved techniques or strategies for individuals and communities to mitigate hazards or effectively deal with their consequences. Drought prediction development, as well as real-time drought predictions are crucial for drought management as it helps identify possible changes in drought. Additionally, one of the vital elements in drought management is drought forecasting, which holds a significant role in risk management, preparedness, and mitigation of drought impacts (Almasi & Tavakkoli, 2019).

2.2.7 Disaster risk

Disaster risk is defined as the potential for loss of life, injuries, or the destruction or damage of assets that could occur within a system, society, or a community during a specific period (Gerber & Mirzabaev, 2017). In a technical context, disaster risk is further probabilistically determined by the combination of three key components: hazard, exposure, and vulnerability. It is widely acknowledged as the result of the interplay between a hazard and the characteristics that render individuals and places susceptible and exposed (Rivera, Tehler & Wamsler, 2015). Disaster risk emerges from the intricate interaction between development processes that generate conditions of exposure, vulnerability, and hazard (de Freitas, 1994). Disaster risk is therefore considered as the amalgamation of the severity and frequency of a hazard, the number of people and assets exposed to the hazard, and their susceptibility to damage.

2.2.8 Disaster Risk Management

Disaster risk management is described as the application of policies and strategies for disaster risk reduction, with the aim of preventing new disaster risks, reducing existing disaster risks, and managing residual risks. This contributes to the enhancement of resilience and the reduction of losses (Kanta Kafle, 2017). Disaster risk management actions are categorized into three main types: prospective disaster risk management, corrective disaster risk management, and compensatory disaster risk management, also referred to as residual risk management (SafarianZengir, et al., 2020).

Disaster-risk management, as defined by UNDRR (2021), is the methodical utilization of administrative directives, organizational structures, and operational skills and capacities to put plans and policies into action, enhancing coping capabilities and ultimately reducing the adverse consequences of hazards and the likelihood of disasters. Disaster-risk management efforts, when successful, aims to reduce the consequences of hazards by implementing actions and procedures for prevention, mitigation, and preparedness.

2.2.9 Natural Disaster Risk Management

Natural disaster is understood as the natural variation surpassing a given expected level, and its consequences can lead to damage in both human and social-economic aspects. Natural disaster represents risk which is defined as prospect of natural calamity's happening and the degree of destruction triggered by it (Lavell, & Maskrey, 2014). Consequently, based on this widely accepted definition, the risk of natural disasters (for a region, a family, or an individual) comprises four key components: hazard, exposure, vulnerability, and

emergency response and recovery capacity (Shah et al., 2020). These components are further discussed below in relation to drought in commercial farming.

- Hazard – Hazard refers to significant natural events that can disrupt human life and property, potentially resulting in disasters of varying probability and severity (Poljansek et al., 2017). In the context of commercial farming, drought serves as a substantial natural hazard characterised by prolonged periods of insufficient rainfall. The likelihood and severity of drought can differ across regions, with some areas experiencing more frequent and severe drought events than others. High likelihood and severity of drought pose an elevated risk to commercial farming operations, leading to potential crop failures, reduced yields, and economic losses (Carrão, Naumann and Barbosa, 2016).
- Exposure – Exposure refers to the assessment of factors such as the number of individuals, the value of property and infrastructure, and the scope of activities that may be susceptible to a hazard and could face adverse consequences resulting from natural disasters (Carrão, Naumann and Barbosa, 2016). Typically, a larger population and a higher significance of exposed property and activities increase the potential for losses stemming from natural disasters, consequently amplifying the overall risk associated with such events.

Within the framework of commercial farming, exposure pertains to the extent of agricultural activities, encompassing activities like crop cultivation and livestock farming, that may be vulnerable to the impacts of drought. Farms characterised by expansive land holdings and substantial agricultural operations are more exposed to potential detrimental effects caused by drought events (Prabnakorn, Maskey, Suryadi and Fraiture, 2019). Moreover, the valuation of agricultural assets, including crops, livestock, and equipment, adds to the level of exposure. Farms endowed with higher asset values face greater susceptibility to potential losses when confronted with drought-related challenges.

- Vulnerability – is the assessment of the capacity for assets and populations to demonstrate resilience when confronted with hazards, ultimately determining the extent of damage incurred during a hazard event. Generally, heightened vulnerability is associated with an increased potential for losses and, consequently, an elevated level of natural disaster risk (Liu & Chen, 2021).

Within the context of commercial farming, vulnerability pertains to the preparedness and resilience of farming practices and infrastructure in response to the challenges posed by drought. Farms equipped with effective water management systems, drought-resistant crop varieties, and well-maintained infrastructure exhibit lower vulnerability to the impacts of drought. Conversely, farms characterised by outdated practices, inadequate irrigation systems, and limited diversification may be more vulnerable, as they are less equipped to withstand the challenges presented by drought conditions (Cozannet, Kervyn, Russo, Speranza, Ferrier, Foumelis, Lopez and Modaressi, 2020).

- Emergency response and recovery capability – represent the capacity to effectively mitigate the risk posed by natural disasters. This encompasses the presence of tangible resources, authority structures, institutional frameworks, collaborative partnerships, and established protocols and procedures aimed at preventing and alleviating effects resulting from natural disasters.

In the context of commercial farming, emergency response and recovery capability encompass the farm's proficiency in managing and mitigating the repercussions of drought events. This involves access to water-saving technologies, the availability of backup water sources, and the implementation of contingency plans. Collaborative partnerships established with local agricultural agencies and institutions serve to enhance a farm's ability to respond adeptly to drought conditions. An adequate emergency response and recovery capability are instrumental in minimising the economic and agricultural losses associated with drought events.

Applying the concepts of hazard, exposure, vulnerability, and emergency response and recovery capability to commercial farming in the context of drought underscores the importance of preparedness, resilience, and proactive measures to reduce the risks and mitigate the adverse impacts of drought on agricultural operations. Farming practices that consider these factors can better adapt to and recover from drought events, ultimately reducing the overall risk to commercial farming.

2.2.10 Components of Natural Disaster Risk

As mentioned earlier, the risk associated with natural disasters is a multifaceted concept determined by four main elements: hazard, exposure, vulnerability, and emergency response and recovery capability. An augmentation in exposure combined with a lag in

reducing vulnerability can result in an increased occurrence of natural disasters and more substantial losses (Masaba et al., 2017).

In the context of drought, this framework remains applicable. Drought can be considered a hazard in this scenario. Exposure relates to the population, agricultural activities, and water resources within an area affected by drought. Vulnerability encompasses factors like water management practices, agricultural resilience, and community preparedness. Emergency response and recovery capability refer to the ability of authorities and organisations to respond effectively to drought-related challenges.

Therefore, in the case of drought, the same principles apply. To reduce the risk associated with drought, it is crucial to decrease vulnerability by implementing better water management strategies, building agricultural resilience, and enhancing community preparedness. Additionally, efforts should be made to protect and minimise exposure to drought-prone areas, ultimately mitigating the overall risk associated with this natural hazard.

2.2.11 Disaster Risk Reduction

Disaster risk reduction has the objective of preventing new disasters, diminishing current disaster risks, and handling residual risks. These efforts collectively lead to the enhancement of resilience and, consequently, the attainment of sustainable development (Masaba et al., 2017). According to the definition provided by the United Nations Office for Disaster Risk Reduction (UNDRR), disaster risk reduction represents the policy objective within the framework of disaster risk management. Its aims and objectives are outlined in disaster risk reduction strategies and plans (UNDRR, 2021).

2.2.12 Production Cost

Cost refers to the monetary value spent on items like raw materials, equipment, supplies, services, labour, and products, which are essential for achieving a specific objective. It is also described as the expenses necessary to produce or sell a product (Svoboda et al., 2020).

Production cost encompasses all the expenditures incurred by a company to produce its products or deliver services to customers, which are reflected in the company's financial statements for the period in which they contribute to the cost of goods sold (Dementyev & Kwilinski, 2020).

In the context of this research, production cost is the overall expenditure incurred for the resources used in the creation of a product or the provision of a service. This includes costs such as raw materials, labour, and other expenses associated with bringing a product to the market (Delibasis, Aronis, Fanariotis, and Maglogiannis, 2020).

Drought can significantly influence the production cost in commercial farming by necessitating increased investments, reducing yields, and driving up resource and operational expenses. It highlights the importance of efficient resource management and preparedness to mitigate the financial impact of drought on commercial farming operations.

2.3 THEORY AND CONCEPTUAL FRAMEWORK

To establish an academic context for the study, it is essential for the researcher to define a theoretical framework to serve as guidance. As per the work of Varpio, Paradis, Uijtdehaage, and Young (2020), a theoretical framework is a conceptual model that enables a researcher to systematically understand the relationships among various factors deemed significant to the research problem. The theoretical and conceptual framework serves the purpose of outlining the direction of a research study, firmly grounding it within theoretical foundations. The primary goal of these frameworks, as emphasized by Adom et al. (2018) and Varpio et al. (2020), is to enhance the significance of research findings, align them with theoretical concepts in the field of research, and guarantee their applicability across different contexts.

Furthermore, theories and conceptual frameworks serve a dual role, providing direction for the analysis, interpretation, and forecasting of phenomena, while also furnishing design and action recommendations. This section of the research is dedicated to exploring three key frameworks: the theory of production, the emergency management framework, and the disaster management framework. In a broader context, these theories and conceptual frameworks are predominantly employed as normative theories, with the primary aim of furnishing farm managers with guidance on how to optimise the achievement of their system goals to the greatest possible extent.

2.3.1 Theory of Production: Cost Theory

The Theory of Production and Cost Theory constitute foundational principles in economic analysis, offering essential insights into how firms manage resources and optimize efficiency. Originating from the seminal works of Adam Smith, David Ricardo, and John

Stuart Mill, these theories collectively underpin our understanding of production processes and cost dynamics in economics.

Smith (1776) introduced the concept of division of labour in "The Wealth of Nations," emphasizing how specialization enhances productivity within firms by efficiently allocating tasks among workers. Ricardo (1817) expanded upon Smith's principles in "Principles of Political Economy and Taxation," introducing the Law of Diminishing Returns. This law posits that as additional units of a variable input, such as labour or capital, are applied to fixed inputs like land, the marginal productivity of the variable input diminishes. Ricardo's contribution underscored inherent constraints in production processes, guiding economic analyses on resource allocation and efficiency.

Marshall's seminal work in "Principles of Economics" (1890) further developed these foundational concepts, significantly contributing to both the Theory of Production and Cost Theory. Marshall formalized the production function, which quantitatively defines the relationship between inputs (labour and capital) and output, thereby providing a framework to analyze production efficiency and output levels. Additionally, Marshall delineated fixed costs (FC), which remain constant regardless of output levels, and variable costs (VC), which fluctuate with production levels. This distinction forms the core of cost theory, essential for understanding cost structures and managerial decision-making within firms.

In practical application, these theories are invaluable for analyzing real-world economic phenomena, such as the impact of environmental factors like drought on commercial farming operations in South Africa. During drought periods, the Theory of Production predicts reduced agricultural output due to limited water availability, a critical variable input. Concurrently, Cost Theory elucidates how such environmental constraints affect cost structures within agricultural enterprises. Increased variable costs, such as expenses related to irrigation or alternative water sources, escalate as farmers strive to maintain productivity amid adverse conditions. Understanding these interconnected theories provides a robust framework for policymakers and agricultural stakeholders to develop effective strategies, mitigate risks, and enhance resilience in response to environmental challenges. The choice of Cost Theory has been motivated by the fact that it is at the heart of business economics. Its choice is also motivated by the fact that it enables commercial farmers and/or other businesses through collective action in determination of price of a commodity or production cost involved. The operations of commercial farms largely depend on its production capabilities since the focus of those operations has production as focal point (Tatum, 2020), whilst it has become apparent that production has been adversely

impacted by the drought (Graw et al., 2017). In other words, drought negatively affects the operations of commercial farms which in turn had ripple effect on the end goal which is production (Graw et al., 2017). The operations represent the process which consist of transformation of the inputs into the output (s) of production (Theintactone, 2018). The inputs refer to what (amongst other things the fertilizer, the labour, the equipment, the land) go (get used) in the production phase and output refers to the items produced.

Upon reviewing the literature, theory of production: production functions appear to occupy a central position within the theoretical framework. The selection of this theory is motivated by several reasons inter alia it is topically relevant to this research, and it has been used in most scientific research (Mahajan, 2014; Shephard, 2015). Commercial farms are driven by profit-maximisation goals, it is therefore natural that farmers understand the concept of the production and the relationship between the inputs and outputs of production. Production (cost) largely impacts the profitability of an organisation, in other words if production was efficient, economical chances are that profit will be realised.

According to Felipe and Adams (2005) the production cost of an organisation depends on two factors namely production function and the price of factors of production. The price factors obviously are strongly dependent of the economy more specifically on demand and supply of goods. Furthermore, various factors influence price factors, including changes in consumer tastes and preferences, consumer income, competitor prices, and the product life cycle (Ukessays, 2018). During drought, the price factors are affected as a result, its adverse effects the economy and the rise of food items (Kenyaprime, 2020). The production function shows the relationship between output and inputs. The production function imposes that the quantity of inputs should be adjusted for the quantity of output to change. Some inputs are variable in nature and others are fixed over a period. The change in input is categorised in two types of changes namely short-term change and long-term change (Felipe & Adams, 2005).

a) Short-term change

This theory explains that the change in the production level in a short run is achieved by changing one or more variable production factors (inputs). Simply because in the short run some other factors of production will be fixed (non-variable). A few examples of fixed production factors in a short run could be land, plant, and equipment.

Since the fixed production such as land do not vary in the short run, it is expected of the farmers to increase the variable production factors (such as labour and ingredients) to

increase the level of output. Although increasing the variable factor(s) of production increase (output), it gets to the point that the more we increase the variable factor of production the more we start incurring a loss because the marginal product becomes negative. This means that the variable increases are not efficiently and economically applied to the existing fixed factor of production (land) as depicted in Figure 2.1 below; this holds relevance to Ricardo's theory where he mentioned that agriculture experiences a diminishing return as more doses of the inputs (like labour equipped with some tools and equipment) are used (Mizuta, 2015).

The relation among output and the quantity of a variable factor (labour) used in combination with a fixed factor (capital)

Quantities of labour	capital	Output *TP*	*AP*	*MP*	Stages of production
(i)	(ii)	(iii)	(iv)	(v)	(vi)
		0			Increasing return to the variable factor (labour)
			4	4	
1	10	4			
			5	6	
2	10	10			
			7	11	
3	10	21			
			10	19	
4	10	40			
5	10	55		15	Diminishing return to the variable factor
			11		
6	10	60		5	
			10		
7	10	63		3	
			9		
8	10	64		1	
			8		Negative return to the variable factor
9	10	63		−1	

Figure 2.1: The relation among output and the quantity of a variable factor (labour) used in combination with a fixed factor.

The inputs vary from a farm to the other, but for the purpose of this research, labour and land are the input used for discussion. Drought has a negative effect on the inputs required for production. This had led to reduction in inputs. The reduction of the input leads to the decrease of the output level. In the context of drought, it is it is crucial to address how drought affects the input factors of production. On labour, it is evident as seen above that drought has caused a loss of employment which in turn reduces the ability to produce more

as it is assumed that the fixed factors of production remained constant. On the land, the effect is worse because it becomes dry and not conducive for cultivation which leads to lower production level.

b) Long-term change

In the long run, all inputs to the production (both fixed and variable) are required to be changed. This could be explained by the change in the business operation scale or business restructuring. In the long run it is possible to change both the fixed and variable factors of production to obtain the desired output level. The change of inputs in the long run does not necessarily lead to the same change in output; it also led to break-even, loss or profit.

The Theory of Production and Cost Theory provide indispensable frameworks for understanding how commercial farmers in South Africa adapt to drought challenges. As highlighted by Adam Smith's concept of division of labour and David Ricardo's Law of Diminishing Returns, these theories underscore the need for efficient resource allocation and strategic planning in agricultural production. Alfred Marshall's contributions further emphasize the importance of adapting technology and adjusting operational scales to mitigate the impacts of drought on farm productivity and cost structures. In response to drought, farmers must leverage these theories to optimize production efficiency, integrate new technologies where feasible, and manage costs effectively through careful investment in machinery and irrigation systems. This proactive approach is essential for enhancing resilience and sustaining agricultural productivity amidst changing environmental conditions.

2.3.2 Emergency management framework

Emergency management is a multifaceted policy subsystem that entails a collaborative, multi-stage endeavour involving various levels of government to mitigate, prepare for, respond to, and recover from disasters (Coetzee & Van Niekerk, 2018). The selection of the Emergency Management Framework (EMF) is driven by its ability to safeguard businesses and communities. It accomplishes this by coordinating and integrating all necessary activities to enhance the capacity for mitigating, preparing for, responding to, and recovering from potential or actual natural disasters, acts of terrorism, or other man-made disasters (Jung, Song, and Park, 2019).

Moreover, the adoption of Emergency Management is driven by its capacity to empower businesses and individuals, fostering collective action to attain favourable results, and ensuring an enhanced and foreseeable response to, as well as recuperation from a broad

spectrum of emergencies. These encompass natural disasters, conflicts, food shortages, epidemics, environmental, chemical, food, and nuclear incidents, political or economic crises, and various other emergency situations that carry public health implications (World Health Organization, 2013). The foundational principles of emergency management are underpinned by four core phases: mitigation, preparedness, response, and recovery (as illustrated in Figure 2.2).

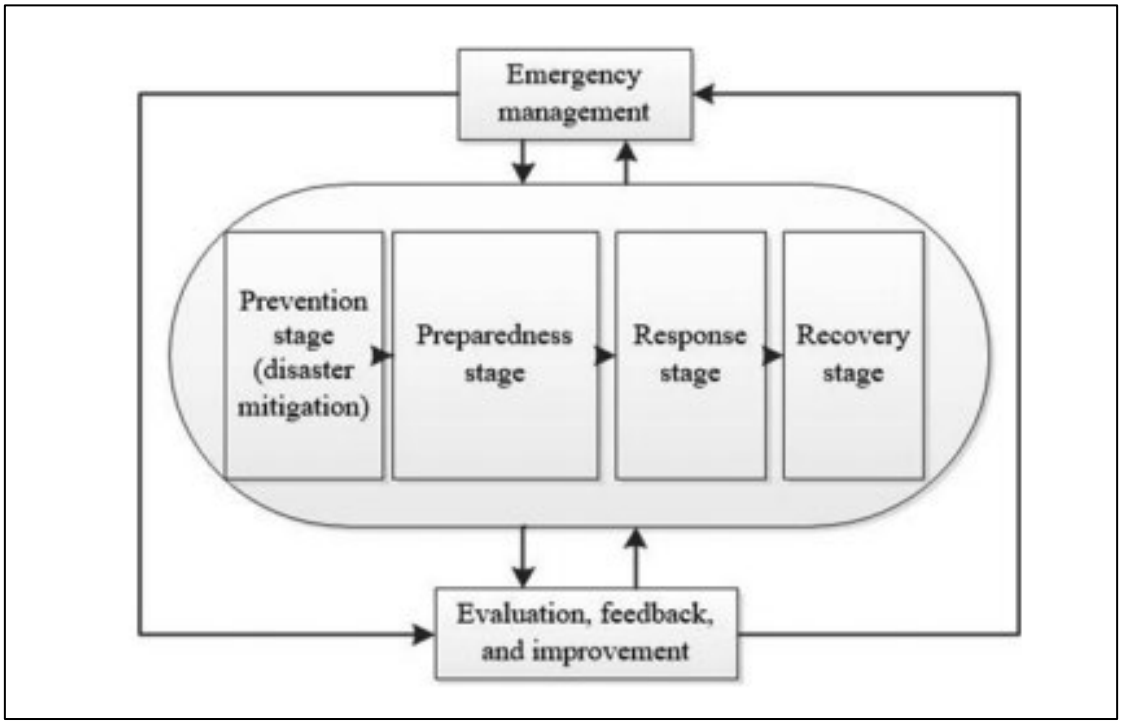


Figure 2.2: The four phases of emergency management (Rose et al., 2017)
Prevention stage (also referred to as disaster mitigation stage)

As outlined by Cao, Zhu, Han, and Zhu (2018), this phase encompasses a range of preventive measures aimed at reducing the likelihood of unforeseen events as well as reducing potential harm prior to the occurrence of such events. Unforeseen events can vary in nature; some may be mitigated, while others are inevitable, but efforts are made to mitigate their adverse effects. Mitigation consists of enduring activities carried out between disasters to prevent emergencies and minimize the consequences of those that do occur. This includes the identification and modification of hazards, the assessment and reduction of vulnerability to risks, and the dispersal of possible losses. Within this phase, risk assessment plays a critical role. It is advisable to anticipate and evaluate which risks are likely to manifest and where they are likely to occur, taking appropriate actions to mitigate these risks.

Preparedness stage:

During this phase, preparations are put in place to address specific or potential unforeseen events. These preparations primarily consist of two key measures: (1) developing various types of emergency plans and (2) striving to improve the capacity to mobilize available resources in the event of disasters. Preparedness entails short-term activities undertaken before the occurrence of a disaster to boost the preparedness of organizations and communities, enabling them to respond effectively. In this stage, hazards can be identified, and plans can be formulated to address the requirements for response and recovery (Jacques, Salon, Barnard, Vernoud & Prudent, 2021).

Response stage:

This phase, often referred to as emergency response, entails the implementation of a range of emergency actions and rescue operations during unforeseen events. Key measures in this stage encompass swiftly obtaining disaster information, activating emergency plans, offering various forms of assistance to address the unforeseen events, keeping the public informed about the event's status, and taking other relevant measures. It is essential to conduct various rescue operations in a manner that minimizes the risk of secondary damage during this phase (Bandurska, 2022).

Recovery stage:

After the unforeseen events are brought under effective control, various restorative measures are implemented to restore normalcy and social order. Key actions in this phase involve initiating recovery plans, offering post-disaster relief, reconstructing damaged infrastructure, reinstating social production and life order, and conducting assessments of disaster management. The emergency management framework serves as a structured roadmap for both decision-makers and emergency responders, offering guidance on how to effectively navigate the complex challenges presented by disasters and emergencies. It places a strong emphasis on the need for coordination, communication, and a systematic approach to manage and mitigate the impact of crises (Li et al., 2020).

In the context of commercial farming, this framework provides a valuable structure for addressing the challenges associated with drought and the subsequent impact on production costs. Within this framework, farmers can strategically plan and implement measures to minimise the increase in production costs when faced with drought. This includes practices like efficient water resource management, the adoption of drought-resistant crops, and the incorporation of mitigation strategies for future drought events. Overall, the emergency management framework equips commercial farmers with an

effective tool to manage both the challenges of drought and their production costs successfully.

2.3.3 Disaster Risk Management

Disaster risk management involves the implementation of policies and strategies for disaster risk reduction, with the goal of preventing new disaster risks, reducing the existing disaster risks, and managing residual risks. This contributes to the aim of strengthening resilience and minimizing the damage caused by disasters. Disaster risk management actions are categorized into three distinct types: prospective disaster risk management, corrective disaster risk management, and compensatory disaster risk management. Disaster Risk Management provides a framework for addressing natural disasters by addressing mitigation, adaptation, and preparedness measures (Naheed, 2021).

Commercial farms are more vulnerable to drought due to its negative effects to their overall business objectives. The lack of sound strategies is one of the greatest reasons why commercial farms suffer drastically from the occurrence of drought. Like any other natural disaster, it is important to first look at how to improve one's resilience to reduce the vulnerability that may derive from such undesired event. Management typically bears the responsibility of safeguarding farms from various unforeseen events to ensure the attainment of the business objectives. Managers of commercial farms should engage in disaster management across different levels, making use of available resources to mitigate the consequences of disasters, such as drought, in various settings. This should be done while considering vulnerability factors, including social and economic considerations. Thus, it is important for commercial farms' management to consider the implementation of a disaster management plan; this would result in having effective strategies to prevent the costs of drought (Liu, Guo, Tan, Zhang, Huang and Wang, 2021).

The aforesaid vulnerability refers to the susceptibility to harm exposure as well as the absence of the capacity to adapt. Farmers find themselves in a vulnerable state as they have reduced to no capacity to cope and recover from the disruptive changes caused by drought. Drought is regarded as one of the most financially burdensome disasters in the Western Cape, causing economic losses, inflation, increase in unemployment, more money spent for irrigation when there is not enough water, reduced incomes.

Stemming from above, it becomes evident that farmers with high level of resilience are the ones that will tend to adapt to drought time and manage their resources efficiently to continue operations with reduced damages or disruptions from the incidence of drought.

The lack of resilience caused by the failure to have adequate or drought-ready resources or the capacity to absorb and rebound from the impact of the hazardous event. According to Kasperson, Kates and Hohenemser (1985) and Kasperson (2019) disaster management is made of four stages as depicted in Figure 2.3, namely: Hazard assessment, control analysis, strategy selection, as well as implementation and evaluation.

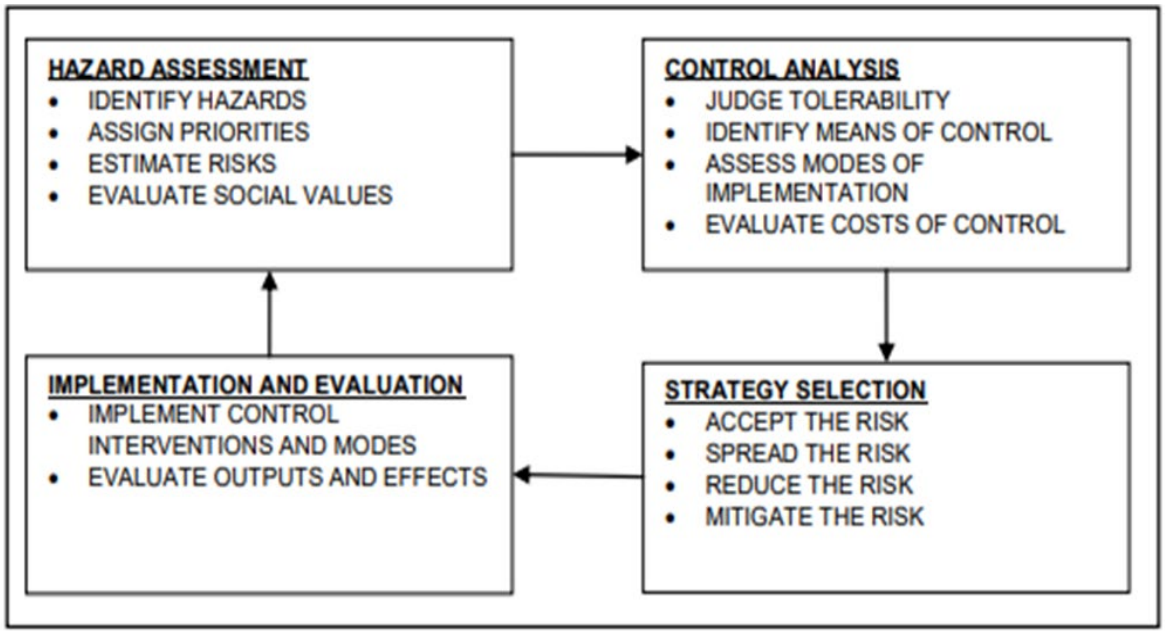


Figure 2.3: A Framework for hazard Management (Kasperson et al., 1985)

In terms of drought planning and management, Quarantelli (2006) and Radović (2020) propose the following phases: mitigation, preparedness, response, and recovery. Mitigation encompasses long-term, pre-impact activities that can be either structural or non-structural in nature, falling into one of the three categories:

1. Efforts aimed at eliminating or reducing the likelihood of a disaster occurring.
2. Measures designed to mitigate the consequences of a disaster.
3. Strategies that assist in redistributing the costs associated with disaster planning and the impacts of disasters.

Preparedness encompasses pre-impact activities focused on getting ready for disasters. These measures are closer to the onset of impact compared to mitigation efforts and are intended to enhance the timeliness of the emergency response if a disaster were to occur. Response pertains to the actions taken following a disaster's impact. Recovery encompasses the disaster-related activities conducted after the emergency phase to facilitate the return to a relatively normal state of functioning (Meza et al., 2021).

Flowing from above, it has become noteworthy that the existence of drought naturally leads to several economic, social, and environmental costs starting from the vulnerability and resilience to drought. When management does not proactively address drought, commercial farms are at a higher risk of incurring greater costs due to the increased overall damage costs (Botzen, Deschenes, and Sanders, 2019). The actions of management could be part of drought management and these actions are implemented or undertaken at a cost which in most cases is lesser than the cost of suffering or being consumed by the devastated consequences of drought. In general, the expenses linked to drought management can be categorized into three groups: preparedness costs, drought risk mitigation costs, and drought relief costs. Costs associated with drought relief can be viewed as crisis management expenses, while drought preparedness and mitigation costs constitute risk management costs. Risk management entails the development of drought management plans and the identification of actions to be taken before and after a drought event and its impacts (Meza et al., 2021).

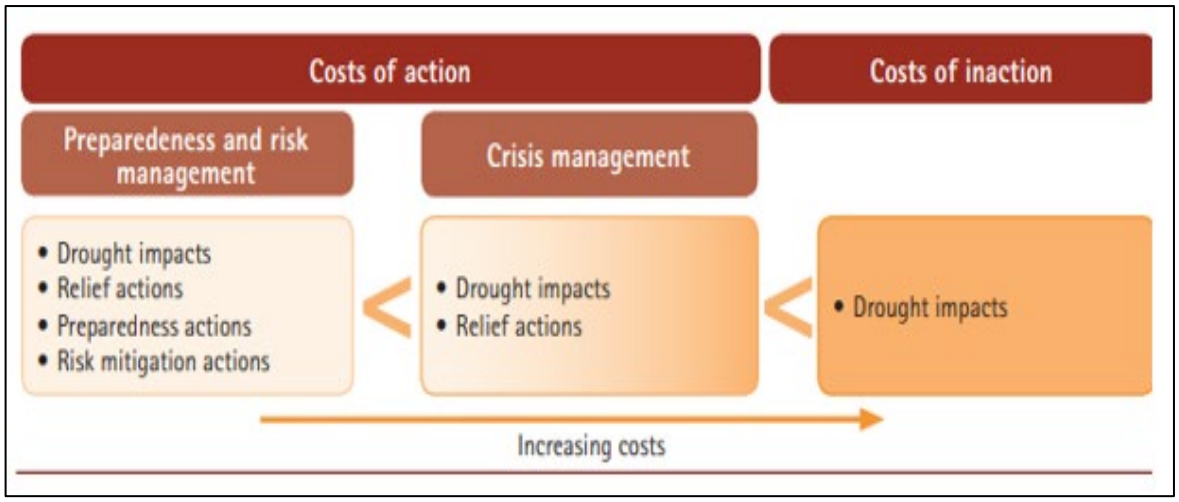


Figure 2.4: Summary of costs of drought under different action scenarios (Gerber & Mirzabaev, 2017)

The figure suggests that the costs incurred due to inaction in response to drought are higher than the costs of addressing drought impacts through crisis management approaches (indicated by the inequality sign '<'). Conversely, the costs of taking action against drought using crisis management methods are expected to be higher than those associated with using risk management approaches. The overall cost of drought damages is likely to increase when no action is taken by management. The costs related to actions against drought can be categorized into three main groups: preparedness costs, drought risk

mitigation costs, and drought relief costs. These costs constitute the expenses associated with crisis management. On the other hand, drought preparedness costs and the costs of proactive drought risk mitigation complete the expenses associated with risk management. The development and implementation of drought management plans play a critical role in enhancing risk management, as they are utilized to identify a set of actions to be taken both before and after a drought event and its effects (Haigh et al., 2021).

The central idea proposed in this study is that the costs of action are typically lower than the costs of inaction, and the returns on investments in ex ante risk management actions are generally higher than those of ex post crisis management, as illustrated in Figure 2.4. Actions related to drought preparedness and drought risk mitigation reduce the ultimate drought relief costs, thereby helping to mitigate the costs of inaction. Management's commitment to taking action in response to drought incidents before and after they occur results in an "adaptive capacity" (Engle & Follette, 2018) and reduces the economic and social costs.

Moreover, mitigating drought risks and employing risk management strategies offer significant and appealing features due to their substantial socio-economic co-benefits. Various actions aimed at drought risk management enhance resilience against droughts, socio-economic shocks, and environmental challenges. Consequently, their application is justified when used as preventive measures to mitigate the detrimental impacts of both direct and indirect costs associated with droughts. Figure 2.5 illustrates the advantages of implementing risk management approaches, including the reduction of drought costs and relief costs. For example, the adoption of enhanced irrigation practices or the utilization of alternative water sources (Hettiarachchi, 2016) may yield positive outcomes in terms of agricultural income and sustainable water and land use, both during normal conditions and drought periods.

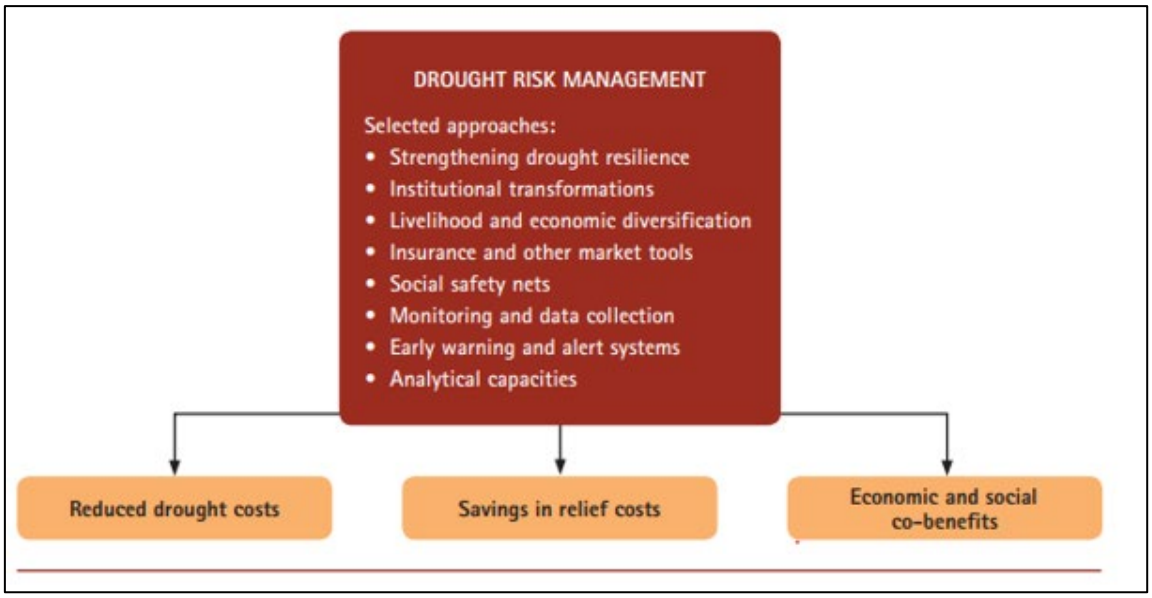


Figure 2.5: Approaches to drought risk management and benefits (Gerber & Mirzabaev, 2017)

Gap in the Literature

The literature on the cost implications of drought on operations of commercial farmers reveals several gaps that merit attention and further research. Despite extensive studies on agricultural economics and climate change impacts, there remains a notable underrepresentation of specific focus on how drought directly influences the cost structures and operational dynamics of commercial farming enterprises.

Specificity to Commercial Farming: Existing research often generalizes the impacts of drought across agriculture without distinguishing between different types of farms. Commercial farms, which operate at larger scales and often rely heavily on mechanization and technology, may face unique challenges and cost implications during drought periods that differ from smaller-scale or subsistence farming operations.

Regional Variability and Context: Studies frequently overlook the regional variability in drought impacts. The cost implications of drought can vary significantly depending on geographic location, local climate patterns, soil characteristics, and irrigation infrastructure availability. Research focusing on specific regions, such as the Cape Winelands District in South Africa, where commercial farming plays a critical economic role, is sparse.

Detailed Cost Analysis: There is a lack of detailed empirical studies that quantitatively analyze the direct and indirect costs incurred by commercial farmers during drought periods.

This includes expenses related to alternative water sources, increased irrigation costs, crop losses, reduced productivity, and potential long-term impacts on farm profitability and sustainability.

Integrated Approach: Many studies tend to examine drought impacts solely from an agronomic or environmental perspective, neglecting the integrated economic and financial dimensions. A comprehensive analysis that integrates cost implications with management strategies, financial planning, and policy responses is needed to provide holistic insights into mitigating drought-related costs.

Management and Adaptation Strategies: While some literature discusses adaptive strategies for mitigating drought impacts, there is a gap in understanding which specific management practices and technological innovations are most effective in reducing costs and enhancing resilience on commercial farms. Research that identifies best practices and benchmarks for cost-effective drought management strategies is crucial for informing industry practices and policy development.

Addressing these gaps in the literature will not only advance theoretical understanding but also provide practical guidance for policymakers, agricultural managers, and stakeholders seeking to enhance the resilience and sustainability of commercial farming operations in the face of drought and other climate-related challenges. By filling these gaps, future research can contribute significantly to the development of informed decision-making frameworks and adaptive strategies tailored to the specific needs of commercial farmers.

2.4 CONCLUSION

The literature review pertaining to the theoretical and conceptual framework, as well as empirical studies, concerning the cost implications of drought on the operational aspects of commercial farming businesses has been thoroughly examined. Through this review, knowledge gaps have been identified, and valuable lessons have been gleaned. These findings have subsequently guided the creation of the conceptual framework. Additionally, the review of relevant literature has been instrumental in directing the methodology employed in the study and influencing the approach to presenting the research results.

Upon review, significant gaps have emerged in the current literature pertaining to South African agricultural contexts. Specifically, there is a notable absence of comprehensive empirical studies that quantitatively assess both the direct and indirect costs incurred by commercial farmers during drought periods. Furthermore, while some research explores

adaptive strategies, there remains a clear need for studies that delineate best practices and establish benchmarks for cost-effective drought management strategies tailored to the unique challenges faced by commercial farming operations in South Africa. Addressing these gaps is crucial for advancing theoretical knowledge and practical applications aimed at mitigating the financial impacts of drought and enhancing the resilience of commercial farming enterprises within the South African context.

In the next chapter, the focus will shift towards an in-depth analysis of the Western Cape water crisis, with a particular emphasis on the economic, environmental, production, poverty, export, and food security implications of drought. Additionally, the chapter will delve into the strategies and measures employed for the mitigation of agricultural drought in the context of commercial farming.

CHAPTER 3
CAPE WINELANDS COMMERCIAL FARMS AND WESTERN CAPE WATER CRISIS

3.1 INTRODUCTION

The previous chapter provides an overview of the theories that underpin the research, along with a brief discussion of drought, farming, and commercial farms to give the reader a foundational understanding of the research. This chapter constitutes a review of the existing literature on the cost effects of drought on the operations of commercial farms and the water crisis in the Western Cape.

The literature review establishes the context for the research, acknowledging where the research aligns with the existing body of knowledge (Snyder, 2019). It presents the reader with the findings of comparable studies closely related to the one at hand. The literature review also connects the research to the ongoing discourse in the literature, bridging gaps and expanding upon previous investigations (Kraus, Mahto, and Walsh, 2023). Commercial farms play a vital role in many countries by contributing to the country's economic development and reducing the unemployment rate. In this chapter, relevant literature on the key aspects of the current research is explored.

3.2 CAPE WINELANDS DISTRICT, WESTERN CAPE

Western Cape is situated in Southwest coast of South Africa and is the fourth largest of the nine provinces. Furthermore, Western Cape is divided into three climate zones, around Cape Town, the Cape Peninsula, and the region around Cape Winelands District. Its rainfall comes in winter which is May to August, and it can be very cold (Morokong, Sibulali, Murdoch and Barends-Jones, 2021).

Figure 3.1 illustrates the Western Cape Province’s demarcations.

Figure 3.1: Western Cape Districts (Source: WCDoA, 2019)

Western Cape Province consist of consist of six grouped districts namely 1) West Cost, 2) City of Cape Town, 3) Overberg, 4) Eden and 5) Central Karoo and 6) Cape Winelands. Cape Winelands is the landlocked area situated between the West Coasts and Overberg coast and it consist of five local municipalities, where Cape Winelands District is one of them.

Figure 3.2: Cape Winelands Local Municipalities (Municipalities of South Africa, 2012-2021)

3.3 OVERVIEW OF SOUTH AFRICAN FARMING

According to research by Wilhite and Glantz in 1985, farming in Southern Africa commenced over a millennium ago when the first African farmers migrated to the region, shifting away from a reliance on hunting and gathering for sustenance. Nevertheless, in the present day, farming has transformed into the primary means of livelihood for a significant segment of South Africa's population, with roughly 70% of individuals depending primarily on agriculture for their sustenance (Arora, 2019).

According to the report published by the Department of Agriculture, Forestry, and Fisheries (DAFF) in 2017, South Africa is divided into various farming regions based on climate, natural vegetation, soil type, and farming practices (Department of Agriculture, Forestry, and Fisheries, 2019). Agricultural activities vary from intensive crop production and mixed farming in regions with winter and high summer rainfall to cattle ranching in the bushveld and sheep farming in more arid areas (Morokong et al., 2021). The combinations of climate and soil make only 12% of the country suitable for rain-fed crop production, with a mere 3% considered truly fertile land. This places South Africa behind other countries like India, where arable land covers 53% of the country (Department of Agriculture, Forestry, and Fisheries, 2019). Livestock farming is the largest agricultural sector in the country, with approximately 69% of South Africa's land surface suitable for grazing.

Farming plays a pivotal role in South Africa's economic growth, food supply, Gross Domestic Product (GDP), employment opportunities, poverty alleviation, foreign trade, and food security. Over the past two decades, South African agriculture has transitioned towards large-scale intensive farming, with a shift from the production of low-value food crops to high-value export products. South Africa even became a net importer of food for the first time in 2008. Between 2010 and 2011, the value of agricultural exports increased by 10 percent, rising from US$4,630 million to US$5,100 million (BFAP Baseline, 2018).

According to the Food and Agriculture Organization (FAO), South Africa is ranked as one of the world's largest producers of various agricultural products, including chicory roots (3rd), grapefruit (4th), green maize (5th), pears (8th), castor oil seed (10th), fiber crops (10th), and sisal (11th) (FAO, 2020). However, the Worldwide Fund for Nature (WWF) highlights that water availability is the primary limiting factor for agricultural production in South Africa. Currently, agriculture already consumes the majority of the country's available

freshwater, with approximately 63 percent allocated to irrigation. Nevertheless, WWF has warned that the water situation is likely to worsen due to climate change and increasing demand from other economic sectors. While only 1.5 percent of South Africa's land is under irrigation, it contributes to 30 percent of the country's crop production. WWF's caution suggests that there is no surplus water, and farmers may need to double their water usage by 2050 to meet growing food demands, given current farming practices (WWF, 2018).

Farming is of paramount importance to the country because it influences the management of land and water resources, aiming to optimize and sustain long-term productivity. Agriculture is crucial for maintaining healthy and functional ecosystems that are rich in biodiversity. Additionally, it plays a pivotal role in enhancing the economic and social well-being of the population, ensuring a secure and high-quality supply of agricultural products, and safeguarding the livelihoods and welfare of farmers, farm workers, and their families (Hussain, Muscolo, Farooq, and Ahmad, 2019). However, in recent years, the South African farming industry has faced significant challenges, including:

- Drought – In recent years, South Africa has faced recurring droughts, resulting in water scarcity and diminished crop yields.
- Climate change – Climate change is causing shifts in weather patterns, leading to increased temperatures and erratic rainfall. This disrupts farming practices and can reduce agricultural productivity.
- Rising Input Costs - Farmers in South Africa are grappling with escalating input costs and their reliance on external factors that are beyond their control, including oil prices and exchange rates.
- Finite Natural Resources - The farming industry in South Africa faces significant challenges due to finite natural resources, including looming water scarcity and the increasing loss of soil.
- Lack of Subsidies and Support - The farming industry in South Africa grapples with challenges related to a lack of subsidies and extension support, affecting both established commercial farmers and emerging/developing black farmers.
- Market Uncertainty: Limited market predictability and non-tariff trade barriers in importing countries affect trade.
- Competition from Imports: Increasing competition from cheap, subsidized imports can impact local farmers.
- Exposure to Chemicals: Farmers may be exposed to toxic chemicals.

- High Crime Rates: The high murder rate and tenure insecurity can have a negative impact on farming.
- Long-term Climate Changes: Predicted negative changes in the climate could further challenge farming.
- Natural Systems Decline: There is a decline in the health and functioning of supporting and underpinning natural systems.

Nevertheless, farming is classified according to what it is cultivated and how it is cultivated. Farming encompasses various types and practices, including subsistence farming, mixed farming, nomadic farming, arable farming, pastoral farming, intensive farming, extensive farming, sedentary farming, and commercial farming. Each type of farming has its unique characteristics and purposes. Notwithstanding the above, the focus of this research is on commercial farming because commercial farms play a pivotal role in the whole country and furthermore, they are the main driver and influencer of the global agriculture industry (Fenibo, Ijoma and Matambo, 2021).

3.4 OVERVIEW OF COMMERCIAL FARMING

South Africa, as the ninth-largest wine producer globally, commands a significant presence in the international viticulture landscape (Gbejewoh, Keesstra and Blancquaert, 2021). Its wine industry is underpinned by an extensive cultivation area of over 110,000 hectares and an impressive vine count exceeding 300 million (Dlakavu, 2021). Notably, a distinguishing feature of this industry is the predominant role played by cooperatives, contributing to approximately 84% of the nation's wine production. Beyond the realm of viticulture, this thriving sector emerges as a substantial source of employment, supporting over 60,000 individuals through more than 4,000 primary wine producers. An extraordinary trajectory is discerned in the realm of wine exports, as the nation's outbound wine shipments increasing from 22 million litres in 1992 to a remarkable 314 million litres in 2007. An auspicious milestone in this trajectory occurred between January 2007 and January 2008 when exports surpassed domestic sales for the first time, underscoring South Africa's burgeoning prominence in the global wine market (Chiapa et al., 2019).

South Africa's agricultural landscape exhibits a dual character, encompassing well-established commercial farming alongside smaller-scale communal farming, often located in former homeland areas. While agriculture's direct contribution to the nation's total GDP is relatively modest, it plays a pivotal role in terms of employment generation and foreign exchange earnings (Harrington, Ottenbacher, Marlowe and Siguda, 2019). Over the years, the commercial agricultural sector has registered substantial growth, averaging

approximately 14% annually since 1970, albeit in a context where the overall economy expanded by 14.5% during the same period. Consequently, agriculture's share of the national GDP has dwindled to 2.5% in 2008 (National Agricultural Statistics Service, 2008)). However, it is imperative to note that the sector's interconnectedness with the broader economy translates into a more substantial estimated contribution of approximately 14% to the GDP (Bernstein, 2013).

Within this agricultural landscape, commercial farming in the Western Cape province of South Africa occupies a pivotal position. This province is renowned for its agricultural diversity, propitious climatic conditions, and accessibility to lucrative markets, rendering it a vanguard within the nation's agricultural domain. The Western Cape's agricultural pursuits encompass a multitude of facets:

Crop and Horticultural Cultivation: The province has carved a niche in wine production, with celebrated regions like Stellenbosch, Paarl, and Franschhoek epitomising the vinicultural excellence of the region (Booyens, 2020). Furthermore, it boasts an array of fruit cultivation, including apples, pears, citrus fruits, and grapes, as well as a thriving market for vegetables such as tomatoes, carrots, and onions. A noteworthy distinction lies in its stature as a major global exporter of table grapes.

Livestock farming: Cattle farming, catering to both beef and dairy production, assumes prominence within the province, while sheep farming, with an emphasis on Merino sheep for wool production, coexists. The poultry industry, encompassing chicken and egg production, flourishes in tandem (Cheteni & Mokhele, 2019).

Diversified agriculture: Many commercial farms in the Western Cape embrace diversified agricultural practices, amalgamating crop cultivation with livestock farming to foster sustainability and augment income streams (Ncube, 2020).

Technological Advancements and Innovation: Modern farming techniques and technological innovations are pervasive among commercial farmers in the Western Cape. These advancements are instrumental in optimising crop yields, conserving water resources, and enhancing overall operational efficiency (Talanow, Topp, Loos and Martín-López, 2021). Nonetheless, the Western Cape's agricultural pursuits are not devoid of challenges. Water scarcity and the pervasive effects of climate change loom as critical concerns with the potential to adversely impact crop production (Zwane, 2019). Furthermore, issues related to land reform and equitable access to agricultural land remain

prominent on the regional agricultural agenda. In response to environmental imperatives and the exigency of long-term agricultural viability, an increasing number of commercial farmers in the Western Cape are transitioning towards sustainable farming practices.

The Western Cape's picturesque landscapes and vineyards beckon tourists, thereby catalysing the emergence of wine tourism and agritourism sectors. These developments attract visitors keen on exploring the region's rich agricultural heritage while contributing to the region's economic vibrancy (Harrington, Ottenbacher, Marlowe and Siguda, 2019). In essence, commercial farming in the Western Cape epitomises diversified agricultural production, comprising wine, fruits, vegetables, and livestock. The province's export-oriented agricultural practices, buttressed by modern techniques and technologies, reinforce its pivotal role in South Africa's agricultural landscape (Morokong & Pienaar, 2019). While grappling with challenges such as water scarcity and land reform, the Western Cape remains a cornerstone of the nation's agricultural sector, exemplifying the resilience and dynamism of commercial farming in South Africa.

Concurrently, statistics underscore the significance of commercial farming to the national economy, with South Africa hosting approximately 40,122 commercial farming enterprises. The Western Cape emerges as a prominent contributor, accounting for a substantial portion of the nation's agricultural value-added, reflected in its substantial gross farm income (GFI) of R64.3 billion, equivalent to 19.3% of the national total in 2017. This agricultural sector also plays a pivotal role in employment generation, with an estimated 757,628 individuals engaged in various capacities as of June 2018 (Stats, 2020). In 2008, the Western Cape led the nation in agricultural employment, with 186,997 employees, equivalent to 24.7% of the total workforce (Stats, 2020).

The Western Cape's strategic geographical location near the Cape Town International Port confers a competitive advantage for exporting agricultural commodities, notably fruits and wines, to international markets. Agricultural imports and exports have collectively injected R127 billion into the country's economy, underscoring the sector's integral role in sustaining South Africa's global agricultural market presence. Importantly, the country features among the top ten 'import and export nations for various grape varieties, further affirming its global significance (Stats, 2020).

In conclusion, commercial farms in the Western Cape play a crucial role in South Africa's economy. Their significant agricultural production, job creation, and export activities highlight their essential contributions at both the regional and national levels. Nevertheless,

the agricultural sector faces challenges, especially related to environmental issues and the need for fair land reform. Despite these obstacles, the Western Cape continues to serve as a stronghold of commercial farming in South Africa, symbolising its resilience, productivity, and commitment to sustainability.

3.5 SOUTH AFRICAN OVERVIEW OF AGRICULTURAL DROUGHT

Our survival is closely tied to water – for drinking and for growing our food. Agriculture relies on freshwater from various sources like rivers, lakes, and underground aquifers. Rain-fed farming and a significant portion of livestock production also depend on the limited rainfall available. Furthermore, water-based ecosystems play a crucial role in supporting livelihoods, ensuring food security, and providing nutrition, particularly through inland fisheries and aquaculture. Clean freshwater supplies are essential for safe drinking water and to maintain hygiene and food safety standards, which are critical for human health (Masipa, 2017; Dettori, Arghittu, Deiana, Castiglia, & Azara, 2022). Additionally, water serves various other purposes and supports various human activities.

Drought is different from other natural hazards like floods or wildfires, primarily in terms of its onset and progression. Unlike those hazards, which can cause immediate and noticeable impacts, drought unfolds gradually over time. Identifying the precise starting and ending points of a drought event is often challenging (Tatli & Dalfes, 2020). Due to this characteristic of drought, it is challenging for farming businesses to prepare for drought. Yet it has imposed a significant impediment on agricultural investment and productivity, leading to severe economic consequences for South Africa. Declining farming profitability and water scarcity (drought, declining rainfall, or over-demand for water) left South Africa with less than two-thirds of the number of farms it had in the early 1990s (Rahman & Rahman, 2019). In many instances the lost farms have been repurposed for other land uses or amalgamated into larger farming units to achieve cost efficiencies. Despite a notable decrease in the area devoted to crops like maize and wheat, as well as in dairy production (representing 5% of the national herd), over the past two decades, overall production has remained relatively steady, pointing to a growing trend in intensified production (Wilhite, 2011; Lv, Song, Giltrap, Feng, Yang, and Zhang, 2020.

The substantial water requirements for food production pose a pressing concern. If current trends in food production, consumption, and environmental practices persist, the nation will confront an impending crisis. This challenge is exacerbated by the convergence of factors such as climate change affecting water availability and scarcity, the rising demand for biofuels, and increasing competition for water resources from expanding industries and

domestic needs (Gizaw & Gan, 2017). To ensure the resilience and prosperity of agriculture in the 21st century, farming methods must prioritise and encourage more sustainable water utilisation.

Southern Africa is the second region globally to grapple with a severe water deficit, with the Middle East and North Africa being the first (Turton, 2005). Among the countries in this region, South Africa is one of the most water-scarce nations. The country also experiences highly variable rainfall patterns, both in terms of geographic distribution and temporal variability. Predictions of climate change suggest that rainfall will become less frequent but more intense (Elum et al., 2017), further reducing the country's arable land and exacerbating agricultural unpredictability. Farmers are increasingly challenged in meeting the growing demand for food due to these factors. This highlights the need for the implementation of effective cropping and rangeland production practices to safeguard soil integrity in the face of anticipated intense rainfall events.

Recent droughts in the Southern and Eastern Cape regions have highlighted the susceptibility of South African farmers to declining rainfall. Livestock farmers in these regions are forced to take measures like transporting water and feed, drilling boreholes, and selling cattle as survival strategies during droughts (Squires, Gaur and Springerlink (Online Service, 2020). Irrigation, a time-tested method for enhancing agricultural output, offers benefits such as expanding arable land, improving yields, and enabling multiple crop cycles in a year. In South Africa, however, only 1.5% of the land is currently under irrigation, yet it contributes to 30% of the country’s crop production (Water Affairs and Forestry (2009). While expanding irrigation appears to be a logical approach to boosting productivity, all South Africa’s irrigable land, estimated to be around 1.2% of the nation’s territory, is already under cultivation. Moreover, irrigation is rapidly encroaching into unsuitable areas, posing environmental challenges (Bernstein, 2013).

In South Africa, the experience of droughts date from as back as before 1982; but this research will only focus on the most recent ones which occurred within the last 5 years. These droughts can be experienced in different manners since they are generally divided into 4 types namely 1) Meteorological drought, 2) Agricultural drought, 3) Hydrological drought and 4) Socioeconomic drought. Meteorological drought is defined by the degree of dryness compared to a normal or average amount of precipitation and the duration of the dry period. Meteorological drought occurs during prolonged periods with less than average precipitation and can lead to agricultural and hydrological droughts (Jooste, 2016; Wu, Ma and Yan, 2020). Agricultural drought is characterized by factors such as precipitation

shortages, differences between actual and potential evapotranspiration, soil-water deficits, reduced groundwater, or reservoir levels. It is mainly caused by extended periods of below-average precipitation and primarily affects agricultural production. Hydrological drought is related to a persistently low discharge and/or volume of water in streams and reservoirs, lasting for months, or even years. Hydrological drought involves stored water that is used but not replaced, in essence this type of drought comes into existence when reserved water in sources such as lakes, aquifers and reservoirs fall below significant threshold (Jooste, 2016; Wu, Ma and Yan, 2020). Socioeconomic definitions of drought consider the supply and demand of economic goods and are associated with meteorological, hydrological, and agricultural drought. Socioeconomic drought is driven by imbalances in the supply and demand of economic goods due to weather-related shortfalls in water supply (Zyl, 1993; Liu & Chen, 2021). Each type of drought has its unique characteristics and can have varying impacts on agriculture, water resources, and socioeconomic conditions. These categories help in understanding and addressing the diverse challenges posed by drought in different contexts.

An investigation into the drought that inflicted significant losses upon the Western Cape Province and its agricultural sector is imperative. It is essential to explore ways to reduce the economic impact of prolonged dry seasons, prioritising cost-effectiveness, and efficiency, to ensure the long-term sustainability of the farming industry in the Western Cape Province.

3.6 THE WESTERN CAPE WATER CRISIS

Over its recorded history, the Western Cape has experienced numerous significant droughts. The most recent drought, which commenced in 2015, led to concerns about "day zero." This term is used when average dam levels drop to 13.5%, and water supply to taps is shut off (Wolski, 2018). The Western Cape has a history of facing severe droughts, with the previous two major ones occurring in 2003 and 2015 (Taking et al., 2019). These droughts resulted in an estimated economic loss of R5.9 billion to the agriculture sector in the Western Cape alone.

Western Cape Agricultural Sector Profile (2018) reported that Western Cape zones have been accepting summer precipitation all through the year, however, dam levels decreased from 37.8% to 20.7% (Partridge & Morokong, 2018). The province experienced the dry spell and water emergency due to the abnormal water capacity in both the major government and on-farm capacities. The winter precipitation season of 2017 conveyed altogether less precipitation than the long-term average (Green Cape, 2020). The winter precipitation

contributed about 39.1% on 30 September to the dam water level which is little compared to 64.1% of the prior year at the about same month. Water drop is directly a result of climate alter; water became scarcer due to population and industrialisation needs (Thomas et al., 2007). The latter has resulted in a greatly challenging summer season whereby watered crops and numerous cash crops were not planted due to not having enough of water.

Agricultural businesses were confronted with a lot of challenges such as bankruptcy and some became dormant (The Conversation, 2019). Increased water tariffs rendered the use of water expensive during the time of drought, but it is also seen as a policy to ensure that optimal water is being used economically and efficiently in farming activities (Department of Water and Sanitation, 2017). A large proportion of the country's agricultural businesses use water irrigation system to access the available water resources to carry out their operations. It is disconcerting that when there is lack of water it become' difficult for farmers to water crops in the field (Western Cape Department of Agriculture, 2014). Drawing from above, it is apparent that the agriculture sector is in danger despite its importance for the economy and for food security.

As mentioned above, the agriculture sector in the Western Cape was compelled to reduce its water consumption by 60% since 2017 due to water restrictions that varied across regions. Consequently, there was a notable decrease in overall agricultural output as farmers chose to prioritize crops with higher profit margins, such as fruit, and opted to abandon vegetables and other crops. Agriculture had to contend with urban water use, including industrial and residential needs, during the irrigation season. Even if the province receives rainfall that aligns with average patterns, it might take between two to three years for dam levels to recover sufficiently, warranting the lifting of existing water restrictions (Western Cape Department of Agriculture, 2014). A multi-year crisis like this one can also exert pressure on future production seasons. Therefore, farmers will need to continue seeking efficient and innovative approaches for water utilization.

3.7 THE COST AND EFFECT OF DROUGHT ON ECONOMY

Drought is widely acknowledged as playing a pivotal role in contributing to farming business risk. According to research by Morokong and Pienaar (2019), drought has shown a significant impact in the economy of South Africa, especially in Western Cape over the past four years. Drought has resulted in a drop of approximately 35% of agricultural output in Western Cape, which translates into R4.96 billion of Gross Value Added. Furthermore, this resulted in about 3500 agricultural job loss. Due to decrease in farming production in the Western Cape, it is expected that exports volume will decrease by approximately 15% as

of 2017, compared to the previous season. Thus, it is more likely to affect the prices for the products exported (Green Cape, 2020).

Preliminary findings on the economic impact of drought on South African agricultural sector indicate an expected aggregate income loss of approximately R5.9 billion. This situation is likely to exert substantial adverse effects on employment and exports (Pienaar & Boonzaaier, 2018). A survey from 2017 indicated that about 6% of farmers expressed concerns that they may not be able to continue farming if the water crisis persists (BFAP, 2017). Given these findings, it is crucial to explore strategies to mitigate the effects of drought to sustain the farming industry in South Africa. Addressing water scarcity, implementing drought-resistant farming techniques, and improving water management practices are likely to be key components of any effective mitigation plan.

3.8 THE COST EFFECT OF DROUGHT ON COMMERCIAL FARM'S PRODUCTION

The Western Cape agricultural sector consists of an estimated 6,653 large-scale commercial producers and 9,480 emerging farmers. In addition, approximately 50,000 economically disadvantaged families rely on irrigated backyard gardening for their subsistence. (Western Cape Government Provincial Treasury, 2018). The latter group relies on municipal water for their backyard gardening, and it is anticipated that a significant portion of them may struggle to produce an adequate amount of food during drought periods. This situation is likely to have adverse effects on both agricultural production and the food security of these households (Morokong & Pienaar, 2019).

Nonetheless, the dominant agricultural sector in the Western Cape is wine grape production, encompassing an estimated 8,400 hectares under cultivation, generating a gross income of approximately R437 million during the 2016/17 season. This industry processes wine grapes delivered to various wineries, resulting in the production of around 145 million liters of wine with a wholesale value of about R730 million. A portion of this wine is bottled and exported, further contributing to its value (Stats SA, 2020). However, the most significant component of the production process is labour, with an annual wage bill estimated at R276 million in the Cape Winelands District, Western Cape area (Stats SA, 2020). The agricultural sector, therefore, provides a sustainable livelihood for numerous families, many of whom reside on farms and receive additional non-monetary compensations. Input costs for intensive farming are on the rise and are subject to fluctuations in oil prices, raw material costs, and exchange rate variations, leaving farmers with limited control over their financial stability. Notable expenses include fertilizer products

(R70 million) and chemicals for spraying (R67 million) (Stats SA, 2020). Farmers paid approximately R31 million for water, and municipal taxes amounted to transfers of around R5.8 million (Lower Olifant River: Economic Impact Assessment of the 2017/18 Drought). This highlights the reliance of numerous organizations and institutions on the prosperity of the agricultural economy.

Enhancing the productivity of irrigated systems can be achieved through investments in new irrigation infrastructure or the restoration and modernization of existing systems. However, the effectiveness of improved water management practices is most effective when combined with improved agricultural practices, such as the cultivation of drought-resistant crop varieties. The issue of water scarcity, characterized by an imbalance between the supply and demand for freshwater, along with concerns regarding water quality, is progressively jeopardizing food security and nutrition across the entire food supply chain – from agricultural production and food processing to consumption by households and individuals. Simultaneously, persistent, and severe droughts, exacerbated by the effects of climate change, are causing increasingly severe water shortages in rain-fed agriculture, amplifying the threat to the livelihoods of rural populations by diminishing both crop and livestock yields. Without prompt action, this situation will only deteriorate further.

3.9 THE EFFECT OF DROUGHT ON COMMERCIAL FARM'S EMPLOYMENT

South Africa is suffering an increasing rate of unemployment which is creating a serious socio-economic issue in the country. There is enormous cause or reasons for the high unemployment rate in the country. However, the purpose of this research is to discuss drought as a possible cause for the rise of unemployment in the country. As mentioned earlier, Western Cape agricultural sector is an important segment of the national economy, yet it is highly susceptible to varied challenges or threats which impair its capacity to produce efficiently and economically. This affects its ability to generate income and in turn it has a negative effect on employment.

In 2014, the Western Cape had 2,237,000 individuals employed, and during the same year, there were 593,000 unemployed people (Partridge & Morokong, 2019). The Western Cape's agricultural sector achieved a significantly higher employment rate compared to the national average of 7.2% for the agricultural sector, as reported in the Western Cape Agricultural Sector Profile (Partridge & Morokong, 2019). The Western Cape accounted for 23% of the entire national agricultural workforce, making it the largest among the provinces. Until 2015, the Western Cape experienced a continuous increase in agricultural employment (Partridge & Morokong, 2019). However, this growth was challenged by the

recent drought, leading to a notable decrease in seasonally adjusted employment within the Western Cape's agricultural sector. By the end of 2015, the sector had 232,319 employees, but this number decreased to 187,044 by the end of 2017 (Partridge & Morokong, 2019). Despite this contraction, it's essential to recognize the progress made before the drought, as employment levels still surpass those before 2015. Additionally, according to BFAP (2018), many individuals lost their jobs because farmers had to reduce their labour force, primarily relying on a much smaller seasonal workforce. In severe cases, some farmers had to lay off permanent employees. As a mitigation strategy, some farmers reduced the working hours of laborers, and in many instances, they retained permanent laborers despite the decreased labour requirements due to substantially lower yields.

3.10 AGRICULTURAL DROUGHT EFFECT ON POVERTY

Agriculture, being a labour-intensive and rural sector, has a vital role in job creation and poverty reduction in South Africa. Unfortunately, employment in the commercial farming sector is dwindling, primarily due to farms becoming larger and more mechanized. According to agricultural statistics from 2008, the total number of farm workers declined from 1.6 million in 1971 to 628,000 in 2005 (Stats SA, 2008). Considering the population growth during this period, the relative contribution of agriculture to employment decreased from 8.3% to 1.3% (Western Cape Government Agriculture, 2017). Moreover, there has been a shift from permanent employment to irregular and temporary employment, leaving farm laborers and their households in precarious and insecure situations. The introduction of a minimum wage for farm workers and the implementation of worker rights were intended to enhance the well-being of agricultural workers but have yielded mixed results and have met mixed success and arguably proved a failure (South African History Online, 2019). The Department of Agriculture's Medium-Term Strategic Framework highlights agriculture as a focal point for job creation. To achieve this objective, it is crucial to promote labour-intensive and sustainable production systems (Drought Policy Brief: Western Cape Agriculture, 2018).

South Africa, despite being a middle-income nation with some highly developed economic sectors, still encounters high level of poverty. There are various factors which were researched to be the roots of such a high level of poverty. These amongst others are apartheid system during which the country’s wealth (about 60 to 65%) was concentrated in the hands of a few, yet minority but privileged, constituting about 10% of the population, economic disparities, inaccessibility to (quality) education, low or weak economic growth, mismatch of skills, etc. (Green Cape, 2017). Although there is a decline in poverty from the year 2000 to 2011, the poverty level rampantly rose in the year 2015 where more than half

of the population lived in poverty. This translates to having about 30 million of South Africans living in poverty (The State of Food and Agriculture, 2020).

Whilst stemming from above, South Africa is undoubtedly regarded as a country with a significantly high rate of poverty. However, investing in agriculture is widely acknowledged as a critical prerequisite for achieving objectives related to enhancing food security, job creation, wealth generation, and ultimately, poverty reduction. The outcomes of agricultural investment are contingent not solely on the quantity of investment but also on the quality of that investment. The agricultural sector is likely to be more propitious to employment if the management of its risks is adequately implemented simply because this sector is susceptible to more risks such as natural risks. During the period of the recent drought, farmers had to cut down staff due to the tough and unprecedented, unfavourable economic stand the drought created. This resulted in unemployment and in turn more South Africans became poor during that period.

3.11 THE EFFECT OF AGRICULTURAL DROUGHT ON FOOD SECURITY

Agriculture plays a pivotal role in both food security and economic development. Furthermore, a significant portion of the global population, particularly in rural areas, relies directly or indirectly on agriculture for their livelihoods (Udemezue & Osegbue, 2018; Aye, Wen, Marin, Thapa, and Tun, 2019). South Africa's population is experiencing rapid growth, with an annual increase of nearly 2%. The population, which stood at 49 million in 2009, is projected to reach 82 million by 2035. To accommodate this expanding population and satisfy their growing needs, food production or imports will need to more than double. Importantly, this must be achieved while utilizing the same or fewer natural resources. Additionally, changes in wealth distribution are influencing the demand for specific types of food, making it essential to adapt to shifting preferences (The State of Food and Agriculture, 2020).

South African agriculture has experienced substantial structural changes over the past 15 years. These changes have led to a transition toward large-scale intensive farming. Furthermore, there has been a shift away from the production of low-value, high-volume goods primarily for domestic consumption, like wheat and milk, towards the cultivation of high-value export-oriented products, including deciduous fruit, citrus, and game. The impact of these policy shifts on aspects such as food prices, food accessibility, and the environmental impact within South Africa are yet to be fully understood (Jooste, 2016).

Food security is commonly assessed concerning the availability and affordability of food. The recent drought significantly impacted food affordability. For instance, the cost of a single serving of maize meal increasing by 43%, while the cost of the staple food basket increasing by 22% from 2015 to 2016. This increase varied across different food categories, with the most notable being sugary foods (17.7%), followed by fruit (16.0%), bread and cereals (14.3%), fats and oils (12.4%), vegetables (11.0%), dairy and eggs (9.0%), and meat (7.2%) (Food Outlook, 2020). In 2017, the rate of food price inflation decreased substantially due to improved weather conditions and a stronger exchange rate. However, it's important to note that this rate is calculated from a higher baseline. Consequently, even though the rate of inflation dropped, food prices remain high in absolute terms (Food Outlook, 2020). This situation has global implications for food security and nutrition, as water shortages and scarcity threaten the environment required to facilitate food access for millions of hungry people worldwide and to reduce the cost of nutritious food to make it affordable for billions of individuals (Food Outlook, 2020). Besides affecting the prices of agricultural products and the resources needed for their production, factors like the exchange rate and fuel prices also impact food price inflation by affecting processing and distribution costs. Consequently, it was anticipated that food inflation would experience a modest increase until the end of 2019, stabilizing at just below 5.5%. In accordance with changes in commodity prices, the primary drivers of food inflation in 2019 were categories such as 'meat,' 'oils,' 'breads,' and 'cereals' (Jooste, 2016).

3.12 MITIGATION OF AGRICULTURAL DROUGHT IN COMMERCIAL FARMING

INTRODUCTION

Drought poses a significant and growing threat to South Africa, particularly as predictions indicate an increase in the frequency and severity of droughts in the future. This alarming trend necessitates proactive efforts to limit the impact of potential droughts through preparedness and mitigation strategies. According to Wilhite (2011), there are four essential components of drought mitigation: prediction, monitoring, impact assessment, and response. Among these components, the response is particularly crucial, as the effectiveness of the response measures directly influences the extent of the drought’s impact.

Response measures encompass a range of strategies and actions aimed at mitigating the effects of drought. These include improving drought monitoring systems, implementing better water and crop management practices, augmenting water supplies by tapping into groundwater resources, raising public awareness and education on responsible water usage, intensifying watershed, and local planning efforts, reducing overall water demand,

and promoting water conservation. Additionally, some scientists suggest that drought mitigation can be achieved through the development of appropriate water supply plans, efficient water conservation management (e.g., rainwater harvesting), adherence to water restrictions (e.g., utilising greywater for specific needs), the establishment of effective irrigation systems, and even cloud seeding to induce precipitation.

In South Africa, recent droughts have prompted authorities to take both immediate and long-term measures to mitigate their severe economic and societal impacts. Immediate measures have included implementing drought operating rules, drilling or rehabilitating boreholes, exploring water sources like rainwater and fog harvesting, protecting and utilising springs, and even cloud seeding. Long-term measures have focused on water storage and transfer developments, infrastructure development (such as dams and conveyance pipelines), legislative revisions to protect ecological infrastructure, and the integration of alternative water sources like groundwater, desalination, and water reuse. As part of these drought mitigation efforts, domestic water consumption has been reduced to 175 litres per person per day, highlighting that combatting drought is a shared responsibility requiring collective action.

3.13 CONCLUSION

In this chapter the researcher has provided an illustration of Cape Winelands District profile, farming community and water crisis. The researcher has unpacked the status of Western Cape commercial farming. Commercial farmers are said to be the key role players to the country's economic growth. Western Cape has been proven to be one of the provinces which has been faced with water crisis for three years counting from 2015 to the extent that the City of Cape Town had to prepare for day zero in 2018. Drought has caused a huge economic loss of approximately 5.9 billion in agricultural sector in Western Cape alone. It is evident that agricultural drought is one of the biggest threats to the economy which significantly affects the commercial farming output production, outside trade, employment rate and GDP of the country. Drought has resulted in a huge environmental and economic significance cost effects in commercial farming production, employment rate and food security and an increase in poverty.

The reviewed literature further indicates that more droughts are expected in future other than the ones experienced thus far. It is therefore vital to have strategies and tools to mitigate the cost effects of agricultural drought to keep the effects of drought to their minimum level for the sustainability of commercial farms. Many researchers have come across the economic effects of drought on farming in general, stating how famers are

affected by drought and how this affects human lives and business organisations. Nonetheless, numerous researchers recommend that it is important to implement strategies to plan for future drought to enable commercial farmers sustainability as they are vital to a country's economy. The next chapter focuses on the design and methodology of the study used to address the research problem and to answer the research questions.

CHAPTER 4
RESEARCH METHODOLOGY

4.1 INTRODUCTION

In the preceding chapter, the researcher presented an illustration of the Cape Winelands District's characteristics, specifically focusing on the farming community and the water crisis. Furthermore, the researcher examined the current state of commercial farming in the Western Cape. This chapter aims to elucidate the research methodology and design employed in the current study. The research procedure encompassed multiple approaches and techniques employed to address the research question and acquire knowledge in a methodical manner. Additionally, this chapter outlines the different phases of the research, encompassing the selection of participants, the collection of data, and the subsequent data analysis procedures.

This chapter diverges from the preceding ones, which primarily provided the foundational theoretical and empirical background for the research. It offers insight to the reader regarding the research strategy employed to conduct the current investigation. The methodology section that ensues discusses the specific approaches and methods deemed suitable by the researcher for achieving the objectives of this study. The chapter concludes by addressing the strategies implemented to guarantee the integrity and reliability of the data, along with ethical considerations. The aim of this research was to gain an understanding of the financial ramifications that drought imposes on the operational aspects of commercial farmers in the Cape Winelands District of the Western Cape.

4.2 RESEARCH PHILOSOPHY

A research philosophy can be described as a collection of beliefs and assumptions about how knowledge is produced (Bianchi, 2021; Tamminen & Poucher, 2020). It relates to the fundamental nature of knowledge, exploring its origins and how it is communicated through language (Hürlimann, 2019). Research philosophies shape the research process, and the way questions are conducted, guided by research assumptions rooted in the three dimensions of research philosophy: ontology, epistemology, and axiology. (Bianchi, 2021; Tamminen & Poucher, 2020; Kirongo & Odoyo, 2020). Saunders, Lewis, Thornhill, and Bristow (2015) provide definitions for these levels: firstly, ontology involves assumptions about the fundamental nature of reality or knowledge. Ontological assumptions influence how the researcher perceives and investigates objects. In this particular study, a subjectivist ontology was employed. The researcher examined and incorporated participants' perspectives on the subject matter, even when they varied significantly. From this

standpoint, participants' social realities were considered, and human intentions were used to elucidate causal relationships among social phenomena. Secondly, epistemology focuses on the nature of knowledge which constitutes acceptable, valid, and legitimate forms of knowledge, as well as how knowledge is communicated to others. According to Saunders et al. (2015), epistemological assumptions acknowledge the acquisition of different types of knowledge, such as numerical data, textual and visual data, facts, interpretations, narratives, stories, etc., each of which can be deemed legitimate. The combined assumptions of ontology and epistemology provided the researcher with a broader range of methods to choose from.

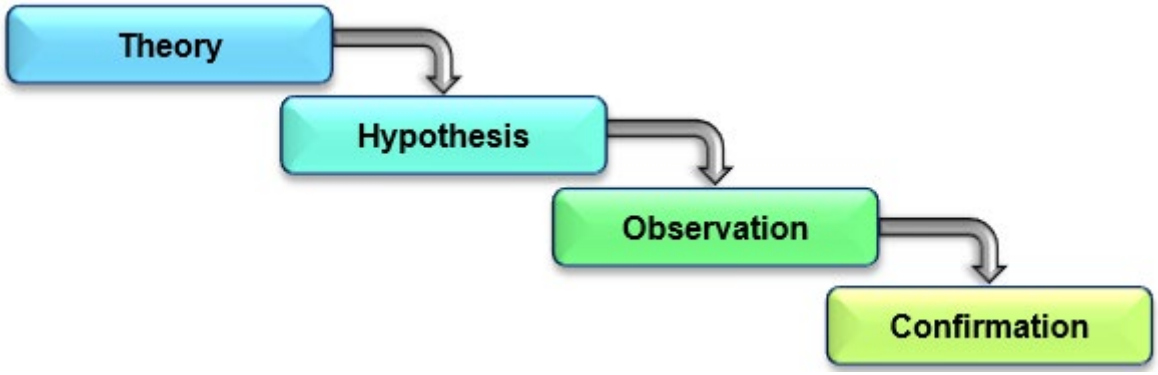
Epistemologically, an interpretivist/constructivist perspective was adopted in this study. The researcher aimed to comprehend the critical factors that negatively impacted historically disadvantaged businesses' participation in the integrated value chain of South African commercial farming. The constructivist perspective does not regard reality as external to the researcher; it recognizes the significance of participants' emotions and opinions that need to be observed and acknowledged during the intricate interpretation process. A constructivist approach was thus well-suited for this qualitative study since the researcher directly engaged with the respondents, seeking clarity when necessary. The research aimed to gain insights into the respondents' experiences, knowledge, and understanding of the subject matter, considering their perspectives and their descriptions of events, beliefs, and behaviours.

The axiological assumptions were a vital consideration during the course of this study as they helped manage the researcher's biases, intuitions, and values. Axiology addresses ethical conduct in research, specifically the role of values and ethics in the research process (Killam, 2013). The researcher had to ensure that this research was conducted ethically and in accordance with the ethical requirements of the Cape Peninsula University of Technology (CPUT). The next stage in respect of the research onion principle entails the researcher’s approaches to undertake in the study.

4.3 APPROACH TO THEORY DEVELOPMENT

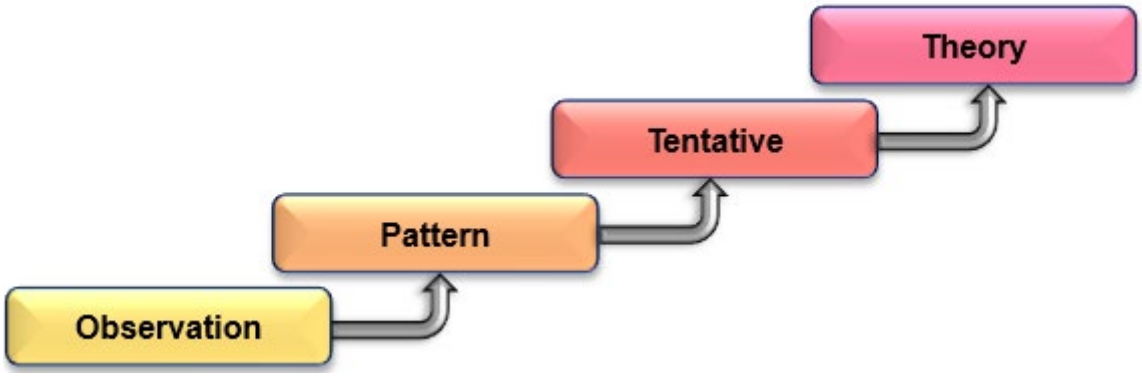
Approach to theory development refers to the type of reasoning adopted in a study. Saunders et al. (2015) identify two primary approaches to research reasoning: deductive (as depicted in Figure 4.1) and inductive (as presented in Figure 4.2). The distinctions between the two approaches are elaborated upon and visually represented in Figure 4.1 and Figure 4.2.

Figure 4.1: Deductive research approach



Source: Adopted from: Babie (2012)

Figure 4.2: Inductive research approach



Source: Adopted from: Babie (2012)

Saunders et al. (2016) emphasize that an inductive research approach aligns with an interpretivist research philosophy, while a deductive research approach is primarily associated with the positivist research philosophy. When comparing the deductive approach to the inductive one, researchers are more likely to employ an inductive research approach in studies where there are few or no existing theories within the field, and new theories and frameworks need to be developed (Antwi-Boampong, 2020) (refer to Figure 4.2). The inductive approach has no predetermined framework guiding data collection; instead, the framework can be formed after the data has been collected (Flick, 2011) (see Figure 4.2). Inductive research, which focuses on testing theories and forming generalizations, primarily employs a qualitative approach (Hammarberg, Kirkman and de Lacey, 2016). The inductive approach is often referred to as the 'bottom-up approach' as it progresses backwards from

observation to identifying patterns, allowing researchers to draw overarching conclusions regarding a given theory. Qualitative research questions require textual data, including images and textual content, while quantitative research questions necessitate numerical data that can be quantified (Mohajan, 2020).

Furthermore, although an inductive approach is more commonly employed in qualitative research (Koporcic & Törnroos, 2019), a deductive approach is instrumental in formulating hypotheses based on existing theories and subsequently formulates the research design to test it (Iovino & Tsitsianis, 2020). Deductive and inductive approaches are both valuable and provide a holistic method for qualitative data analysis, which involves the researcher deeply engaging with data, reading, and comprehending the dataset (Iovino & Tsitsianis, 2020). Deriving from the above research approach discussion, this study employed the inductive research approach. The inductive approach was utilized during data analysis, allowing codes to emerge naturally, unconstrained by the study's theoretical framework. The researcher recorded the codes and their frequencies, then organized them into the mentioned themes, with many of the insights aligning with the theories outlined in the literature review.

4.4 RESEARCH APPROACH

The term ‘research approach’ refers to an action plan that provides direction for conducting research in a systematic manner (Alase, 2017). According to Mohajan (2018), there are three categories of research approaches: i) structured quantitative research, ii) unstructured qualitative research, and iii) hybrid approach, which is a blend of structured and unstructured research.

4.4.1 Quantitative approach

According to Garbers and Konradt (2014), quantitative research is used to evaluate theories, conduct statistical analyses, and determine facts. The researcher who employs this strategy, according to the author, remains in the background and does not become involved in events that influence the subject’s conclusion. Mohajan (2018) agrees that to arrive at fair conclusions, the quantitative researcher must remain separated from the subjects. Quantitative researchers collect data based on one or more variables under investigation and rely heavily on deductive reasoning (Taherdoost, 2022). As a result, quantitative research is described as descriptive because it employs more formal measures of behaviour, such as quantified and systematic observations that can be subjected to statistical analysis (Marlow, 2023). Structured research questions are used in this technique

(Marlow, 2023). When collecting data, the researcher works on a planned set of questions (structured). Likert scale questions, which include agree, disagree, and neutral sorts of questions, are a good example of structured questionnaires.

4.4.2 Qualitative approach

Qualitative research, according to Small (2021) is a type of interpretive inquiry in which researchers interpret what they see, hear, and comprehend as a way of examining and understanding the meaning people attribute to a social or human situation. In this study, qualitative research approaches, such as semi-structured interview questions, were used to understand the cost implications of drought on operations of commercial farmers in the Western Cape, Cape Winelands district (to be explained more in later section). When a researcher conducts face-to-face interviews and employs interview guiding points to acquire data from respondents, this is a good example of qualitative research. This study falls into the qualitative research approach category which also supports an inductive style. According to (Muzari, Shava and Shonhiwa, 2022) characteristics of qualitative research approach can be presented as follows:

Table 4.1: Characteristics of qualitative research approach

Feature	**Brief description**
Natural set-up	researchers tend to collect data in the field at the site (primary data) where participants experience the issue or problem under study
Researcher as key instrument	researchers are the ones who gather the information through observations, interviews or examining documents themselves
Multiple sources of data	Instead of relying on a single data source, researchers collect many types of data, such as interviews, observations, documents, and audio-visual information.
Inductive and deductive data analysis	The inductive process depicts researchers working back and forth between the themes and the database until they have established a comprehensive set of themes, whereas the deductive process depicts researchers reviewing their data from the themes to see if more evidence can be found to support each theme or if they need to gather more data.

Participants meanings	The researcher focuses on learning the participants' interpretations of the problem or issue, rather than the researchers' interpretations.
Emergent designs	The term emergent refers to the fact that the initial research plan cannot be precisely described, and that any or all aspects of the process may vary or shift once the researcher enters the field and begins collecting data.
Reflexivity	The inquirer considers how their position in the study, as well as their own personal history, culture, and experiences, may influence their interpretations.
Holistic accounts	Researchers attempt to create a comprehensive picture of the subject or issue under investigation. This entails presenting several points of view, identifying the various aspects at play in a scenario, and drawing the overall picture that emerges.

Source: Adapted from Creswell and Poth (2016)

4.4.3 Mixed approach

When a researcher must utilise both quantitative and qualitative approaches in the same study, this is referred to as a mixed method design (Anguera, Blanco-Villaseñor, Losada, Sánchez-Algarra and Onwuegbuzie, 2018). The main premise of the mixed approach, as described by Creswell and Poth (2016), is that the integration of two approaches enables a more comprehensive, complete, and synergistic utilization of data compared to conducting separate quantitative and qualitative data collection and analysis. Mixed approach strategies, according to past studies (Dawadi, Shrestha and Giri, 2021; Pearson, White, Bath-Hextall, Salmond, Apostolo & Kirkpatrick, 2015; Clark & Ivankova, 2015), enable researchers to combine elements of qualitative and quantitative research methods to enhance and validate understanding. Therefore, mixed methods are valuable approaches for evaluating complex research interventions.

In line with the recommendations of Macharia, Thinguri, and Gacheru (2020), the selection of a mixed method design should consider evaluation questions and resource limitations, which aid in conducting more profound and meaningful research. Fetters and Freshwater (2015) emphasize that integration is a central element in mixed methods research. Scholars employing mixed methods must effectively combine quantitative and qualitative components to contribute to the advancement of business research. Creswell and Clark

(2011) contend that this approach enhances understanding to a greater extent than employing a single research method. The benefits of using mixed methods include a) providing comparative data for quantitative and qualitative information, b) uncovering contradictions between quantitative results and qualitative findings, c) reflecting participants' perspectives, d) promoting scholarly dialogue, e) offering methodological flexibility, f) yielding rich and comprehensive data. Finally, mixed methods employ data triangulation, which allows for the convergence and corroboration of results derived from various research methods.

4.4.4 Justification for choosing qualitative research approach.

The researcher opted for qualitative research approach because it is mostly inductive, with the interviewer deriving meaning from the data obtained in the field. The researcher chose qualitative research over other approaches such as quantitative and mixed research methodologies. An inductive strategy, as described by Azungah (2018), involves iteratively moving between topics and the database until researchers have generated a comprehensive set of themes. It may also entail interactive collaboration with the participants, making it appropriate for Creswell's research (2014). In the qualitative approach, researchers engage directly with respondents, study human actions in natural settings, seek similar cases to generalize findings, and create interpretive reports that reflect the researcher's data interpretation (Smith & Fieldsend, 2021). This approach was deemed appropriate for this study as it facilitated a deep understanding of participants' perspectives through direct interaction. The study's findings were organized into generalized themes and presented as interpretive reports in Chapter 5, the findings section.

4.5 STUDY POPULATION AND SAMPLING

The complete mass of observations, which is the parent or universal group from which a sample is produced, is referred to as the population. A population, according to Rahman, Tabash, Salamzadeh, Abduli and Rahaman (2022), is the total number of components that must be included in a survey. Sampling, on the other hand, is the process of selecting a specific number of people from a defined population to serve as a representative sample of that community (Otzen & Manterola, 2017, Bhardwaj, 2019). A sample is a subset, or a proportion of a population chosen for observation from a larger group of people. According to Taherdoost (2016), when sampling a population, the researcher requires a sample plan and there are several steps to be considered which are as follows:

4.5.1 Sampling process

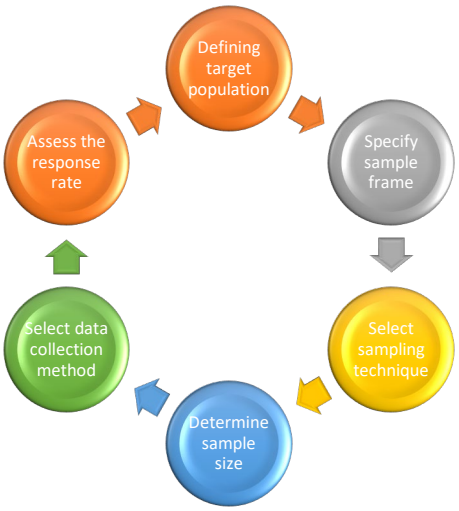


Figure 4.3: Sampling Process

Source: Adapted from Taherdoost (2016)

***Step 1:* Defining the Target Population**

The survey population is specified in terms of sample elements and sample units in this stage. The total target population in this research was commercial farms in Western Cape, Cape Winelands. According to secondary data collected by the Western Cape Department of Agriculture, the total number of commercial farms in the Western Cape for the 2020/21 period stands at 2,981, with 20 of these commercial farms located within the Cape Winelands district (Western Cape Department of Agriculture, 2022). The target population for this study comprises 2,981 farmers, representing the commercial farms in the Cape Winelands district as of 2020/2021. Table 4.2 below illustrates the number of commercial farmers supported in each district between 2018 and 2021.

Table 4.2: Number of commercial farmers supported for each district between 2018 – 2021.

District	2018/19	2019/20	2020/21
Garden Route	360	328	165
Overberg	7	7	8
West Coast	333	322	164
Central Karoo	372	398	395
Cape Winelands	62	40	20
Total	1134	1095	752

Grand Total	2981

Source: Western Cape Department of Agriculture (2022)

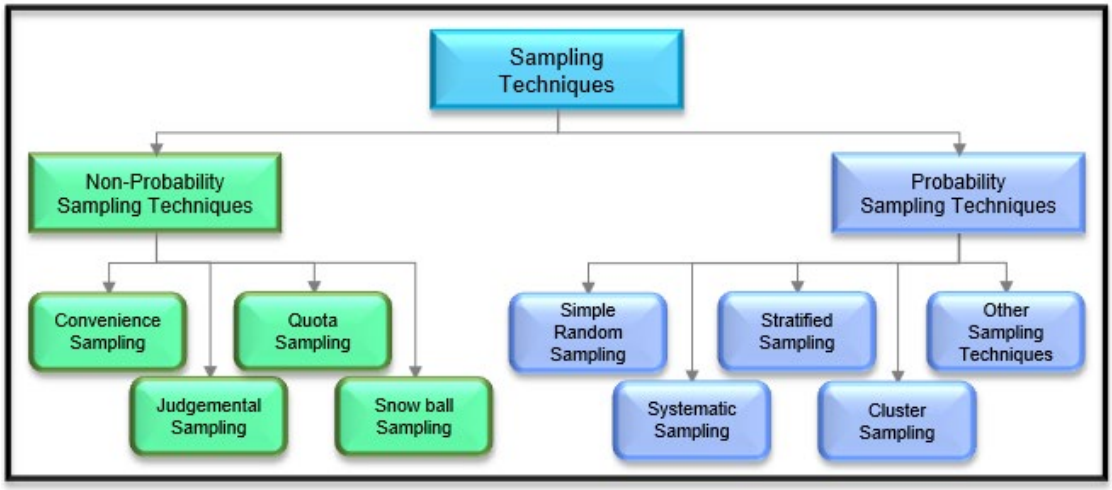
Step 2: **Specify the sampling frame.**

A sample frame is a set of population elements from which the researcher chooses the units for the sample (Rahman, Tabash, Salamzadeh, Abduli and Rahaman, 2022). The sampling frame for this study thus consisted of registered commercial farmers in Cape Winelands District, Western Cape.

Step 3: **Select the sampling technique.**

Probability and non-probability sampling are the two types of sampling procedures (Sisodia, 2019; Sharma, 2022; Taherdoost, 2016). To draw the sample, one must first decide whether he/she wants to use a probability or non-probability approach. Figure 4.6 presents the two main techniques of sampling.

Figure 4.4: Classification of sampling techniques



Source: Adapted from Malhotra (2010)

From Figure 4.4, it is evident that probability sampling involves assigning a known non-zero probability to each element in the population, with the probability of selection known for each element (Pandey & Pandey, 2021). Examples of probability sampling methods include cluster sampling, systematic sampling, simple random sampling, and stratified random sampling (Sisodia, 2019). According to Etikan and Bala (2017), the probability of selecting a sample can be expressed using the formula shown below:

$Probability\ of\ selection = sample\ size/population\ size$

Non-probability sampling techniques involve the purposeful selection of items within a sample, where each unit does not have an equal chance of being chosen (Sisodia, 2019). Non-probability sampling methods include quota sampling, snowball (referral) sampling, judgment sampling, and convenience sampling (Sisodia, 2019; Makwana, Engineer, Dabhi, and Chudasama, 2023). For a comprehensive understanding of each sampling sub-group, please refer to Table 4.3.

Table 4.3: Sub-groups of non-probability and probability sampling techniques

NON-PROBABILITY SAMPLING TECHNIQUES	**DESCRIPTION**
Quota sampling	Designed to ensure that the proportion of the sample elements with a certain characteristic is approximately like that in the population of interest.
Judgement sampling	Involves selecting certain respondents for participation in the study, presumably because they represent the population of interest and/or meet the study's specific needs.
Snowball sampling	Involves first locating respondents with the necessary qualifications to be included in the sample and then using these respondents as informants to identify others with the desired qualifications to belong to the target population.
Convenience sampling	Respondent participation is voluntary or leaves the selection of sampling units primarily to the interviewer.
Systematic sampling	Random selection of a digit (n) and then selection of sample element at every (n) interval depending on population size and the required sample size.
Cluster sampling	The population is divided into sub-groups of mutual characteristics and a simple random sample is chosen from subgroups. Often associated with area sampling.

Stratified random sampling	The population is divided into sub-groups of mutual characteristics and a simple random sample is chosen from each sub-group.
Simple random sampling	Each element of the population has an equal and known chance of being selected as part of the sample.

Source: Adopted from Makwana et al. (2023); Babin and Zikmund (2016)

A two-stage non-probability sampling technique was adopted to select respondents. In the first stage, a purposive sampling technique was adopted to select farmers registered and situated in Cape Winelands, while a convenience sampling technique was adopted to choose any 12 respondents.. The reason for purposive sampling was to obtain rich data on a particular delineated area of focus and for convenience sampling was to enable the researcher to choose respondents based on their availableness and willingness to take part. Moreover, only responses from the selected district (Cape Winelands) were regarded as valid. Based on the data received from the Western Cape Department of Agriculture in 2021, the Cape Winelands District had only 20 registered and operating commercial farmers.

The inclusion criteria for selection of a sample were that: (i) the Commercial farm should be registered and situated in Cape winelands, Western Cape and (ii) they have been operating for more than 2 years. A total of 12 semi-structured interviews were conducted for analysis.

Step 4: **Sample Size Determination**

A sample size focuses on the number of respondents required to participate in a study. In determining the sample size, Bekele and Ago (2022) recommends that researchers should consider several factors, and these include: (a) the nature of the research, (b) the significance of the decision to be made in the study (c) the type of the analysis to be conducted, (d) previous sample sizes used in related studies., and resource constraints. By considering these factors, researchers can determine an appropriate sample size for their study. Therefore, in this study, the following qualitative considerations were employed:

1) the nature of resource constraints (Creswell & Poth, 2016) and
2) least possible number of respondents for data saturation (Hennink & Kaiser, 2022).

Out of the total target population of 2,981 commercial farms, the sample size includes 20 commercial farms in the Cape Winelands district. However, only 12 registered commercial

farms agreed to participate in the study, resulting in the number of respondents being limited to these 12 registered commercial farms.

***Step 5*: Select Data collection method.**

A critical phase in any research project is the process of data collection. Data collection, as defined by Sileyew (2019), involves systematically obtaining and measuring information about variables of interest. Researchers employ data collection to address research questions, test hypotheses, and assess outcomes (Roh, Heo, and Whang, 2019; Sileyew, 2019). The objective of data collection is to acquire high-quality information that can be employed for thorough data analysis and to deliver a compelling and trustworthy response to the research questions (Moser & Korstjens, 2018). It is also important to consider the sort of data that will be collected, since this will aid the researcher in deciding which data gathering method to use. Quantitative and qualitative data are both acceptable. Quantitative data methods include a) use of questionnaires b) experimental/clinical trials c) observations d) polls. Consequently, the most prevalent qualitative methods used in evaluation can be categorized into three groups: a) in-depth interviews, b) observational methods, and c) document analysis.

On the other hand, data collection methods can be classified as primary or secondary data. Primary data is information acquired directly by the researcher, whereas secondary data is material that has been collected and assembled by someone and made available to the public, such as published reports, newspaper, or journal articles (Mazhar, Anjum, Anwar and Khan, 2021). To achieve the objectives of the study by capturing famer's experiences on drought, semi- structured questionnaires were employed for Microsoft teams interviews. The aim was to gather data on farmer's production costs effects of drought in commercial farms, drought effects on the performance output of commercial farmers, control strategies and costing tools in place. The researcher conducted in-depth interviews, which facilitated a more profound comprehension of the implemented measures and a more comprehensive analysis of results in the subsequent stages. In-depth interviews are characterized by their deep individual focus, offering an opportunity for thorough exploration of each respondent's personal perspective, a profound understanding of their specific context within the research phenomenon, and a comprehensive coverage of the subject matter.

Twelve commercial farm owners/managers were conveniently and purposely selected to participate in the study as they were willing to participate in the research, they then provided first-hand information on their experiences as the owners/managers of the farms. The selected respondents were first contacted by e-mail and telephonically to request their consent to participate in an interview. The emails which were sent out contained of brief

information about the research study, Appendix A (ethical clearance) and Appendix B (consent form) were attached to the email. For the ones contacted via a phone call, the objective of the research was explained to them on the phone and for the ones that agrees to participate, the information brief was sent to them via an email. However, the researcher was not receiving any feedback from emails and not all contacted farmers could be reached telephonically as the managers/owners were always in the field. The researcher had to physically visit the farms, to be able meet up and have an understanding conversation with the farm owners/managers to set-up an interview appointment. An appointment was set at the convenient date and time for the farmers. On the day of the interview, the following steps were followed:

1. The researcher took some time to further brief the respondents on the research entail and the purpose for conducting the research.
2. After the brief, the researcher got a confirmation of the willingness to continue with the interview.
3. They were also informed that the interview will be recorded.
4. The interview was conducted on the set date at the various farms and the recording was done using Camtasia screen recording software. Where necessary, probing questions were asked to capture more details needed to completely answer the research questions.
5. After the interview, the recordings were converted into a portable MP4 format.
6. The interview was transcribed into a Word document and subsequently imported into Atlas.ti, a software package provided by Atlas.ti Scientific Software Development GmbH for data analysis and management. Atlas.ti is particularly useful when working with extensive text, graphic, audio, and video data.

The purpose of used interviews was to elicit the professional opinions of the respondents and have them address the research questions, distinct from the information gathered through the literature review. The interviews conducted followed a semi-structured format, featuring open-ended questions. The choice of semi-structured interviews was driven by the flexibility they offer, enabling the researcher to prompt or seek additional information as needed. This approach also grants the researcher the autonomy to delve deeper into an area of interest or explore new lines of inquiry arising from the interviewee's responses. Semi-structured interviews additionally provide respondents with the freedom to express their views in their own words.

Step 6: **Evaluate the rate of participation or response rate.**

The response rate in a study refers to the number of cases that agreed to take part (Augustini, 2018). It is common for researchers to not achieve a 100 percent response rate, as mentioned by Hendra and Hill (2019) due to various reasons such as respondents refusing to reply, being ineligible to participate, unable to respond, or when researchers are unable to establish contact with the respondents. In this study, a total of 12 semi-structured interviews were carried out, resulting in a 100% response rate.

4.6 QUALITATIVE DATA RELIABILITY AND VALIDITY

The researcher had to disclose the steps taken to check for accuracy, trustworthiness, and credibility of the data findings. According to Creswell and Poth (2016), validity and trustworthiness in qualitative research does not carry the same connotations as in a quantitative study. Other authors may not use data reliability/validity in qualitative research but rather use the term data integrity, (Nichols-Casebolt, 2012; Rose & Johnson, 2020) but they all serve the same purpose. Research integrity, according to Shaw and Satalkar (2018) is a commitment sometimes in face of adversity to trustworthiness, accuracy, and credibility of the research process by the researcher.

4.6.1 Data reliability

Rose and Johnson (2020) posit that consistency of measurement throughout time and across the many components in the instruments, in this case the interview guide, is the foundation of data reliability in qualitative research. Instead of ‘reliability’, some scholars prefer the term ‘dependability’ (Mohajan, 2017; Moon, Cho, Choi, Gaul, Lamb and Gorsich, 2018), which refers to an evaluation tool that delivers steady and consistent outcomes. To enhance data reliability in this study, the researcher detailed the measures taken to address and account for the potential influence of the respondents' philosophical preferences, aligning with the study's ontological and epistemological stance. This approach aimed to ensure that the research findings were grounded in the firsthand experiences and perspectives of the participants rather than being biased by the researcher's own views.

Korstjens and Moser (2018) proposes that to assure qualitative data dependability, one must offer a complete set of notes on the following: i) research team meetings, ii) decisions taken during the research process. iii) reflective thoughts, iv) sampling, v) research materials used, vi) results and data management information. This also aided the researcher in making the research process more transparent.

4.6.2 Data validation

In qualitative research, validity refers to whether the study's findings are true and certain—'true' in the sense that the findings properly reflect the situation, and 'certain' in the sense that the findings are backed up by evidence (Rose & Johnson, 2020). The adoption of procedures by the researcher to guarantee that the findings are accurate - in order to minimise data biases – is what is meant by the term 'qualitative validity'. Also, ensuring the 'appropriateness' of the instruments, processes, and data used is another reason for validating the findings (Hayashi Jnr, Abib & Hoppen, 2019). It can be validation of i) the research question for the desired outcome, ii) the methodology choice is appropriate for answering the research question, iii) the appropriateness of the design for the methodology, iv) the sampling and data analysis appropriateness, and v) the results and conclusions validation for the sample and context (Hayash, Abib, and Hoppen, 2019).

On another note, Heale and Twycross (2015) suggest that a researcher can check data validity through member checking. Member checking involves the researcher double checking with the respondent or targeted group on the information that the respondents have provided during the data collection process (Motulsky, 2021). For the sake of this study, during the interviewing process, the researcher had to double check by repeating the respondents' feedback to the interviewee before proceeding to the next question. This process of double checking the questions and feedback helped the interviewer to make alterations if any were made by the respondents and reduces the likelihood of 'errors of fact' and 'errors of interpretation'. The researcher had to describe fully in detail of any changes in the respondents' feedback after correcting any errors. The researcher also made use of debriefing other people to enhance accuracy of the findings. Sousa (2014) posits that the more experience a researcher has the more accurate or valid the findings.

4.6.3 Trustworthiness

Trustworthiness implies employing various procedures that entail a clear and rigorous description of all methodological steps used in the study. These can encompass the appropriateness of research questions, participant samples, and data collection or analysis (Noble & Smith, 2015). A set of techniques that establish trustworthiness include: 1) credibility, 2) transferability, 3) dependability, and 4) confirmability. The researcher demonstrated the credibility of the collected data by illustrating how the data was analyzed with precision, consistency, and thoroughness through recording, systematizing, and disclosing the analysis techniques.

4.7 DATA ANALYSIS

The researcher transcribed the recordings by carefully listening to them multiple times and typing the participants' responses verbatim. While this process was time-consuming, it served as a crucial initial step in the data analysis process. It allowed the researcher to immerse themselves in the interview experience and internalize key themes. The file containing the transcribed participant responses was securely stored in a locked area at the researcher's workplace.

Thematic analysis (TA) represents a methodical and systematic approach, as articulated by Braun and Clarke (2022). In this approach, themes arising from a qualitative dataset are meticulously identified, assessed, and methodically documented. Echoing this perspective, Ozuem, Willis, and Howell (2022) underscore the foundational role of TA in qualitative research, providing a structured framework for the comprehensive examination of interview transcripts with the aim of uncovering all potential themes (Anon, 2023).

The study adhered to the TA process as outlined in existing academic literature. Following the guidelines set forth by Vaismoradi and Snelgrove (2019), the procedure for TA involved the meticulous recording of interviews, subsequent transcriptions, and a thorough examination of the transcripts. This rigorous process served to identify, analyze, and present the emerging themes within the context of qualitative investigations, a methodology corroborated by scholars such as Maziriri, Madinga, and Lose (2017), Castleberry and Nolen (2018), and Kiger and Varpio (2020). Furthermore, as highlighted by Kiger and Varpio (2020), TA was judiciously selected as the foundational approach for qualitative analysis in the current research due to its suitability for addressing the exploratory nature of the study, thus aligning with established research conventions.

One of the primary advantages of TA is its systematic approach, enabling researchers to comprehensively scrutinize interview transcripts and identify potential themes (Castleberry & Nolen, 2018). When using TA, researchers must choose from a range of approaches, each with differing conceptualizations of qualitative research and knowledge production, as well as key constructs such as themes (Braun & Clarke, 2022).

As outlined by Braun and Clarke (2021), TA comprises six essential phases. These include getting acquainted with the data, performing coding, generating initial themes, reviewing these themes, defining themes more precisely, and finally writing the narrative or dissertation. ATLAS.ti software is utilised for coding process. In the context of utilising ATLAS.ti for coding, the process begins after transcribing the data. Researchers leverage

ATLAS.ti to read and review the transcribed notes, facilitating the systematic generation of codes relevant to the study. Codes are applied to similar responses within the dataset. Subsequently, patterns and commonalities among the codes are discerned, laying the foundation for the initial themes or categories that emerge from the data. This entailed reorganising codes, consolidating similar codes, and delineating sub-themes to enhance conceptual clarity. To uphold participant anonymity and confidentiality, pseudonyms are assigned to individuals as part of this coding process. Throughout these phases, ATLAS.ti serves as a valuable tool for managing the coded data and themes. It streamlines data organisation and facilitates the retrieval of specific segments, enhancing the overall efficiency of the analysis process (Smit & Scherman, 2021).

TA was applied to the data collected from the interviews. The process involves an initial coding phase followed by the subsequent generation and grouping of themes (Braun & Clarke, 2021). This analysis is conducted using ATLAS.ti software. Thematic analysis, particularly when facilitated by software like ATLAS.ti, is a powerful method for systematically analysing qualitative data, such as interview transcripts. ATLAS.ti plays a crucial role in streamlining the coding process within thematic analysis, resulting in improved efficiency and organisation. This software provides valuable assistance to researchers in the management, analysis, and visualisation of qualitative data. This capability is especially advantageous when researchers are dealing with extensive datasets or intricate thematic structures. In essence, the integration of ATLAS.ti into the thematic analysis process empowers researchers to unearth profound insights from their qualitative data, enriching the research endeavour (Smit, & Scherman, 2021).

4.8 ETHICAL CONSIDERATIONS

During the course of this research, the researcher diligently adhered to ethical considerations, which are integral components of academic research. Ethical considerations revolve around the safeguarding of research subjects and the conduction of research in accordance with ethical standards (Suri, 2020). Researchers bear the responsibility of ensuring that participants do not experience physical or emotional harm during or after the research process (Tammeleht, Rodríguez-Triana, Koort, and Löfström, 2019; Suri, 2018). Ethics should not merely be viewed as a set of regulations mandated by the academic institution; instead, it should be an intrinsic aspect of research practices (Morgan, Neufeld, Holroyd, Ruiz, Taylor, Nolan, and Glegg, 2023). The paramount focus is on protecting participants by upholding ethical principles in research. To this end, the researcher obtained ethical clearance from the relevant Ethical Committee at Cape Peninsula University of Technology, and official permission was granted for the research to

proceed (please refer to the attached appendix A). The researcher submitted the interview questions to the committee for their approval, and prior to each interview, informed consent forms were duly signed by all participants (see the attached appendix B).

Throughout the study, the confidentiality of respondents and the concept of debriefing were conscientiously considered. Kamanzi and Romania (2019) describes ethical consideration as the bulk of moral issues with research studies area unit lined within the following categories:

- Protection from harm or damage: All respondents ought to be shielded from any physical harm or adverse effects.
- Informed consent: All respondents ought to be fully informed about the nature and purpose of the research.
- Voluntary participation: Respondents have the right to choose to take part in the research without any form of coercion.
- Right to privacy: Respondents ought to be assured that their responses will be treated with strict confidentiality.

To safeguard respondent anonymity and adhere to ethical standards, responses were labelled with abbreviations (e.g., "R1" for Respondent 1, "R2" for Respondent 2). This measure was implemented to protect participants' privacy and create a confidential research environment, ensuring that their personal information was not disclosed, thereby encouraging open and truthful participation.

The researcher followed ethical guidelines, and all participants provided their consent to participate in the study. The information collected during the fieldwork was treated with the utmost confidentiality. Confidentiality ensures that the information is kept private and is only accessible to those individuals who require it for the research study's purposes (Kidd, 2022).

4.9 DATA MANAGEMENT PLAN (DMP)

According to Smale, Unsworth, Denyer, and Barr (2018), a data management plan (DMP) is a comprehensive document that provides researchers with a structured framework for outlining their approach to data management across the various phases of a research project’s data lifecycle. Furthermore, Kvale and Pharo (2021) expound upon the concept of a DMP, characterising it as a fundamental tool designed to facilitate effective data

management. A DMP serves as an initial undertaking aimed at optimising data accessibility, enhancing the reproducibility and reusability of acquired data, and mitigating data loss risks.

In the context of a Data Management Plan (DMP), Miksa, Oblasser, and Rauber (2021) emphasise its essential role in delineating the comprehensive management of research data. Specifically, a DMP is anticipated to delineate aspects such as the nature and volume of research data, data structuring methods, quality control procedures, metadata generation, data storage protocols, backup strategies throughout the project's duration, data sharing mechanisms, considerations related to legal and ethical standards, and strategies for the prolonged curation and preservation of data beyond the duration of project funding. Furthermore, the DMP also encompasses a critical element, which is the allocation of the necessary budget and resources to implement the proposed plan. The principal objective underpinning the development and implementation of a DMP is to ensure that researchers adhere to all pertinent legal, ethical, and contractual obligations, while concurrently advocating for the adoption of best practices in research data management.

Data for this study was collected through interviews and subsequently transcribed from audio recordings. The transcriptions were then translated for analysis. To maintain the security of the data, the data is currently stored in a locked cabinet at the researcher's office. This physical storage method is employed to ensure the data's protection against unauthorised access. To enhance data security and prevent data loss, a backup copy of the data is maintained. This backup is stored in the cloud via a reliable cloud storage service (google cloud). Moreover, the data is encrypted in the cloud, adding an extra layer of security against potential breaches.

It is essential to establish a clear plan for data disposal or archiving at the conclusion of the project to ensure responsible data management. Therefore, the data is stored safely and securely, adhering to best practices, and will be retained until it is no longer relevant or needed for the research project. Access to the data stored in the locked cabinet is restricted to authorised personnel only. Access to the cloud-stored data is controlled through robust authentication and authorization mechanisms. Sharing of the data with authorised personnel (research supervisors) via cloud storage is conducted while maintaining data confidentiality and access controls. The regular reviews and updates of security measures is conducted to protect the data against evolving threats. Data security standards are established guidelines and best practices designed to safeguard digital information and protect it from unauthorized access, breaches, and other security threats (Taherdoost, 2022). Therefore, General Data Protection Regulation is adhered to ensure the data's

integrity and confidentiality. The data management plan for this research complies with relevant data protection and privacy regulations.

4.10 RESEARCH LIMITATIONS

Clancy (2019) defines limitations as constraints or restrictions in research analysis that are beyond one's control, such as constraints related to time, financial resources, access to data, and other similar factors (Clancy, 2019). In research, limitations refer to the boundaries or constraints that researchers encounter during their study, which may affect the scope, validity, or generalisability of their findings. These limitations are often factors that researchers cannot easily change or overcome but need to acknowledge and consider when interpreting the results of their research **(**Theofanidis & Fountouki, 2018). The analysis of this research was to focus solely on commercial farms in Western Cape, Stellenbosch, however due to farmers not willing to participate the researcher had to expand the study area to Cape Winelands District, Western Cape.

The researcher had no funding for the study and that resulted in constraints on the data collection method used. Due to unavailability of data the researcher had to limit the study to qualitative study. The researcher faced time constraints because between March and June most of the farmers were not willing to participate due to harvest period. The researcher had to set up appointments based on respondent’s convenience and availability. All correspondents signed a consent form before the interview was conducted.

4.11 CONCLUSION

The researcher elucidated the research paradigm, strategy, and approach employed in the study, along with the study’s population. Additionally, the procedures for sampling the targeted population, data collection methods, the analysis tools used, and ethical considerations observed throughout the investigation were explained. The findings obtained through the data collection process will be presented in Chapter 5 of the dissertation.

CHAPTER 5
DATA ANALYSIS AND PRESENTATION OF FINDINGS

5.1 INTRODUCTION

In the preceding chapter, the researcher discussed the research design and methodology. In this chapter, the focus shifts to the crucial aspect of data analysis. This chapter centres on exploring and interpreting the research data to organise, structure, and derive meaningful insights from it. The researcher presents the findings in this chapter and engages in insightful discussions. Furthermore, details are provided on data collection, the process of arranging interviews with respondents, and the structure of the interviews. The chapter follows the interview guide's structure, connecting respondents' responses and the research questions being addressed. The study aimed to answer several key research questions, which include:

- What is the estimated production cost effects of drought in commercial farms in the Cape Winelands District, Western Cape?
- What are the cost implications of drought on commercial farmer's yielding outputs in the Cape Winelands District, Western Cape?
- What are the strategies used by commercial farmers in the Cape Winelands District, Western Cape to encounter the effects of drought differ?
- What costing tools are in place to keep the cost under control from the effects of drought in Cape Winelands District, Western Cape?

To address these questions, interviews were conducted with farm owners and managers in the Cape Winelands District via Microsoft Teams. Once the data collection process (interviews) was completed, the transcribed data underwent thorough analysis using content analysis techniques. While the presentation of findings in this section mainly relies on descriptive methods and incorporates charts for general questions, it is important to note that the research methodology leans toward qualitative investigation. Finally, the subsequent section focuses on the demographic profile of the respondents, providing valuable context for the study.

5.2 DEMOGRAPHIC INFORMATION OF RESPONDENTS

Demographics typically refer to statistical information about the characteristic features of a population, such as age, gender, race, education level, income level, and more. In this research, it was crucial to provide detailed participant characteristic information to promote

diversity awareness, recognizing that "universal psychological processes may be understood or interpreted differently" based on cultural, racial, or ethnic factors (Jones, Peter, and Ruckle, 2020; Hammer, 2011, p. 261). Therefore, it's essential for the researcher not to assume the absence of differences between groups until hypotheses are substantiated. Providing an in-depth description of participants allows readers and researchers to determine the generalizability of research findings and enables comparisons across study replications (Hammer, 2011; Ghaleb, Refae, Kaba, and Eletter, 2021). Additionally, Connelly highlights the importance of describing participants, the context, and recruitment methods in qualitative research (Connelly, 2013; Jones, Peter, and Ruckle, 2020). Furthermore, from an ethical perspective, given the use of small sample sizes in qualitative research, demographic data should be reported in an aggregated form to prevent any inadvertent identification of individuals (Morse, 2008; Ziegenfuss et al., 2021).

The demographic profile was crucial for this research to determine whether the respondents are representative of the targeted population for generalisation purposes. For respondents to meet the parameters of the research, the following characteristics were all required or otherwise the farm which did not possess all the requirements was disqualified:

- The farm should be situated in Cape winelands, Western Cape.
- The farm should be formally registered.
- The farm should be a commercial farm.
- The farm should have been in operation for the minimum of 8 years.
- The farm should not be an animal farm.
- Respondents should be either owner or a manger.
- Respondent must have been working on the farm for more than 4 years.

From above, the physical demographic parameters are restricted to the Western Cape, Cape Winelands District. Twelve registered commercial farmers which produce various commodities were contacted to participate in the interviews. The respondent demographics sections below describe the respondents' age, the commodities (products) with which they farm, the farm operating years, respondents' number of years working in the farm, gender, ownership, and the education level. This section provided a basis for understanding the rest of the interview questions. Below are the demographic details of the respondents.

5.2.1 Length of farm operation

Operating years with the highest frequency of 6 respondents was for about 21-40 years, followed by 4 respondents who have been in operations for more than 41years in farming and the least was 2 farmers who have been in farming industry for below 20 years (Figure 5.1). Based on the correspondents' responses, none of them has been in operations for less than 10 years, it is deemed that they have the necessary experience to provide the adequate information regarding cost implication of drought on operations of their commercial farm businesses.

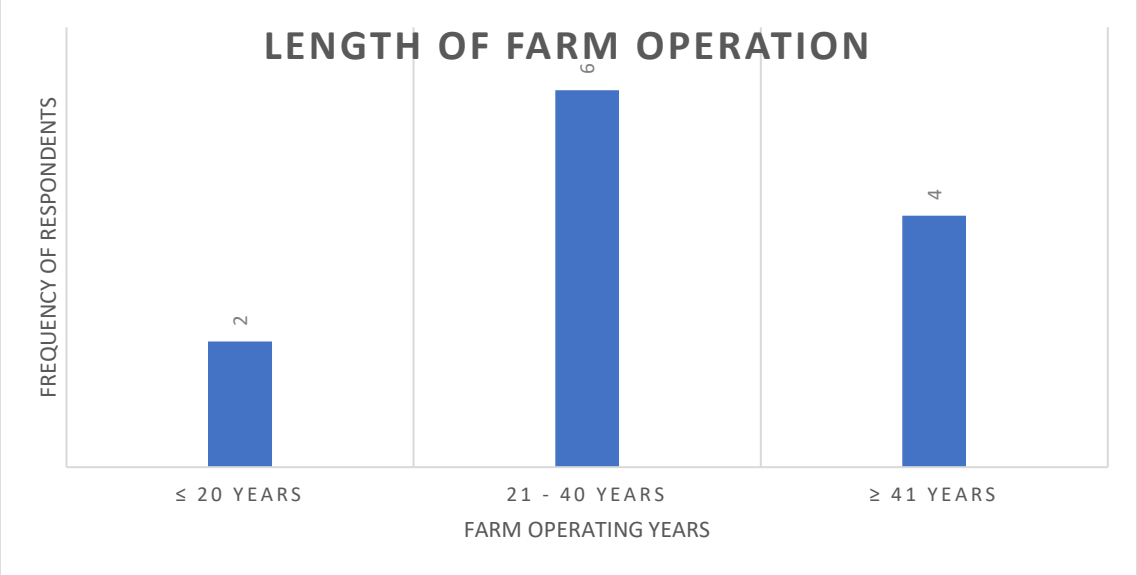


Figure 5.1: Farm operating years

5.2.2 Position and gender of respondents

The researcher was targeting commercial farm managers and owners to interview for the research because they occupy managerial positions and have deciding power as they run the business. Therefore, they would have more access to information about drought cost implication on operations of their commercial farm businesses. Therefore, all respondents had to fall within those categories to meet the research parameters. Hence this question was formed to qualify the respondents.

The research sample consisted of 12 male participants. This indicates that approximately 60% of commercial farms in the Cape Winelands District are male dominated. Gender inequality is influenced by various factors on a global scale, with workplace gender bias being a significant contributor (Smith & Sinkford, 2022). Cognitive biases often lead to erroneous conclusions, stereotypes, and prejudices. For instance, in job applications,

female candidates are sometimes unfairly perceived as less committed, less self-confident, and less likely to stay in a job compared to male candidates (Gebre et al., 2019). The International Labour Organisation recognizes gender bias as a leading cause of discrimination in hiring and promoting workers with equal qualifications and merits. The underrepresentation of females in the sample suggests that, to some extent, gender inequality persists in this sector. It's important to note that these findings may not be broadly applicable, as the sample was specific to the Western Cape's agricultural sector.

Out of the pool of 12 respondents who were interviewed, it was observed that 10 of them held the role of farm managers, whereas only 2 individuals could be identified as farm owners (as depicted in Figure 5.2). Notably, one of the farm owners shared insights into his journey, disclosing that he had initially rented the farm in 2004. Subsequently, in 2015, an agreement was reached between him and the farm's owner for the sale and transfer of ownership, which was ultimately formalized in 2017 after many years of actively managing the farm. This participant underscored the challenges associated with transitioning from a tenant to a farm owner.

This distribution within the interviewed sample signifies that, within the broader context of the Cape Winelands district, a notable 50% of commercial farms are overseen and operated on a day-to-day basis by farm managers, while ownership rests in the hands of a smaller fraction of individuals.

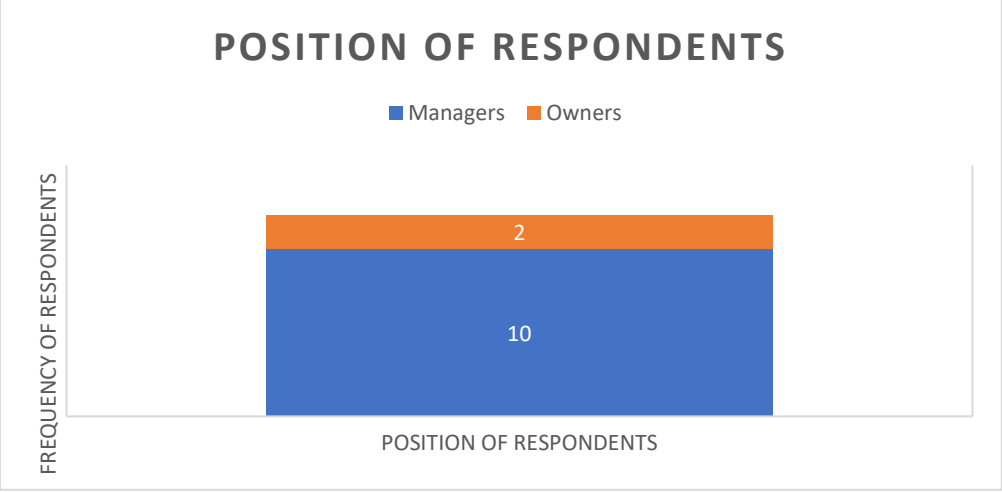


Figure 5.2: Position of respondents

5.2.3 Age category of respondents

The research findings indicate a notable distribution of respondents across different age categories. The age group of 40 to 49 years had the highest representation, with 6

respondents, followed by individuals aged 50 and above, comprising 4 respondents. In contrast, the age categories of 30 to 39 years and below 30 years had only one respondent each. This distribution raises intriguing questions about the potential link between age and engagement in the farming sector. It suggests that older individuals may bring greater experience and involvement in agricultural activities, potentially impacting their farming practices, while younger individuals could represent generational shifts in farming, influenced by evolving technologies and education. Understanding how age interacts with education and influences farming practices is essential for gaining insights into the multifaceted nature of the agricultural sector.

The study's findings highlight the diverse age composition of respondents and the potential implications for their roles and approaches within the agricultural context. The research underscores the significance of considering age and education as key demographic factors that shape farming practices and outcomes, emphasizing the need for a comprehensive understanding of these dynamics in agricultural research and policy development.

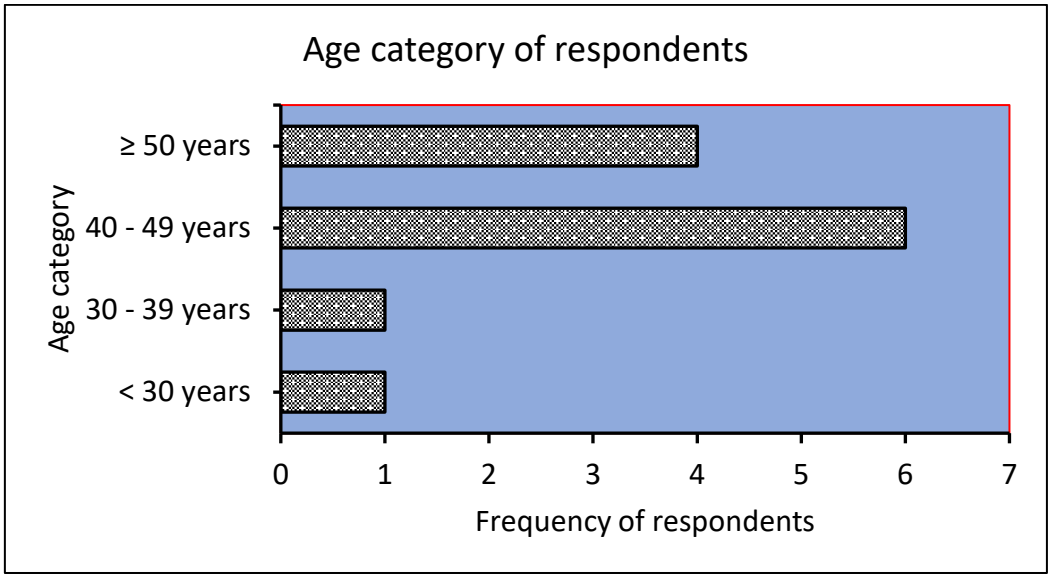


Figure 5.3: Age categories of respondents

5.2.4 Educational level of respondents

A significant majority, consisting of 7 respondents, hold undergraduate degrees, followed by 3 respondents who have attained postgraduate qualifications. The remaining 2 respondents have completed their high school education, achieving a Grade 12 level of education. Notably, none of the respondents possessed qualifications lower than a matriculation level, resulting in a negatively skewed distribution of educational qualifications (as depicted in Figure 5.4).

The educational background of respondents in this study bears implications for the agriculture sector. Paltasingh and Goyari (2018) emphasize that education plays a pivotal role in enhancing the farming skills and productivity of farmers. Moreover, they contend that education directly contributes to economic growth by improving human capital. Therefore, the inclusion of this question in the study is of paramount importance, as education serves as a vital tool for advancing agricultural productivity. It not only equips farmers with knowledge but also provides them with hands-on training and better farming methods, thereby fostering growth and innovation in the agricultural sector.

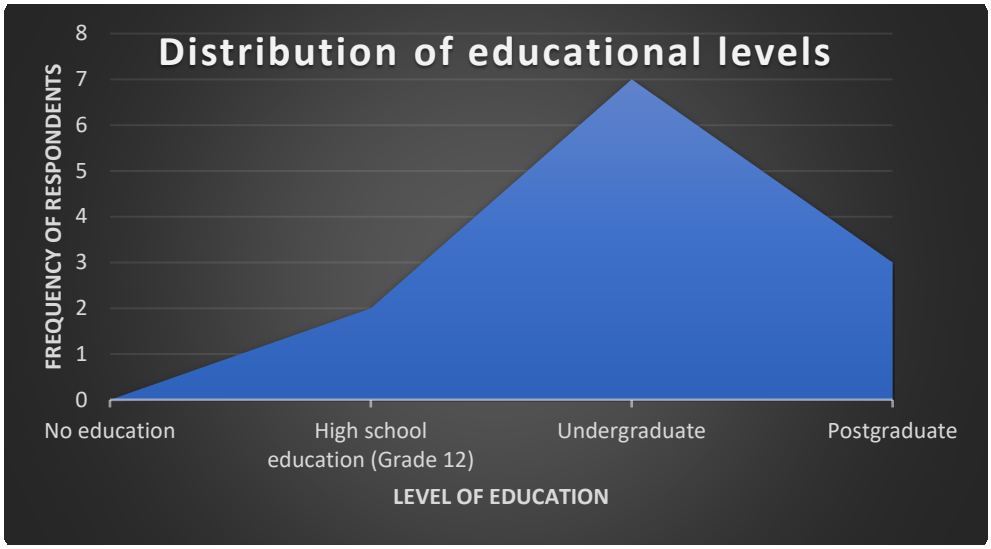


Figure 5.4: Level of education of respondents

5.2.5 Years of farming experience

The findings reveal that the majority of respondents (7) boast extensive farming experience exceeding 20 years, followed by 4 respondents with a moderate range of experience spanning 6 to 10 years. In contrast, there is one respondent with a mid-range experience of 16 to 20 years (as presented in Figure 5.5). Notably, none of the respondents reported having less than 6 years of farming experience. This comprehensive distribution underscores that both farm owners and managers possess substantial expertise, signifying a deep understanding and knowledge of farming practices.

The inclusion of the question pertaining to respondents' years of farming experience was motivated by the research's objective to examine the impact of such experience on farming effectiveness and success. The data indicate that a substantial proportion of respondents bring years of hands-on knowledge to their roles, which suggests a potential positive

influence on the performance and outcomes of their farming endeavours. Understanding the relationship between experience and farming effectiveness is essential for comprehending the nuances of the agricultural sector and, in turn, for informing strategies and policies that can enhance agricultural productivity.

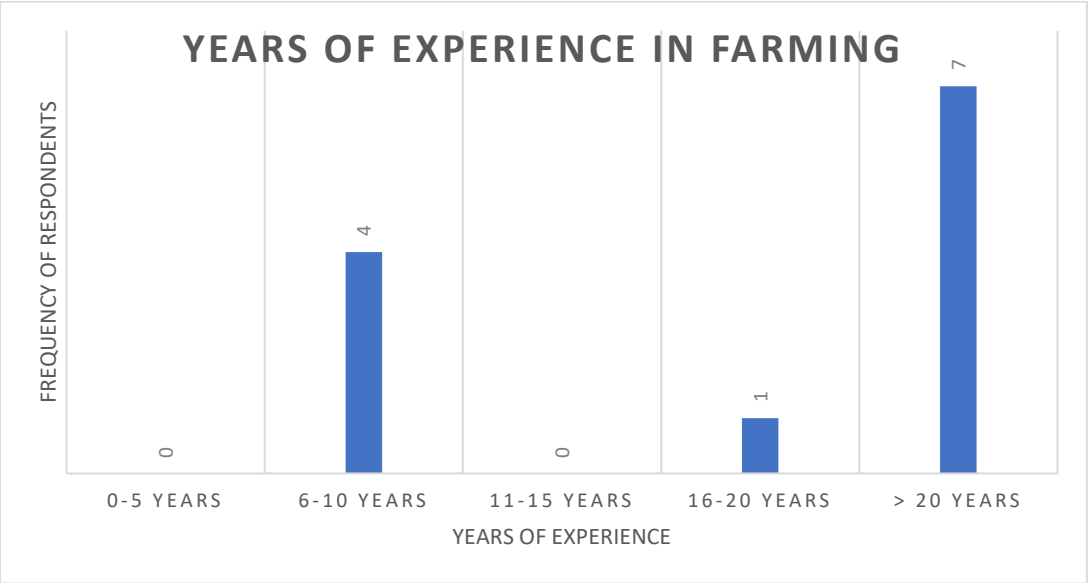


Figure 5.5: Years of farming experience

5.2.6 Farming commodities produced by respondents.

It was crucial for the researcher to know which commodities the interviewed farmers produce to draw the conclusion based on the commodities produced by the respondents.

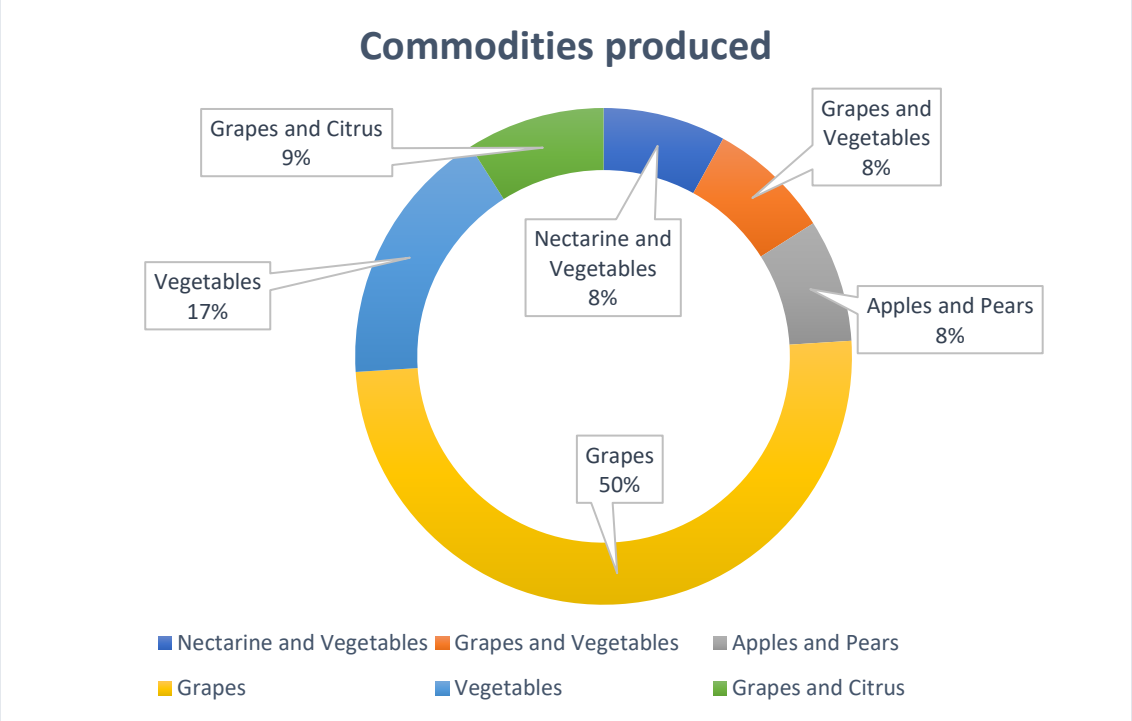


Figure 5.6: Commodities produced by the farms.

Figure 5.6 illustrates the variety of commodities produced by the interviewed respondents. Among the twelve farms examined, six primarily focus on grape production, while two specialize in growing vegetables. The remaining four farmers engage in a diverse array of agricultural activities, including the cultivation of grapes and citrus, grapes and vegetables, apples and pears, and nectarines. This diversity in the range of commodities produced reflects the multifaceted nature of agricultural practices within the studied region, with each farmer's choice of crops likely influenced by factors such as climate, market demand, and individual expertise.

5.3 RESPONSES FROM INDIVIDUAL RESEARCH QUESTIONS

Offering thorough and significant answers to research inquiries is important in qualitative research. Qualitative research aims to investigate and understand intricate phenomena by exploring individuals' or groups' subjective experiences, viewpoints, and meanings. The responses received from participants provide deep and comprehensive insights that go beyond mere statistical data, enabling a more profound comprehension of the research subject. By carefully analysing and interpreting these responses, researchers can identify patterns, themes, and subtleties that quantitative measures alone may not reveal. These responses form the foundation for constructing a comprehensive narrative and drawing meaningful conclusions. Additionally, they contribute to the credibility and reliability of the study, as they demonstrate the researchers' commitment to capturing the voices and perspectives of participants. To summarise, providing thoughtful and detailed responses in qualitative research enriches the research process, enhances understanding, and adds valuable context to the findings. The following section presents a summary of the responses obtained from the research questions posed.

5.3.1 Research Question 1: What is the estimated production cost effects of drought on commercial farms in the Cape Winelands District, Western Cape?

The following questions were asked in this section:

5.3.1.1 Have you experienced drought since the inception of this farm? If yes, does your production level meet the demand of your product during the drought period?

All respondents unequivocally affirmed the occurrence of drought conditions within their respective farming operations. It is of particular significance to note that Respondent 5 reported an extended and consistent exposure to drought, surpassing the durations reported by the other respondents. Following closely, Respondent 6 indicated a six-year history of drought experience. Respondents 4 and 8, in contrast, disclosed a five-year

tenure of drought exposure, while Respondent1 reported a four-year history. Respondents 2, 3, 7, 9, and 10 collectively shared a three-year tenure of drought, and Respondent 11 had a comparatively limited one-year experience. It is essential to acknowledge that the abbreviated duration of drought exposure for Respondent 11 can be attributed to their adaptive approach of synchronising planting activities with water availability.

However, a notable exception was observed in the case of Respondent 12, who claimed an absence of drought on their farm for the past six years. Nevertheless, it is noteworthy that Respondent 12 acknowledged the repercussions of the prolonged drought period. Consequently, Respondent 12 was classified in the dataset as having endured a six-year drought episode. These findings collectively underscore the widespread impact of drought on all participating farms, thereby accentuating the substantial drought risk confronting these agricultural enterprises.

Furthermore, all respondents conceded their inability to meet the production demands of their products during drought periods, except for Respondent 9. Notably, Respondent 9, despite facing a three-year drought period, reported achieving the capacity to meet their production demands. This anomaly suggests that Respondent 9 may have incurred additional costs to sustain production levels or implemented effective mitigation strategies that facilitated operational continuity during drought seasons.

These findings accentuate the imperative for farms to fortify their preparedness and resilience in response to drought conditions. Drought constitutes an external risk that can manifest despite preventive measures, thereby underscoring the exigency of proactive measures aimed at mitigating its adverse impact on agricultural operations.

5.3.1.2 What is your estimated production cost during the normal and drought period?

In this research, all respondents were requested to provide estimations of their production costs, as they expressed discomfort in disclosing the precise amounts expended in this regard. The focus of this inquiry pertained to the primary expenses incurred in commercial farming, encompassing direct costs integral to the production process. These expenses encompassed labour costs, irrigation expenditures, pruning outlays, harvesting expenses, replanting costs, and similar items directly linked to production.

Additionally, respondents were prompted to offer estimations for fixed costs and overhead expenses. Fixed costs pertained to expenses such as accounting fees, vehicle

expenditures, machinery investments, and equipment-related outlays, among others. Overheads costs, on the other hand, encompassed costs associated with equipment and machinery maintenance, fuel consumption, and related expenses.

The responses received from the participants are as follows:

Respondent 1 elaborated on their firm's production costs during drought periods, revealing a total expenditure of approximately R120,000 which includes expenses related to contractors. They provided a detailed breakdown of these costs: In terms of sea water, they stated an annual outlay of approximately R25,000. Notably, during droughts, this cost increases by 20%. Labour costs were identified as a significant component, totalling R95,000, covering the workforce engaged in various farm activities.

Regarding replanting, Respondent 1 explained that this activity occurs roughly once every ten years, without specifying a precise cost. They mentioned that this process involves "nesting" and that the plantings in question were established many years ago.

Electricity costs were estimated at around R100,000 per year, with the respondent underscoring the substantial impact of electricity expenses, particularly during droughts. One unique and notable expense highlighted by Respondent 1 was the maintenance of an electrical line on the farm. Despite not consuming a significant amount of electricity, they must pay approximately R4,000 per month to Eskom, the electricity supplier, solely to maintain the electrical infrastructure. This cost encompasses the preservation and safeguarding of the electrical infrastructure, as vandalism incidents, such as pole damage, necessitate ongoing vigilance and maintenance efforts.

Respondent 2 conveyed the challenges of providing precise estimates but shared valuable insights regarding their farming operation. They manage a total of 100 hectares of land, with a notable 40% dedicated to old vines in need of replanting. Their production costs typically range from R80,000 to R100,000 per four to five hectares annually, applicable when the plants have matured.

Respondent 2 further, emphasised the importance of allocating additional funds to pruning, underscoring its critical role in the farming process. For the process of replanting old vines, costs were estimated to be in the range of R250,000 to R300,000 per hectare. It was explained that the ideal timeframe for replanting is when vines reach the age of 15 to 20 years, as this rejuvenation process is essential for their productivity.

During the period when vines are being replaced, typically between the 15th and 20th year, the farm may not generate substantial income. This is because resources are directed toward nurturing the newly planted vines, resulting in an initial period of investment without immediate returns. Furthermore, Respondent 2 noted that the quality of crops may not be optimal in the early years following replanting. However, on the third, fourth, fifth, sixth, and up to the seventh year, a significant improvement in yield is expected, ultimately contributing to more favourable outcomes.

Respondent 3 highlighted the substantial impact of electricity costs on their farm, which fluctuated based on water availability. Their annual electricity expenses increased significantly during dry periods, rising from approximately R32,000 in 2017 to R86,000 in 2021. These electricity cost fluctuations were closely tied to the need for increased water pumping during droughts. In the broader context, Respondent 3 noted that their overall annual production costs amounted to around R1.6 million, necessary to yield a 200-ton production. The response emphasised the sensitivity of electricity expenses to climatic conditions and their notable influence on the farm's overall production costs, which had implications for profitability and financial sustainability.

Respondent 4 discussed their agricultural production costs and related expenses. They mentioned that their production cost per hectare is around R34,000 for non-citrus crops and R55,000 for citrus crops. Additionally, they spend approximately R50,000 per hectare on the irrigation system when installing it initially. For water expenses, they pay about R110,000 annually, which covers the water needed for 96,000 cubic litters. During drought periods, they pay a reduced amount based on the percentage of their water quota they receive. Regarding salaries, they have an annual expenditure of approximately R900,000. This information gives insight into their overall agricultural costs and how they manage expenses related to water and labour.

According to Respondent 5, the production cost per hectare for their 237-hectare property is approximately R42,000. They also mentioned that the cost of replanting a hectare is about R400,000. For irrigation, they incur significant costs, spending roughly R1.5 million solely on Eskom power, which is used for pumping water. Rainwater is free, but they pay about R250,000 annually for government scheme water. However, regardless of usage, they are charged the full amount.

At the Eersteriver site, the cost is about R35,000. During droughts, they were charged the full amount for government scheme water despite receiving only 50% of their allocation. Strict monitoring was implemented with weekly readings of water usage. Their annual salary expenses amount to around R4 million, and they also allocate approximately R1 million for seeds and fertilizers. Factory equipment and maintenance combined cost them about R1.5 million. Regarding vine replanting, they aim to replace vines every 20 years, but the cost has risen to about R400,000 per hectare. They typically replace 5-10% of their total hectares each year. However, drought periods have affected their cash flow, hindered their replanting efforts and created financial challenges.

Respondent 6 explained that during drought periods, they refrain from replanting on their farm. However, if they decide to replant, the cost amounts to approximately R100,000 per hectare. Regarding their expenses, they allocate around R1.5 million for salaries, which covers salaries for permanent employees, external labour brokers, picking teams, and casual labourers hired during the harvesting season. Fertilizer expenses amount to roughly R300,000 per year. For pest control, they budget approximately R800,000 to manage various aspects of pest control on their farm. Maintenance costs are estimated at R150,000, while their annual expenditure on Eskom power is about R300,000. Additionally, they spend approximately R170,000 on diesel costs.

Respondent 8 explained that the cost of planting crops on one hectare amounts to approximately R400,000. With their land covering 52 hectares, this translates to a significant initial investment required for the replanting process. Additionally, Respondent 8 noted that during the first five years following replanting, ongoing maintenance expenses, averaging around R50,000 per hectare, are incurred before any harvest income is generated. Subsequent, to this initial five-year period, the annual expenses experience a substantial increase, reaching approximately R1.5 million per year. This heightened yearly expenditure places considerable pressure on their cash flow. Consequently, Respondent 8 stressed the importance of making prudent financial decisions to effectively manage these costs in order to maintain the financial health of their agricultural enterprise.

Respondent 12 explained how the drought affects various aspects of their grape farming operations, including costs and tonnage. They pointed out that the impact of the drought on tonnage is somewhat offset by certain fixed costs that remain consistent. These fixed costs include office expenses, telephone bills, electricity, and management costs.

Regarding labour costs during harvesting, they mentioned that these costs decrease during droughts. When there are fewer grapes to harvest, contractors are paid based on the tonnage they collect. With fewer grapes, the harvesting costs are reduced. For example, in dry years, they might have an average yield of 7 tons per hectare, compared to 10 tons per hectare in normal years. Contractors are typically paid R500 per ton harvested by hand, so harvesting costs would be 7 tons x R500 = R3,500 per hectare during droughts, compared to R5,000 in non-drought years.

However, certain expenses remain unaffected by the drought. Pruning and spraying costs stay the same, as all vines and weeds still need to be maintained. Pruning costs are fixed at R2.16 per vine. Spraying the vineyards costs R5,500 per hectare and does not vary between dry and normal years. Additionally, they mentioned that pumping costs increase during droughts. They need to start pumping water for irrigation earlier and run more cycles due to the dry conditions. Pumping costs can be 10-15% higher in dry years.

Summary drawn from the above responses.

The provided responses from various respondents offer valuable insights into the production costs and operational challenges faced by farmers in Cape Winelands District, particularly during drought periods. These responses shed light on the intricacies of cost components and the impact of environmental factors on the agricultural industry.

Regarding production costs and drought implications, the respondents collectively highlighted the multifaceted nature of production costs associated with farming. These costs encompass various aspects, including labour, electricity, water, replanting, and maintenance of infrastructure.

Electricity expenses emerged as a significant concern for several respondents, with costs fluctuating in response to water availability. Dry periods necessitate increased water pumping, which substantially drives up electricity costs. This sensitivity of electricity expenses to climatic conditions directly affects overall production costs, creating challenges for profitability and financial sustainability.

Replanting old vines was a recurring theme, with varying cost estimates. Respondents underscored the importance of replanting for rejuvenating vineyards, but the associated expenses can be substantial. The costs associated with replanting were seen as long-term investments, often requiring several years before yielding returns. The economic

implications of replanting were significant, affecting cash flow and necessitating prudent financial management.

Labour costs are identified as a substantial component of production expenses. Respondents indicated that labour expenditures covered a range of activities critical to farming. Notably, during drought periods with reduced yields, some respondents experienced reduced labour costs related to harvesting.

In addition to the aforementioned costs, respondents mentioned other fixed and variable expenses, such as irrigation system installation costs, seed and fertilizer expenditures, pest control, and maintenance. These costs contribute to the overall financial landscape of farming operations.

Respondent 12 emphasised the impact of drought on tonnage, which is partially offset by consistent fixed costs, including office expenses, telephone bills, electricity, and management costs. During droughts, tonnage may decrease, affecting harvesting costs paid to contractors. However, certain expenses such as pruning and spraying remain unaffected by drought conditions, while pumping costs increase due to the heightened demand for irrigation.

The responses provided valuable insights into the intricate web of production costs and challenges faced by farmers in Cape Winelands District. The impact of drought on electricity, water, and replanting costs highlighted the vulnerability of the industry to environmental fluctuations. Labour and other operational expenses added complexity to the financial dynamics. Respondent’12's perspective illuminated the nuances of cost fluctuations during drought periods. These findings emphasise the critical significance of maintaining financial resilience and making judicious decisions to ensure the sustainability of farming operations in a volatile climate.

5.3.1.3 Has drought resulted in increase on your production inputs? If yes, do you increase the selling price to cover your cost or how do you recoup the loss?

All respondents unanimously affirmed that production costs rise during drought periods. Additionally, Respondent 1 noted that they address this cost increase by implementing a strategy of raising their selling prices by 10 to 15% to recover the incurred losses.

Respondent 2 provided valuable insights into the intricacies of pricing strategies during drought periods. Despite acknowledging the increase in production costs, they highlighted

constraints in raising selling prices due to pre-established contracts with buyers. These contracts have fixed terms and conditions that prevent immediate price adjustments. Respondent 2 elucidated that these contracts are typically formed several years in advance, lasting five to six years and are agreed upon before the harvest period. However, Respondent 2 mentioned a potential avenue for mitigating the impact of increased production costs. At the end of these contracts, they have the flexibility to make modest price adjustments, with an upper limit of up to a 17% increase. This adjustment is aimed at recuperating the losses incurred during drought periods. Notably, Respondent 2 shared the practical impact of these challenges, revealing that during the last drought period, a significant portion of their land, approximately 14.9 hectares, was allocated solely to cover the production costs incurred during the drought. This underscores the complexities faced by grape farmers in navigating the financial implications of droughts within the confines of fixed contracts while striving to maintain profitability.

Respondent 3 provided a crucial perspective on the challenge of maintaining product quality during droughts and its impact on pricing strategies. According to their response, when faced with drought conditions, there is a higher likelihood of products being of lower quality. In such circumstances, raising the selling price becomes challenging, as buyers tend to seek out sellers with consistently high-quality products. To avoid losing customers and market share due to reduced product quality during droughts, Respondent 3 further, mentioned that they opt to keep their selling prices at the same level, despite facing increased production costs. This decision reflects a commitment to customer satisfaction and product consistency. Consequently, the additional production cost input they incurred during drought periods effectively translates into a loss for the farm, as they absorb these costs rather than passing them on to their buyers. This approach, while maintaining customer loyalty, means that the farm absorbs the financial impact of droughts, ultimately affecting their profitability. Respondent 3's response highlights the complex trade-offs faced by farmers, balancing product quality, pricing strategies, and financial sustainability in the face of volatile climatic conditions like droughts.

Respondent 4: "*Yes. Well, many of my contracts are being set per hectare not per ton. So, when I'm planting now, I'm tying down per hectare deal and not a per ton deal. Cause the area where we are in, we can't really go after the quantity, we need to do quality. That's how Stellenbosch is known for. So, we are not supposed to be much higher than 10 tons per Hector, otherwise you're gonna start losing quality. So, so, uh, that's, that's how we are mitigating the losses and it's something that we need to adapt to 'anyway, 'because, um, um, that's the only way that we are going to get our prices per ton that we are wanting, to*

be able to have a sustaining business." Respondent 4 further explained farmers in his area, usually increases their price by the average of between 5 and 7% per season, however, that is not a formal thing that is put in place to mitigate the losses that they incur during drought. It is the normal increases not specifically because of the drought. *"So, whether the drought is there or not, if there was no increase during that season of drought, then it's your loss."*

Respondent 4 provided insightful commentary on their contracting and pricing strategies, particularly in the context of preserving product quality and addressing the challenges posed by drought periods. Respondent 4 indicated that a significant portion of their contracts is structured on a per-hectare basis rather than being tied to tonnage. This strategic choice is driven by the need to prioritise quality over quantity, which is a hallmark of grape production in the Stellenbosch region, renowned for its exceptional grape quality. Consequently, they adhere to a yield limit of no more than 10 tons per hectare to ensure that the desired quality standards are maintained. The per-hectare contract approach is viewed as a key method to mitigate potential losses during drought periods. By doing so, they aim to adapt to this approach as an essential part of their operational strategy, recognising it as the means to achieve their desired price per ton for grapes. This approach is seen as crucial for the overall sustainability of their farming business. Respondent 4 also mentioned that, in their area, it is customary for farmers to implement price increases averaging between 5% and 7% per season. However, these price adjustments are not specifically designed as a formal measure to offset drought-related losses. Rather, they are standard annual increases. In essence, whether a drought occurs during a given season, the absence of such price adjustments would be regarded as a financial setback.

Respondent 5 acknowledged that production costs inevitably rise during drought periods. However, they outlined a deliberate strategy of not increasing selling prices, primarily due to the awareness of the increased production costs. Instead, their approach centres on cost reduction efforts in various aspects of production without compromising product quality. Basically, to mitigate the financial impact of drought, Respondent 5 adopts a frugal approach to farm management. They focus on living modestly and prioritising only essential activities to recover losses. For example, they reduce the frequency of certain farming practices, such as spraying, from eight times to six times a year. Additionally, they emphasise conservation measures, including minimising unnecessary vehicle usage and optimising energy and diesel consumption. These efforts collectively contribute to reducing pump costs and other expenditures. In essence, Respondent' 5's strategy revolves around prudent cost management and resource optimisation, allowing them to absorb increased

production costs during drought periods without passing these costs on to buyers. This approach underscores their commitment to maintaining product quality and financial stability in challenging climatic conditions.

Respondent 6: *"No, we do not increase the price, because the wines also get less. 'It's less good, you know. So, the price remains the same. So, you'll get lower price points as well. Basically, the only thing you can do is you stop expenses, you stop replanting, you stop fixing tractors etc"*. The respondent conveyed a clear stance on pricing strategies during drought periods, highlighting the challenges associated with maintaining product quality and pricing. The respondent firmly stated that they do not raise the price of their products during drought periods. This decision is rooted in the recognition that the quality of the wines produced during such conditions tends to be diminished, resulting in less desirable products. Consequently, they opt to maintain the same pricing structure, even though it results in lower price points for their wines. In response to the financial constraints posed by drought, the respondent outlined a practical strategy. They explained that the primary approach is to curtail expenses in various areas of their operation. This includes suspending activities such as replanting and tractor repairs. Essentially, the strategy involves a temporary halt to non-essential expenditures as a means of weathering the financial challenges brought about by drought conditions. The respondent's approach underscores the complex decisions faced by vineyard operators during drought periods, where the compromise between product quality, pricing, and cost containment becomes a critical consideration in maintaining financial stability.

Respondent's 7, 8, 9, 10, 11, and 12 provided consistent responses, indicating that they do not implement specific measures to recover production losses incurred during drought periods. These respondents do not take proactive actions to increase selling prices or adjust their business practices to offset production losses during drought periods. Instead, they appear to absorb the financial impact of reduced yields and increased production costs without passing these costs on to buyers. This approach suggests a commitment to maintaining stability in pricing and product quality, even in the face of climatic challenges. While some other respondents discussed strategies such as per-hectare contracts, price adjustments, or cost-cutting measures, these respondents seem to opt for a more passive approach, possibly prioritising consistency and long-term relationships with buyers over short-term financial gains.

Summary drawn from the above responses

The responses from the various respondents collectively underscore the challenges faced by commercial farmers when dealing with the financial impact of drought. One of the key takeaways is that many of these farmers do not have a specific strategy in place to recoup the losses incurred due to drought conditions. Instead, their responses highlight a multifaceted approach to addressing this challenge:

Quality Over Price: Respondents emphasised that drought can negatively affect the quality of their agricultural products, making it difficult to increase selling prices. Consequently, they prioritise maintaining consistent product quality as a means of retaining their customer base. This suggests a customer-centric approach that prioritises long-term customer relationships over immediate financial gains.

Cost Reduction: To mitigate the financial impact of drought, many respondents mentioned implementing cost-cutting measures. This includes reducing expenses in various aspects of their operations, such as reducing the frequency of certain practices, optimising resource usage and limiting non-essential expenditures. Cost reduction serves as a practical means of absorbing increased production costs without passing them on to buyers.

Absorbing Losses: Several respondents indicated that they essentially absorb the losses incurred during drought periods rather than attempting to recover them through price increases or other strategies. This approach reflects a commitment to maintaining stability in pricing and product quality, even in the face of climatic challenges.

The responses collectively reflect a pragmatic approach among commercial farmers, where the preservation of product quality and cost management take precedence over immediate efforts to recoup drought-induced losses. These strategies highlight the complexities and trade-offs involved in maintaining financial sustainability in agriculture, particularly in regions prone to climate-related challenges.

5.3.2 Research Question 2: What are the cost implications of drought on commercial farmer's yielding outputs in the Cape Winelands District, Western Cape?

The following interview questions were asked in this section:

5.3.2.1 How often have you experienced drought in your farm?

The experiences shared by the respondents regarding drought on their farms reveal a consistent pattern of frequent occurrence and lasting impact:

All but one of the respondents (Respondent 11) encountered droughts over multiple years, with some enduring drought conditions for more than five years. Notably, Respondent 5 endured a prolonged seven-year period of drought. These extended durations of drought underline the recurrent nature of this climatic challenge.

Respondent 11 offered a distinctive perspective by explaining their approach to vegetable farming, which depends on water availability. During drought periods, they abstain from planting to prevent losses, illustrating the direct and immediate influence of drought on farming decisions.

Respondent 12 noted that while they had not experienced drought for the past six years, they still felt the repercussions of the six previous years of drought *"In our farm we have not experienced the last 6 years of drought, but we felt the 6 years of drought consequences"*. This underscores the enduring consequences that drought can have on farming operations, even after more favourable conditions return.

Collectively, the respondents cited the years between 2015 and 2018 as particularly challenging due to severe drought conditions. During this period, the scarcity of water made irrigation difficult, placing additional stress on their farming endeavours.

The responses highlight the recurrent and impactful nature of drought as a significant challenge for commercial farmers. These experiences underscore the importance of advanced preparation and effective mitigation strategies, given the enduring effects of drought on agricultural productivity and the livelihoods of these farmers.

5.3.2.2 What is the source of irrigation?

This study revealed that respondents have diverse water sources that they use for irrigation which are presented in Table 5.1. The sources that are most utilised by the farmers include municipal water (7), ground water (6) and surface water (5). Some farmers (3) use grey water and only one had their own dam.

Respondent	Response
R1	Grey water

R2	Surface water, Municipal water
R3	Ground water, Surface water
R4	Municipality water and dams
R5	Ground water, Surface water, Municipal water, grey water
R6	Municipal water
R7	Surface water, grey water
R8	Ground water, Municipal water
R9	Ground water, Municipal water
R10	Ground water, Surface water
R11	Ground water, Municipal water
R12	Own dam

Table 5.1: Sources of water used for irrigation by the farmers.

Diversifying sources of water for irrigation is indeed a critical strategy for farmers, particularly in regions prone to climatic challenges like droughts. As previously discussed, droughts can have significant financial implications for farmers, with increased irrigation costs being a notable factor. Having a range of water sources available provides farmers with essential options during challenging events such as droughts. As previously highlighted, one of the most substantial financial burdens faced by farmers in the Cape Winelands District of the Western Cape during drought periods is the scarcity of water. Water is a fundamental input for agricultural production and plays a pivotal role in ensuring food security. During droughts, farmers often incur higher costs for irrigation because they must either pump water from available sources or even import it. This increased expenditure on irrigation underscores the critical importance of having access to multiple water sources. Diversification not only helps mitigate the financial impact of drought but also enhances the resilience and sustainability of farming operations in the face of unpredictable climatic conditions. In essence, maintaining a diverse portfolio of water sources is a proactive strategy that empowers farmers to better navigate the challenges posed by drought and ensure the continuity of agricultural production.

5.3.2.3 What is your estimated farm output quantity produced during the normal period and drought period per annum? (In units)

The responses provided by the respondents regarding their estimated farm output quantity during both normal and drought periods per annum are presented in the table below:

Respondent	Crop/Produce	Normal Period (Tons)	Drought Period (Tons)	Decrease During Drought
R1	Grapes	40	20	50%
R2	Grapes (Wine)	900	800	11.11%
R3	Wine Grapes	200	200	0%
R4	Grapes	700	500	28.57%
R5	Wine Grapes	2,600	Varies (up to 27% less)	Varies
R6	Grapes	350-370	250	32.43%
R7	Wine Grapes	170	51-85 (30-50% less)	Varies
R8	Apples and Pears	730	219	70%
R9	Vegetables	800	Up to 640 (80% of normal)	Varies
R10	Vegetables	20,000-40,000 (each)	4,000-8,000 (each, 25% less)	Varies
R11	Vegetables	500	500	0%

Table 5.2: Estimated farm output quantity during normal and drought periods per annum

It is worth noting that in some responses, there were ranges or variations provided for the drought period. For those cases, the provided ranges were included in the data. Respondent 5 mentioned a percentage decrease during the drought period without specifying the exact quantity, so this decrease is represented as a percentage in the data.

From the responses, it is evident that the impact of drought varies significantly depending on the type of produce and the specific farm practices. Some crops are more susceptible to substantial reductions in production during drought, while others demonstrate greater resilience. The severity of the impact also varies among respondents, with some experiencing minor reductions in output and others facing more significant challenges. Notably, certain farming practices and management strategies can enhance resilience to drought. The findings highlight the need for adaptable and resilient farming practices to mitigate the adverse effects of drought on agricultural productivity.

5.3.3 Research Question 3: What are the strategies used by commercial farmers in the Cape Winelands District, Western Cape to encounter the effects of drought differ?

The following question were asked in this section:

5.3.3.1 What strategies do you use to ensure that your cost of production is effective?

Below are the verbatim responses.

Respondent 1: *"We don't need any strategies, I have a contract, so all risks are transferred to the contractor. Now I only work on a percentage of the contract and the share in the profit, so we have a contract with him as he takes all the risk, uh, and profit."*

Respondent 2 stated that they do not have a specific strategy in place. However, they aim to reduce production costs through various means, including:

- Implementing spot spray techniques.
- Taking preventive measures.
- Reducing travel expenses by driving less.
- Hiring more affordable labour.
- Conserving water resources.
- Adjusting insurance arrangements.
- Seeking skilled and experienced labour

Respondent 3: *"We don't really have strategies in place, the only thing we do is try minimise the costs, for instance the biggest thing that we do, because a very big cost of our production is labor, we choose obviously, to use our own people for as much as we can, and not bring it bring in contractors."*

Respondent 4 mentioned their strategy, which revolves around ensuring that every task is executed correctly. They follow the principle that it is more prudent to save money by doing things right from the start rather than overspending. They prioritise proper vineyard planting to enhance the longevity of the block. Unlike the old notion of fertilizing trees only when they generate income, they believe in efficient and proactive management right from the beginning.

Respondent 5: *“Well, ‘it’s only as effective as the money you can get in. Yeah. We might try and see what the income is going to look like the next season and then work accordingly and try and make it, if it's a good year, you make it. And if it's something goes wrong, which is out of your control, then you won't make it.”* The effectiveness of their approach is directly tied to the income they can generate. They assess the projected income for the upcoming season and adjust their actions accordingly. If it is a prosperous year, they succeed, but if unforeseen circumstances beyond their control arise, they may not meet their goals. Essentially, they do not have a formal strategy in place.

Respondent 6: *“Yes. Everything I do, I try to do it as effectively as possible. And if I can go without it, I'll go without it. So, for instance, at the moment we're discussing if we're going to have two weed killer applications, or if we're going to do a real light once off application, which is obviously much less.*” Respondent 6 emphasized their commitment to maximising efficiency in everything they do. They aim to streamline their operations and minimise unnecessary expenses. Some of their strategies include:

- Careful planning of pesticide application.
- Reducing cover crops when necessary.
- Implementing efficient tractor usage strategies.
- Employing skilled labor for pruning.
- Emphasising teamwork with a small, dedicated crew.

Respondent 7's primary strategy revolves around cost-saving measures. They aim to be efficient and economical in their approach, which includes implementing electric pruning to reduce labour costs, using dig dishes to enhance water flow to dams during rainfall, thereby reducing labour and minimising tractor usage. Below is their verbal response:
“The only strategy we have is to try and save where possible. For instance, using electric pruning to save labour cost, dig dishes to increase water flow to dames during rain, reduce labour and minimising tractor usage.”

Respondent 8 employs a management tool known as the "PULSE system" for their water management. This system allows them to monitor their 52-hectare farm, divided into several blocks, with about four blocks per hectare. Each block is further divided, for example, into one hectare per block for specific grape varieties. They ulitise a pulse system with water level measurement probes in each block to track water usage and conservation. This system helps them effectively manage and conserve water resources on their farm.

Respondent 9 does not have a formal strategy in place; their approach is to be mindful of cost-saving opportunities and make efforts to save wherever possible. Below is their verbal response.
“We don’t really have a strategy; we try to save where we can.”

Respondent 10's strategy is to reduce permanent labour and increase mechanisation in their operations. Below is their verbal response.
“Drop the permanent labour mechanise more.”

Respondent 11 follows a comprehensive strategy that includes:

- Conducting pilot runs to assess the suitability of a product or strategy before implementing it across the entire farm.
- Continuously evaluating the effectiveness of their strategy by comparing the incurred costs to the yield.
- Adapting their cultivation practices based on the availability of water resources.
- Utilising a dripping irrigation method for crops that require water at the root level and using sprinklers for others.

Respondent 12: *“We don’t have a strategy we spend where it’s necessary.”*

Summary drawn from the above responses.
From the verbatim responses provided, it can be observed that different individuals or farms have varying approaches and strategies when it comes to ensuring cost-effective production. Below is an analysis of the findings from each respondent:

Respondent 1 states that they have a contract with a contractor, which transfers all the risks to the contractor. They only work on a percentage of the contract and share in the profit. This strategy allows them to avoid direct production costs and share both risks and profits with the contractor.

Respondent 2 mentions several strategies they employ to reduce production costs, such as spot spraying, preventive measures, driving less, hiring cheaper labour, saving water, optimising insurance, and using more experienced labour.

The strategy mentioned by Respondent 3 is to minimise costs, particularly focusing on labour costs. They prefer to use their own employees rather than hiring contractors.

The strategy shared by Respondent 4 emphasises doing things right from the beginning to ensure the longevity and efficiency of their farming operations. They prioritise proper practices and investments to avoid spending excessively later.

Respondent 5 seems to indicate that their strategy is highly dependent on the income they expect to generate. They adjust their operations based on the projected income for the season.

Respondent 6 highlights the importance of doing things efficiently and without unnecessary expenses. They use strategic planning for pesticide application, adjust cover crop usage, optimise tractor use, and employ skilled labour for pruning.

The strategy mentioned by Respondent 7 centers around saving costs where possible. They use electric pruning to save labour costs, implement dig dishes to improve water flow during rain and minimise labour, and reduce tractor usage.
Respondent 8 refers to using a pulse system as a management tool to monitor water levels in different blocks. This helps them optimise water usage and potentially save on water costs.

Respondent 9’s approach is also focused on saving costs where they can, although specific strategies are not mentioned.

The strategy mentioned by Respondent 10 involves reducing labour costs by dropping permanent labour and increasing mechanisation.

Respondent 11 emphasises the constant evaluation of strategies and cost analysis in comparison to yields. They also mention pilot runs to test the suitability of new products or strategies before implementing them widely. Cultivating based on available water and using appropriate irrigation methods are also part of their cost-effective approach.

Respondent 12 reiterates the focus on spending only where necessary to control costs.

Overall, the respondents' approaches to cost-effective production vary. Some explicitly outline cost-cutting strategies, while others highlight the significance of efficient practices and sound decision-making to control production costs. Each farm or individual may have

distinct circumstances and objectives that shape their specific approaches to cost management in agriculture.

5.3.4 Research Question 4: What costing tools are in place to keep the cost under control from the effects of drought in Cape Winelands District, Western Cape?

The following research questions were asked:

5.3.4.1 What costing tools are in place to keep the cost under control from the effects of drought in Cape Winelands District, Western Cape?

The costing tools mentioned by the farmers include cost-benefit analysis, value analysis, budgetary control, actual vs forecast analysis, and the use of probes to measure water levels in the blocks. These tools help monitor and control expenditure to mitigate the effects of drought on costs. Below are the verbatim responses.

Respondents	Cost control tools used
R1	Cost-benefit analysis, Value analysis, Use of budget (budgetary control)
R2	Cost-benefit analysis, Value analysis, Use of budget (budgetary control), Actual vs Forecast analysis
R3	Cost-benefit analysis, Value analysis, Use of budget (budgetary control), Actual vs Forecast analysis
R4	Cost-benefit analysis, Value analysis, Use of budget (budgetary control), Actual vs Forecast analysis
R5	Cost-benefit analysis, Value analysis, Use of budget (budgetary control), Actual vs Forecast analysis
R6	Use of budget (budgetary control), Actual vs Forecast analysis
R7	Use of budget (budgetary control)
R8	Cost-benefit analysis, Use of budget (budgetary control), Actual vs Forecast analysis
R9	Value analysis, Use of budget (budgetary control)
R10	Cost-benefit analysis, Use of budget (budgetary control)
R11	Cost-benefit analysis, Value analysis, Use of budget (budgetary control), Actual vs Forecast analysis

5.3. Cost control tools used by farmers in the Cape Winelands District, Western Cape

From the verbatim responses provided, the main cost control tools used by businesses to monitor their expenditure can be identified. Responses indicated that they all use more than just one cost control tool to monitor their expenditure. The most used control tool is the budget control tool which is used by all respondents followed by Forecast analysis and Cost benefit and analysis, followed by value analysis. Below is the explanation of each tool:

Cost-Benefit Analysis**:** Cost-benefit analysis is a tool used to evaluate the costs incurred in a project or decision and compare them to the expected benefits or returns. By conducting a cost-benefit analysis, businesses can assess the financial viability of a project or investment and make informed decisions about resource allocation.

Value Analysis: Value analysis involves assessing the value of various elements or components within a product or service. It helps identify opportunities for cost reduction without compromising quality or functionality. By analysing the value of different elements, businesses can optimise their spending and eliminate unnecessary expenses.

Use of Budget (Budgetary Control): The use of a budget, along with budgetary control, is a fundamental cost control tool. A budget sets a financial plan for a specific period, outlining the expected revenues and expenses. Budgetary control involves monitoring actual expenses against the budgeted amounts and taking corrective actions if there are significant deviations. It helps businesses stay on track financially and ensure they do not overspend.

Actual vs. Forecast Analysis: Conducting an actual vs. forecast analysis involves comparing the actual financial performance of a business with the previously projected or forecasted figures. This analysis helps identify any discrepancies between the expected and actual outcomes, enabling businesses to adjust their strategies and make necessary cost-saving measures.

Tools Explained

Businesses use these cost control tools to monitor their expenditure and maintain financial stability. Below are the explanations pertaining to the significance of each tool:

Cost-Benefit Analysis: This tool helps businesses make decisions based on the potential return on investment. By evaluating the costs and expected benefits of various projects or expenses, businesses can prioritise investments that offer the highest returns or value.

Value Analysis: This tool is focused on analysing value while optimising costs. By critically assessing the value of different components or aspects of their operations, businesses can identify areas where cost-saving measures can be implemented without compromising quality.

Use of Budget (Budgetary Control): Budgets are essential financial planning tools that provide a roadmap for the allocation of resources. By comparing actual expenses to the budgeted amounts, businesses can identify areas of overspending or cost overruns and take corrective actions to align their financial performance with the set budget.

Actual vs. Forecast Analysis: This analysis enables businesses to track their actual performance against the previously projected figures. If there are significant deviations, it signals the need for adjustments in their strategies or operations to control costs effectively.

Overall, these cost control tools are crucial for monitoring business expenditure, optimising resource allocation and maintaining financial discipline. They empower businesses to make informed decisions, identify cost-saving opportunities, and ensure sustainable financial health.

4.3.4.2 What actions does management take if costs exceed the budget?

Below are the verbatim responses.

Respondent 1: *“The contractor takes all the risk, and He is the one taking care of budget.”*

Respondent 2: *“Never overshoot the budget.”*

Respondent 3: *“Check to see areas to reduce cost.”*

Respondent 4: *“So yeah, no, my, my bookkeeper, um, slap me on the wrist, but, um, but yeah, it's, never because of excessive expenditure or anything.*” His bookkeeper keeps track and monitors the budget, so they do not exceed the budget.

Respondent 5: “*We save where we can*.”

Respondent 6: “*Institute stop spending on some areas*.”

Respondent 7: “*Planning to see how to reduce the cost for next year*.”

Respondent 8: "*Monthly meeting, projections are made ahead of time where there will likely be more expenditure (apply for overdraft when the cost is expected to exceed the budget)*."

Respondent 9: "*We plan better for the next season*."

Respondent 10: "*Check to know where the overspending came from*."

Respondent 11: "*Check to see areas they spend less*."

From the verbatim responses provided, we can identify various actions that management takes when costs exceed the budget. Below is an analysis of the findings from each respondent:

Respondent 1: In this case, the responsibility for managing the budget and dealing with any cost overruns lies with the contractor, not the management. The contractor assumes the risk and manages the budget on their own.

Respondent 2: The response here simply states that they never overshoot the budget, without providing specific actions or strategies for achieving this.

Respondent 3: The management checks for areas where cost reduction is possible when costs start to exceed the budget. This suggests that they proactively analyse expenses and identify areas to cut back.

Respondent 4: The bookkeeper closely monitors the budget, and the management takes necessary precautions to ensure that they do not exceed the budget. This implies that they maintain tight financial control and accountability.

Respondent 5: The management takes a conservative approach and looks for ways to save money during times of budgetary constraint. They avoid unnecessary expenses and prioritise only essential expenditures.

Respondent 6: In situations where costs exceed the budget, the management institutes a stop spending policy in some areas. This means that they impose restrictions on further expenses until the budget is back on track.

Respondent 7: The management engages in planning to find ways to reduce costs for the next year. This suggests that they learn from their budgetary challenges and work to implement cost-saving measures for future periods.

Respondent 8: Monthly meetings are held where projections are made to anticipate potential areas of increased expenditure. They take proactive steps, such as applying for an overdraft, to manage costs when they are expected to exceed the budget.

Respondent 9: Learning from the experience of exceeding the budget, the management focuses on better planning and preparation for the next season to avoid similar financial challenges.

Respondent 10: The management conducts a post-mortem analysis to determine the reasons for overspending. By identifying the sources of overspending, they can take corrective actions and prevent similar issues in the future.

Respondent 11: Similarly, the management analyses areas where they have spent less than budgeted. This information can help them understand their spending patterns better and make informed decisions to optimise budget allocation.

Overall, the findings indicate that various approaches are taken by management when costs exceed the budget. These actions include proactive planning, cost reduction measures, close monitoring of expenses, and better preparation for future periods. It is clear that effective budget management and financial control are essential for businesses to navigate budgetary challenges successfully.

5.4 THEMATIC ANALYSIS

The following responses highlight some of the themes that can emerge from the research question one “what is the estimated production cost in commercial farms in the Cape Winelands District, Western Cape?” particularly with regards to the impact of drought on farming operations. These themes collectively provide insights into the various cost implications that commercial farm businesses in the Cape Winelands District, Western Cape, face due to drought. They illustrate the direct costs, reduced crop yields, increased input costs, and infrastructure investments necessary to adapt to water scarcity and its impact on farm operations.

Theme A: Direct Cost Increase Due to Drought

This theme focuses on the direct impact of drought on production cost increases experienced by farmers. Farmers mention the increased expenses they face due to water scarcity during droughts. They may need to invest in additional water sources, such as importing water or drilling boreholes, and purchase equipment to mitigate the effects of water scarcity. These additional costs directly affect the overall production expenses. This perception is capture from the following verbatim:

> "*The cost of irrigation has significantly increased due to water scarcity during droughts. We have to invest in additional water sources and equipment, which adds to our production costs*."

Another participant mentioned that:

> "*Drought forces us to spend more on importing water or drilling boreholes, which is a considerable expense. It directly affects our production cost*."

Another participant elucidated that:

> "*During droughts, we have to invest in measures like water-efficient irrigation systems, which are costly but necessary to maintain productivity. This increases our production expenses*."

The responses from participants underscore the tangible and immediate financial challenges that farmers face when grappling with drought. The direct cost increase due to drought is a pressing concern, impacting the economic viability of agricultural operations. This analysis provides valuable insights for policymakers, researchers, and stakeholders, optimising the need for support and strategies to mitigate the financial burdens imposed by water scarcity in agriculture.

Theme B: Crop Yield Reduction

This theme highlights the negative impact of drought on crop yields. Farmers mention that drought leads to reduced crop yields, resulting in lower revenue. Despite the same production costs, they experience losses due to poor yields. They also note that drought can lead to stunted crop growth, which further affects their productivity and profitability. This perception is captured from the following verbatim:

"*Drought leads to reduced crop yields, which means lower revenue. The cost of production remains the same, but the returns are significantly reduced*."

Another participant mentioned that,

"*Drought affects the quality and quantity of our produce. We face losses due to poor yields, which affects our profitability*."

Another participant elucidated that,

"*With drought, we have to deal with stunted crop growth, which impacts our productivity. It's costly to maintain the farm operations while facing reduced yields*."

Participant responses highlight the detrimental impact of drought on agriculture. Drought conditions lead to reduced crop yields, resulting in lower revenue for farmers. Despite the cost of production remaining consistent, the returns are significantly diminished. Farmers also face challenges related to the quality and quantity of their produce, leading to losses and reduced profitability. Additionally, drought-induced stunted crop growth adds to the overall costs of farm operations while negatively affecting productivity. These responses underscore the economic challenges and financial losses experienced by farmers in the face of drought, optimising the need for strategies to mitigate these adverse effects on agricultural sustainability and profitability.

Theme C: Increased Input Costs

This theme delves into the ongoing rise in expenses incurred by commercial farmers, encompassing factors such as the increasing costs of seeds, fertilizers, pesticides, machinery, and labour, and how these continually rising input costs are affecting the overall economics of farming operations. This perception is capture from the following verbatim:

"*Drought affects the availability and price of inputs like fertilizers and seeds. We end up paying more for these inputs, adding to our production cost*."

Another participant said:

“*We do not plan during drought because of reduced water availability affecting seed germination and crop establishment.”*

This respondent further explained that seeds may fail to germinate or have lower germination rates hence they do not plant at all during drought to avoid purchasing more seeds to replant for reduced yields. Consequently, they opt not to plant anything during drought to avoid potential losses. This cautious approach is understandable, as planting during a drought carries risks, including the possibility of poor crop establishment and reduced yields. However, the respondent also mentioned an alternative strategy – adjusting crop choices. They have the option of favouring drought-resistant varieties or selecting crops that require fewer seeds. However, it was noted that those varieties can be more expensive than the traditional varieties even though they are better suited to water-scarce conditions. This indicates a potential adaptive response to drought conditions, although it appears that this particular respondent prefers to avoid planting altogether during drought to minimise risk.

Another participant elucidated that,

> "*During drought period we pump more water and sometimes the machine breaks and maintenance can be high*."

The respondent further mentioned that during drought, they pump a significant amount of water for irrigation, and this increased demand for water necessitates early and more frequent pumping. As a result, the maintenance costs for machinery rise substantially. The higher workload imposed on the machinery during drought leads to more frequent wear and tear. As a result, maintenance becomes a critical and ongoing task. To ensure the proper functioning of machinery, the maintenance team needs to check and service the equipment more often. This increased frequency of maintenance checks incurs additional costs.

The information provided by the respondents regarding labour costs during drought periods is noteworthy. More than 2 respondents mentioned that, despite the increased production costs and decreased yields associated with drought, their labour costs remain consistent between drought and normal periods. The observation has been attributed to several factors:

- Fixed Labour – consistent number of permanent or salaried workers who are employed year-round, regardless of weather conditions.
- Labour Contracts – agreements that guarantee employment and wages regardless of seasonal variations.

While labour costs remaining the same during drought periods can provide job security for workers, it is essential to recognize that the overall financial burden on the farm may increase due to rising production costs and reduced yields. This can impact the ’arm's profitability and sustainability, highlighting the complex economic dynamics at play in the agricultural sector during challenging weather conditions.

Theme D: Infrastructure Investments

This theme revolves around the infrastructure investments required to cope with drought. Farmers explain that to mitigate the effects of water scarcity they need to invest in infrastructure such as water storage tanks, pipelines, improved drainage systems, and alternative water sources like dams or reservoirs. These investments are necessary to ensure water efficiency and long-term sustainability. However, they also add to the production expenses of the farm businesses. This view is aptly encapsulated in the following comment:

> "*To cope with drought, we have to invest in infrastructure like water storage tanks, pipelines, and improved drainage systems. These investments increase our production costs*."

Another participant elucidated that:

> "*Drought pushes us to invest in alternative water sources like dams or reservoirs, which requires substantial capital investment. It adds to our production expenses*."

Another participant said:

> “*During droughts, we need to upgrade our farm infrastructure to minimize water wastage. This includes investing in water-efficient irrigation systems, which can be costly but necessary for long-term sustainability*.”

Thematic analysis (RQ2)

Based on the research question, “What are the cost implications of drought on commercial farmer’s yielding outputs in the Cape Winelands District, Western Cape?” some themes emerged from the responses of the farmers in the Western Cape provinces of South Africa. These themes represent various aspects and consequences of the cost implications of drought on commercial farmers’ yielding outputs in the Cape Winelands District, Western Cape.

Theme E: Crop Loss and Reduced Yields

This theme indicates that drought significantly affects agricultural productivity by causing crop losses and reducing overall yields. Farmers experience a decline in the quantity and quality of their crops, leading to lower profits and potential food shortages in the region. This view is aptly encapsulated in the following comment:

"*Drought significantly reduces our crop yields, leading to lower profits."*

Another participant elucidated that:

"We experience extensive crop damage due to water scarcity during droughts."

Also:

"The lack of water availability negatively impacts our agricultural productivity."

The overall agricultural productivity suffers due to the lack of water availability. These statements collectively underscore the severe challenges and financial losses experienced by farmers during droughts, highlighting the critical need for effective drought mitigation and water resource management strategies in agriculture.

Theme F: Increased Irrigation Costs

Farmers must invest more in irrigation systems and technologies during droughts to compensate for the lack of water. This theme highlights the additional expenses incurred by farmers to ensure their crops receive adequate water, such as installing or upgrading irrigation infrastructure and implementing water-saving techniques. This view is aptly encapsulated in the following comment:

"To cope with drought, we have to invest heavily in irrigation systems, which adds to our expenses."

Another participant elucidated that:

"During droughts, we incur higher costs for irrigating our fields, affecting our profitability."

Another participant said:

“The need for additional water resources during dry spells increases our irrigation expenses.”

These statements collectively emphasize the critical role of irrigation in mitigating the effects of drought but also highlight the considerable financial strains it places on agricultural businesses. Effective water management and drought adaptation strategies are essential for maintaining the economic viability of farming operations in water-scarce environments.

Theme G: Infrastructure and Equipment Costs

To mitigate the impact of drought, farmers may need to invest in infrastructure and equipment. This can include water storage tanks, pumps, pipelines, or other irrigation systems to manage water resources efficiently. The theme emphasises the additional financial burden placed on farmers due to the need for infrastructure upgrades or new equipment. This view is aptly encapsulated in the following comment:

“To mitigate the impact of drought, we need to invest in infrastructure like water storage tanks or boreholes.”

This was supported by another participant, who said:

“Drought necessitates the purchase of specialized equipment to manage water efficiently.”

Another participant said:

“Maintaining and repairing irrigation systems becomes costly during prolonged drought periods.”

These statements highlight the proactive measures and financial considerations that farmers must undertake to adapt to and endure through drought periods. Such investments are crucial for ensuring the sustainability and resilience of agriculture in water-scarce regions.

Theme H: Financial Instability and Debt:

The theme focuses on the financial challenges faced by farmers during droughts. Reduced yields, increased costs, and potential income losses contribute to financial instability. To

cope with these challenges, farmers may have to rely on borrowing money, accumulating debt, or facing economic hardships. The following are some of the farmers' comment:

> *"Drought increases our financial vulnerability, pushing us into debt to sustain operations."*

In addition:

> *"Borrowing becomes necessary to cover the costs of drought mitigation strategies."*

Another participant said:

> *"We face economic hardships and struggle to manage debts during drought periods."*

Furthermore, one of the respondents mentioned that farmers are shifting away from traditional farming practices and transitioning into bed-and-breakfast (B&B) or alternative ventures. The respondent's statement underscores a concerning trend in the face of ongoing drought challenges. This shift is attributed to the difficulties and financial strains associated with maintaining farming operations during drought periods. This observation highlights the severe economic and sustainability challenges that drought can impose on the agricultural sector. Farmers, in response to prolonged water scarcity and increased production costs, may opt for alternative income-generating activities that appear more viable and less risky. While diversification of income sources can be a reasonable strategy for some, it also points to the potential decline in agricultural activity in drought-affected areas, which can have broader implications for food production and rural economies.

Thematic analysis: RQ3

The subsequent themes provide an overview of the strategies employed by farmers in the Cape Winelands District to mitigate the effects of drought on their operations. Based on the research question, "What are the strategies used by farms in the Cape Winelands District, Western Cape to counter the effects of drought?" the following themes and verbatim responses from 12 farmers in the Western Cape Province of South Africa emerge:

Theme I: Water Conservation and Efficiency

This theme focuses on strategies aimed at optimising water usage and maximising efficiency. The theory of water conservation optimizes the importance of using water

resources wisely to sustain agricultural operations during drought conditions. Techniques such as drip irrigation, rainwater harvesting, and soil moisture monitoring are applied to optimise water usage and minimise waste. The following are some of the farmers' comment:

> "*We've implemented drip irrigation systems to minimise water wastage and ensure efficient water usage*."

This was supported by another participant, who state:

> *'We collect rainwater in large tanks and use it for irrigation during dry periods."*

Another participant said:

> *"We have invested in soil moisture sensors to monitor water levels and irrigate only when necessary."*

These strategies demonstrate the proactive efforts made by farmers to adapt to water scarcity and enhance the sustainability of their agricultural practices. By optimising water use and implementing innovative technologies, farmers aim to mitigate the adverse effects of drought, while maintaining productivity and resource efficiency. Such approaches are essential in building resilience in agriculture and ensuring long-term viability in water-scarce regions.

Theme J: Crop Selection and Rotation

This theme involves selecting and rotating crops based on their water requirements. The theory of crop selection for drought resistance suggests that farmers should choose crop varieties that are better adapted to dry conditions. By diversifying crop choices and rotating between water-intensive and less water-intensive crops, farmers can manage water demands more effectively. The following are some of the farmers' comment:

> *"We have an option to shift towards drought-tolerant crop varieties that require less water."*

Furthermore, this respondent said:

> *"Crop rotation can help reduce water demand by alternating between water-intensive and less water-intensive crops."*

These adaptive approaches underscore the importance of diversifying crop choices and adopting practices that optimise water use in agriculture. By selecting crop varieties suited to local conditions and implementing crop rotation, farmers can better cope with drought challenges while promoting sustainable water management in farming operations.

Theme K: Water Storage and Harvesting

This theme involves strategies for storing and collecting water for use during drought periods. The theory of water storage emphasises the importance of creating reservoirs, dams, or other storage systems to capture and store water during wet seasons. This stored water can then be utilized for irrigation when water availability is limited. The following views were captured:

> *"We have invested in large-scale water storage infrastructure like reservoirs and dams to store water for dry periods."*

Another participant said:

> *"We capture and store runoff water from nearby streams to supplement our irrigation needs."*

The adoption of water management strategies, despite their associated costs, is essential for mitigating the financial impacts of drought and water scarcity in agriculture. These strategies enable farmers to maintain stable water supplies, reduce production losses, and enhance their economic resilience in the face of challenging environmental conditions.

Theme L: Technology and Innovation

This theme focuses on the use of advanced technologies and innovative practices to manage water resources efficiently. The theory of precision agriculture suggests that by utilizing technologies like remote sensing, weather forecasting, and smart irrigation systems, farmers can optimise water usage, monitor crop conditions, and make data-driven decisions to counter the effects of drought. The following views were capture:

> *"We use weather forecasting tools to plan irrigation schedules and make informed decisions about water allocation."*

Another participant said:

“Smart irrigation systems with real-time data monitoring help us optimize water usage and prevent over-irrigation.”

Overall, the integration of advanced technologies and precision agriculture practices in water management not only enhances resource efficiency but also helps mitigate the financial impacts of drought. By optimising water usage, preventing over-irrigation, and maintaining crop health, these practices contribute to cost-effectiveness and improved economic sustainability in agriculture.

Thematic analysis (RQ4)

The research question, "What costing tools are in place to mitigate the financial impact of drought in Cape Winelands District, Western Cape?" has generated several themes that encapsulate diverse strategies and tools adopted by farmers in the Cape Winelands District to manage and control costs in the face of drought effects. These approaches encompass budget control measures, value analysis, cost-benefit analysis, and forecast analysis, all of which enable farmers to optimise resource utilization, make well-informed decisions, and navigate the economic challenges posed by drought in their commercial farming enterprises.

Theme M: budget control tool

The budget control tool refers to the practices and measures implemented by farmers to manage and control their expenses during periods of drought effectively. It involves developing and maintaining a detailed budget that tracks income and expenses, allowing farmers to prioritise essential expenditure and identify areas where costs can be reduced. By implementing budget control measures, farmers aim to ensure financial stability and optimise the allocation of resources during drought conditions. The following incepts were capture:

“We implement strict budgeting measures that allow us to allocate resources effectively during drought periods. This helps us prioritise essential expenses and make informed decisions about where to cut costs.”

Also:

“*We maintain a detailed budget that helps us track expenses and income throughout the year. This way, we can identify areas where we need to cut costs during drought periods and ensure that we stay financially stable.”*

Another participant said:

> *“We utilize budget control tools such as financial software that helps us monitor our expenses and revenues in real-time. This allows us to identify areas of overspending and take immediate action to mitigate the impact of drought on our finances.”*

The participants' responses highlight the importance of strict budgeting measures in managing the financial impact of drought on their farming operations. Farmers employ detailed budgeting practices and utilize tools such as financial software to allocate resources effectively, track expenses and income, and identify areas where cost-cutting is necessary during drought periods. These budget control measures enable them to make informed decisions, prioritise essential expenses, and maintain financial stability in the face of drought-related challenges.

Theme N: Value analysis tool

The value analysis tool systematically assesses the value chain within the farm operations. It examines the costs and benefits associated with different inputs, processes, and outputs. By analysing the value chain, farmers can identify areas where costs can be reduced without compromising the overall value of their products. This tool helps farmers optimize resource utilization, improve efficiency, and make informed decisions about cost management during drought periods. This view is summarized in the following comment:

> *“We conduct regular value analysis to identify areas where we can reduce expenses without compromising the quality of our produce. This helps us optimise our resources and maximize the value we get from each input.”*

Also:

> *“We regularly assess the value of each input and operation on our farm. This analysis helps us identify areas where we can reduce costs without compromising the overall value we deliver to our customers.”*

In addition:

> "*We regularly assess the value chain of our farming operations. This includes analysing the cost and quality of inputs, processes, and outputs. By optimising the*

value chain, we can reduce costs without compromising the overall value of our products."

Theme O: Cost benefit analysis

Cost benefit analysis is a method used by farmers to evaluate the economic viability of potential investments or strategies aimed at mitigating the impact of drought. It involves comparing the costs associated with implementing these measures against the expected benefits they would provide. By conducting a cost benefit analysis, farmers can make informed decisions about which drought mitigation strategies are most effective and economically feasible. This analysis helps prioritise investments that offer the highest return on investment, considering the specific context of the Cape Winelands District. This view is summarized in the following comment:

"We perform cost benefit analyses for various drought mitigation strategies. By weighing the potential costs against the expected benefits, we can make informed choices about which measures to invest in and which to avoid."

In addition:

"Before implementing any new strategies or technologies, we conduct a thorough cost benefit analysis. This ensures that we make economically sound decisions and only invest in measures that are likely to have a positive return on investment, even during drought conditions."

Also:

"We conduct rigorous cost-benefit analyses for potential investments in drought-resistant crops, water-saving technologies, and irrigation systems. This helps us determine the economic viability of such investments and make informed decisions regarding their implementation."

Theme P: Forecast analysis

The participants confirmed that they increase their forecasting activities, especially during droughts, because of the fluctuating costs involved. Those who use forecast analysis tools stated that the ease of monitoring and user-friendly nature of these tools are the main factors influencing their adoption. In the field of accounting, forecasting refers to predicting

future financial outcomes based on historical data, trends, and relevant information. Farmers use forecasting techniques to make informed decisions about their agricultural operations. They employ Crop Yield Forecasting to estimate crop yields, allowing them to plan production levels and allocate resources effectively. Farmers also use Price Forecasting to monitor and predict commodity prices, helping them determine the best time to sell their products. Cost forecasting is used to estimate expenses associated with farming operations, allowing farmers to plan budgets and assess profitability. Cash flow forecasting helps farmers manage ongoing expenses, investments, loan repayments, and other financial obligations by anticipating periods of surplus or shortage."

> *"We rely on forecasting techniques to make smarter decisions for our farming operations. Crop Yield Forecasting helps us estimate how much we can expect to harvest, which guides our resource allocation and planning' It's crucial for optimising our farming activities."*

Also:

> *"Price Forecasting is a game-changer for us. By closely monitoring market trends and predicting commodity prices, we can strategically time the sale of our crops. It helps us maximize our revenue and minimize risks associated with unpredictable price fluctuations."*

Additionally:

> *"Cost forecasting is an essential tool in our financial planning. By estimating the expenses involved in our farming operations, we can create budgets and assess the profitability of our ventures. It allows us to identify areas where we can reduce costs and allocate our resources wisely."*

Another participant mentioned that:

> *"Cash flow forecasting is a lifeline for us. It helps us manage our day-to-day expenses, investments, and loan repayments. By forecasting cash inflows and outflows, we can prepare for periods of surplus or shortage, ensuring the financial stability of our farming business."*

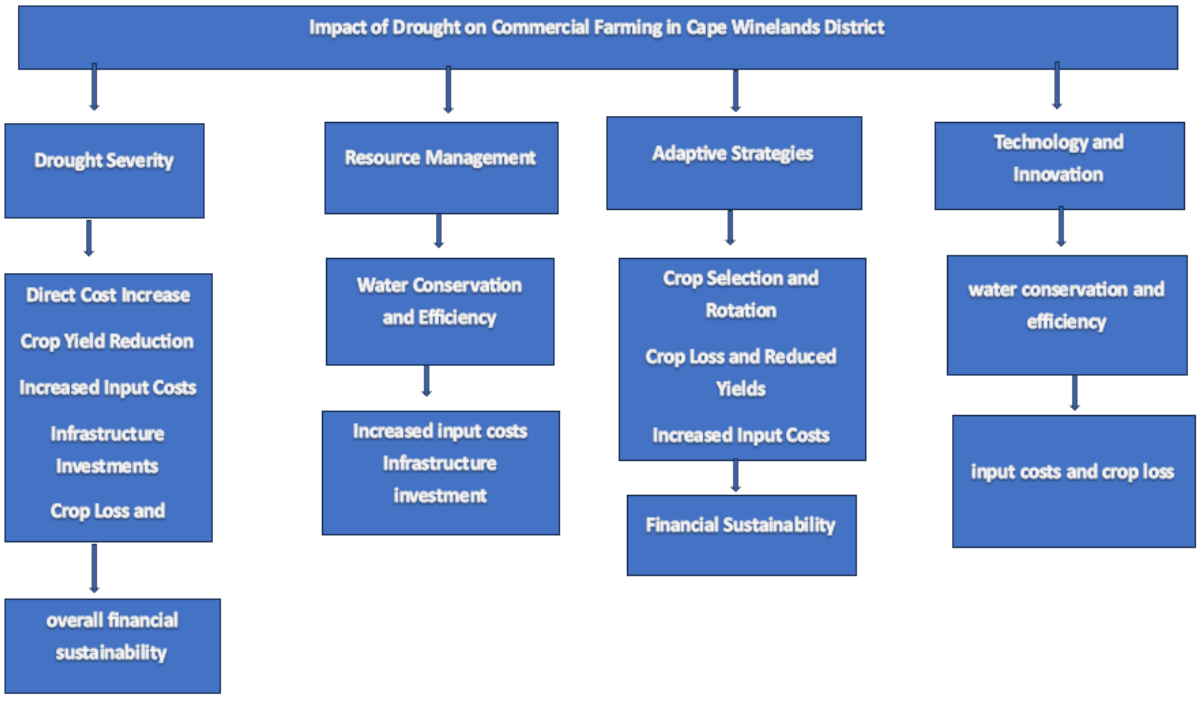
Theme Q: Efficiency of costing tools

During drought periods, farmers find themselves in a challenging financial predicament, and while some may exceed their budgets out of necessity, others successfully adhere to their financial plans. For those who exceed their budgets, the decision is often driven by the immediate needs posed by water scarcity; they are compelled to take action to secure water sources and maintain their crops. It is a testament to their dedication and resilience in the face of adversity. Conversely, some farmers benefit from arrangements where contractors handle their budgeting, alleviating them from the stresses of financial planning during drought. This arrangement provides a sense of financial security and allows them to focus on farming activities without the added burden of budget management.

Throughout these trials, one common thread among farmers is their unwavering commitment to product quality. Regardless of financial constraints or budget considerations, they prioritise delivering top-quality produce to the market. This dedication underscores their professionalism and determination to uphold the reputation of their agricultural products, even in the face of challenging conditions.

The farmers adopt various financial strategies during drought, including both exceeding budgets and relying on contractors for budget management. Regardless of their approach,

Conceptual Conclusion: Impact of Drought on Commercial Farming in Cape Winelands District



their commitment to maintaining the quality of their products remains steadfast, reflecting their resilience and dedication to their craft.

Figure 5.7: Conceptual Conclusion – Impact of drought on commercial farming in Cape Winelands District

A conceptual conclusion was developed to enable a better understanding of the complex cost effects of drought on commercial farmers (see Figure 5.7). The financial sustainability of commercial farms during droughts is a complex interplay of several key factors. Drought severity plays a central role, directly and indirectly affecting various aspects of farm operations. It impacts crop yield, financial stability, and infrastructure investments. However, the impact of drought severity is not uniform across all farms, as farm characteristics act as moderators, influencing the relationship between severity and these outcomes.

Resource management practices also come into play, affecting water conservation and efficiency, which subsequently influence input costs and infrastructure investments. Adaptive strategies are vital, influencing crop selection, rotation, crop loss, and input costs, ultimately shaping financial sustainability during droughts. Additionally, technology and innovation can enhance water conservation and efficiency, further impacting input costs and crop loss.

In summary, the financial sustainability of commercial farming during drought is a result of the intricate interplay between drought severity, farm characteristics, resource management, adaptive strategies, technology, and mediating variables. To effectively mitigate the impact of drought on financial sustainability, it is essential for farms to utilize tools and practices related to water conservation, budget control, value analysis, cost-benefit analysis, forecast analysis, and costing efficiency.

5.5 CONCLUSION

The thematic analysis conducted in this chapter shed light on the cost implications of drought on commercial farms in the Cape Winelands District, Western Cape. The identified themes collectively provided valuable insights into the various challenges faced by farmers in the region due to water scarcity and its impact on farm operations. The first set of themes, including Theme A, B, C, and D, highlighted the direct cost increase due to drought, crop yield reduction, increased input costs, and infrastructure investments necessary to cope with water scarcity. These themes emphasized the financial burden placed on farmers,

resulting from additional expenses such as acquiring alternative water sources, mitigating the effects of poor yields, and investing in infrastructure and equipment.

Furthermore, the analysis explored the strategies employed by farmers to mitigate the effects of drought on their operations. Themes I, J, K, L, and M demonstrates the various approaches adopted by farmers in the Cape Winelands District, including water conservation and efficiency techniques, crop selection and rotation, soil management and conservation practices, water storage and harvesting strategies, and the use of technology and innovation. These strategies aim to optimise water usage, preserve soil moisture, and utilize advanced technologies to counter the effects of drought effectively.

Lastly, the analysis delved into costing tools and approaches utilized by farmers to manage costs during drought periods. Themes N, O, P, and Q emphasized the importance of budget control measures, value analysis, cost-benefit analysis, and forecast analysis. These tools helped farmers in the Cape Winelands District optimise resource allocation, make informed decisions, and mitigate the financial impact of drought on their commercial farm businesses.

Overall, this chapter provided a comprehensive understanding of the cost implications of drought on commercial farms in the Cape Winelands District. The identified themes and insights derived from farmers' responses contribute to the existing knowledge on the challenges faced by farmers in water-scarce regions and highlight potential strategies and costing tools that can be employed to mitigate these challenges. This knowledge can inform policymakers, agricultural practitioners, and researchers in developing effective measures to support the resilience and sustainability of commercial farming in the face of drought.

CHAPTER 6
CONCLUSION, RECOMMENDATIONS, LIMITATIONS AND FUTURE RESEARCH AVENUES

6.1 INTRODUCTION

The analysis, discussion and interpretation of the findings was presented in the previous chapter. The steps to collect and analyse data have been identified. The information was analyzed and summarized using thematic analysis. This chapter provides a general overview of the study by putting the objectives in context. The study aimed to gain a comprehensive understanding of the financial ramifications that drought imposes on the operational aspects of commercial farmers in the Cape Winelands District of the Western Cape. Through thematic analysis and examination of the responses provided by the farmers, valuable insights were obtained, shedding light on the challenges faced by farmers in the region due to water scarcity and its impact on farm operations.

The findings from the responses to the research questions provided a diverse range of strategies used by farmers to ensure cost-effective production. Different farms or individuals adopted unique approaches based on their circumstances and goals. Some farmers emphasized cost-cutting measures, such as optimising labour usage, mechanisation, and efficient planning, while others focused on doing things right from the beginning to avoid excessive spending later. Understanding these strategies is crucial for both farmers and policymakers to develop targeted solutions to tackle water scarcity and rising costs effectively.

Moreover, when costs exceeded the budget, farmers adopted various actions to manage the financial constraints. Proactive planning, cost reduction measures, close monitoring of expenses, and better preparation for future periods were among the approaches taken by management to navigate budgetary challenges successfully. These actions underscore the importance of effective budget management and financial control to withstand the impact of drought and ensure the sustainability of agricultural operations.

Furthermore, the study identified several costing tools in place to control costs and cope with the effects of drought in the Cape Winelands District. These tools included cost-benefit analysis, value analysis, budgetary control, actual vs forecast analysis, and the use of probes to measure water levels in the blocks. By utilizing these tools, farmers were better

equipped to monitor and optimise expenditure, thereby mitigating the financial impact of water scarcity on their businesses.

In conclusion, the findings from this study contribute to the existing knowledge on the challenges faced by commercial farmers in water-scarce regions and provide insights into potential strategies and costing tools that can be employed to address these challenges effectively. The information gathered can assist policymakers, agricultural practitioners, and researchers in formulating targeted measures and support systems to bolster the resilience of farmers in the face of drought and rising production costs. Based on the theory and the empirical study, recommendations are made to relevant key actors. It concludes with the limitations and implications for future research.

6.2 OVERVIEW OF THE STUDY

It is important to draw on the contributions from the studies in the previous five chapters to formulate relevant suggestions and a conclusion. The main research question (Section 1.1.2) and a discussion of the primary objective in (Section 1.1.1) were revisited to determine if they were met. The primary purpose of Chapter 1 was to lay out the background of the study, problem statement, formulate research objectives and outline research methods. The introduction and theoretical and practical scoping of the problem were also presented in Chapter 1 under Section 1.3. The research questions and objectives formulated in Chapter 1 under Section 1.1.1 were used in structuring Chapter 2 (literature review).

Chapter 2 presented a comprehensive understanding of various elements, including defining concepts, providing a concise context and description of terms, introducing both the conceptual and theory frameworks. The primary objectives of this chapter were as follows:

- To elucidate the meanings and explanations of the terminologies used throughout the research, facilitating better comprehension for the readers.
- To establish a clear research path and provide a solid foundation for the study.
- To outline the research boundaries and offer readers insights into the scope of the study.
- To enhance the significance and acceptance of the research findings within the theoretical constructs of the field, thus ensuring their applicability and generalizability.

Chapter 3 of the research was titled "Cape Winelands District Commercial Farms and Western Cape Water Crisis." This chapter aimed to provide a comprehensive literature review on the cost effects of drought on the operations of commercial farms and the ongoing water crisis in the Western Cape. The literature review played a crucial role in setting the context for the research by identifying its position within the existing body of knowledge. It also presented the findings of related studies that were closely linked to the current research. By doing so, the literature review filled gaps in the ongoing dialogue and extended previous research efforts.

In this chapter, various sections were dedicated to exploring different aspects of the subject matter. Section 3.2 delved into the background of the Cape Winelands District in the Western Cape, while section 3.3 provided an overview of South African farming. Section 3.4 focused on shedding light on commercial farming, and section 3.5 offered an overview of agricultural drought specifically in South Africa. The Western Cape water crisis, which is a critical factor in this context, was discussed in detail in section 3.6.

The chapter continued by examining the cost and effects of drought on the economy in section 3.7, followed by an in-depth analysis of the cost effects on commercial farm production in section 3.8. Furthermore, the impact of drought on employment in commercial farms was thoroughly explored in section 3.9. Sections 3.10, 3.11, and 3.12 focused on the far-reaching consequences of agricultural drought on poverty, environment, food security, and their interconnections. Finally, section 3.13 centered on proposing and discussing various mitigation strategies for agricultural drought in the context of commercial farming.

By encompassing a wide array of interconnected topics, this chapter successfully laid the groundwork for the subsequent research, providing valuable insights and knowledge essential for understanding the challenges posed by drought and water scarcity in the Cape Winelands District and the broader Western Cape region.

Chapter 4 of the study outlined the research methodology employed in the research. The study embraced a constructivism paradigm, acknowledging that knowledge is socially constructed and shaped by individuals' experiences and interactions (section 4.2). To achieve its objectives, the research adopted an inductive research approach, allowing for the generation of new insights and theories based on the data collected (section 4.3). The chosen research design was qualitative and descriptive, enabling a detailed exploration and understanding of the participants' perspectives and experiences (Section 4.4.4).

The target population for the study was limited to commercial farms within the Western Cape's Cape Winelands District. The sampling frame consisted of registered commercial farmers in the specified region, who were considered as potential participants. To gather data, the researcher conducted interviews with the selected farmers, aiming to gain valuable insights into their experiences and perspectives on the effects of drought and the water crisis.

Thematic analysis was applied to the data collected from the interviews. This involved an initial coding process to identify patterns, recurring ideas, and significant statements. Subsequently, themes were generated and grouped to provide a comprehensive and coherent understanding of the research topic.

Ensuring the quality and rigor of the data was of paramount importance. The last sections of the methodology chapter discussed the strategies employed to achieve this. By using a well-defined research approach and adhering to the principles of qualitative research, the study aimed to enhance the credibility and dependability of its findings. Additionally, ethical considerations were addressed to safeguard the rights and privacy of the participants, maintaining the highest standards of research ethics throughout the study. By employing this robust methodology, the research aimed to produce valuable and reliable insights into the impact of drought and the water crisis on commercial farming in the Cape Winelands District, Western Cape.

Chapter 5 reported on the data analysis and the results. The thematic analysis (Section 5.4) conducted in this chapter shed light on the cost implications of drought on commercial farms in the Cape Winelands District, Western Cape. Chapter 5 presented the results of the data analysis conducted using thematic analysis, focusing on the cost implications of drought on commercial farms in the Cape Winelands District. The analysis identified several themes that shed light on the challenges faced by farmers due to water scarcity and its impact on farm operations. Themes A to D highlighted the direct cost increase, crop yield reduction, increased input costs, and infrastructure investments needed to cope with water scarcity. Themes I to M explored farmers' strategies to mitigate drought effects, such as water conservation techniques and technology adoption. Themes N to Q delved into costing tools utilized by farmers, like budget control and cost-benefit analysis. This comprehensive understanding of the cost implications and the identified strategies and costing tools can aid policymakers, practitioners, and researchers in supporting the resilience and sustainability of commercial farming amid drought challenges in water-scarce regions.

6.3 THE EVALUATION OF THE RESEARCH OBJECTIVES OF THE STUDY

In Chapter 5, Section 5.3, the researcher addressed and achieved the objectives/questions stated in Section 1.1.2 through an analysis of the responses obtained from the research questions posed to commercial farmers in the Cape Winelands District, Western Cape.

Objective 1: To assess the production cost effects of drought on commercial farms in the Cape Winelands District, Western Cape.

The researcher achieved this objective by analysing the responses from the farmers, particularly in Research Question 5.3.1. The responses revealed various strategies employed by farmers to ensure cost-effective production. Some farmers mentioned minimising labour costs, while others focused on efficient practices from the beginning of their operations. These insights shed light on how drought affects production costs and how farmers adapt to mitigate its impact.

Objective 2: To assess the significance of drought on commercial farmers' yielding outputs in the Cape Winelands District, Western Cape.

This objective was met through the examination of the responses in Research Question 5.3.2. Responses indicated that when costs exceed the budget due to drought or other factors, farmers take various actions to manage the situation. These actions include analysing areas for cost reduction, planning for the future, and closely monitoring expenses. The insights provided by the farmers' responses give a clear picture of the challenges posed by drought on farmers' yields and the strategies they employ to cope with such challenges.

Objective 3: To evaluate the strategies and costing tools used by commercial farmers in the Cape Winelands District, Western Cape, to counter the effects of drought.

This objective was achieved through the analysis of the responses in Research Question 5.3.3. and 5.3.4. As mentioned in the first chapter 1.5., this objective was achieved by two research questions RQ3 and RQ4. The responses highlighted the costing tools used by farmers to control costs amid the effects of drought. Cost-benefit analysis, value analysis, budgetary control, and actual vs. forecast analysis were among the tools mentioned. These tools enable farmers to make informed decisions, optimise resource allocation, and maintain financial discipline during periods of drought.

In conclusion, Chapter 5, Section 5.3 of this research report successfully addressed each objective stated in Section 1.1.2. The responses obtained from the research questions provided valuable insights into the strategies employed by farmers to cope with the effects

of drought on production costs and yielding outputs. Additionally, the study shed light on the costing tools utilized by farmers to manage expenses effectively. Overall, the researcher effectively achieved the objectives and provided a comprehensive analysis of the impact of drought on commercial farms in the Cape Winelands District, Western Cape.

6.4 CONTRIBUTION OF THE STUDY

This study significantly contributes to empirical research and policy formulation within management accounting and agribusiness, particularly focusing on water-scarce regions like the Cape Winelands District in the Western Cape. By employing thematic analysis, the research provides an in-depth exploration of the financial impacts of drought on commercial farms, detailing the challenges farmers face and the strategies they use to mitigate these challenges. This empirical approach enriches the existing literature by offering nuanced, context-specific insights into agricultural resilience, and documenting diverse cost-effective production strategies such as optimizing labor usage and efficient planning. These findings serve as a valuable resource for researchers investigating similar issues in different contexts, enhancing the empirical discourse on financial management in agriculture under adverse conditions.

From a policy perspective, the study's findings offer actionable recommendations to enhance the resilience of commercial farms in water-scarce regions. Policymakers can use these insights to design comprehensive water management policies that promote sustainable water use in agriculture, including the adoption of water-efficient technologies and conservation practices. The study emphasizes the need for financial support and incentives, such as grants and low-interest loans, to encourage the implementation of drought-resilient strategies. Additionally, it advocates for strengthening research and extension services to disseminate knowledge on water-saving practices and sustainable farming methods, fostering collaboration between farmers, agricultural organizations, and research institutions to enhance the adoption of effective strategies.

Furthermore, the research highlights the importance of developing climate-resilient crop varieties and promoting sustainable land management practices. By prioritizing the development of drought-tolerant crops and encouraging soil conservation techniques, policymakers can support long-term agricultural sustainability. The study's comprehensive analysis and actionable recommendations bridge the gap between theoretical insights and practical applications, providing valuable resources

for scholars, practitioners, and policymakers aiming to enhance the resilience and sustainability of commercial farming in water-scarce regions.

6.5 RECOMMENDATIONS

Based on the conclusions drawn from the thematic analysis in this study, several recommendations can be made to relevant stakeholders, including policymakers, agricultural practitioners, and researchers, to address the challenges posed by drought and support the sustainability of commercial farms in the Cape Winelands District, Western Cape:

Implement Water Management Policies: Policymakers should develop and implement comprehensive water management policies that prioritise sustainable water use in agriculture. These policies should encourage the adoption of water-efficient technologies, promote water conservation practices, and incentivize the use of alternative water sources, such as rainwater harvesting and water recycling systems. By creating a conducive regulatory environment, policymakers can help farmers cope with water scarcity more effectively. These measures help farmers manage their costs effectively, reduce their reliance on expensive external water supplies, and enhance the economic resilience of the agricultural sector in regions prone to water scarcity.

Provide Financial Support and Incentives: Given the financial burden faced by farmers due to the cost implications of drought, financial support and incentives should be provided to encourage the adoption of water-saving practices and the implementation of drought-resilient strategies. This could include grants, low-interest loans, and subsidies for investments in water-efficient infrastructure and technology.

Promote Research and Extension Services: Researchers should focus on further investigating innovative strategies and technologies that can enhance drought resilience in agriculture. Extension services should be strengthened to disseminate this knowledge and provide training to farmers on the practical implementation of water-saving practices and sustainable farming methods. Aligning research efforts with practical extension services enhances the adoption of cost-effective, drought-resilient practices in agriculture. This synergy between research, knowledge dissemination, and on-farm implementation can help farmers optimise resource usage, reduce production costs, and build resilience to the financial impacts of drought.

Foster Collaboration and Knowledge Exchange: Collaboration between farmers, agricultural organizations, and research institutions is vital for knowledge exchange and sharing best practices. Establishing platforms for farmers to share their experiences and successes in coping with drought can facilitate peer learning and promote the adoption of effective strategies. Collaborative efforts and knowledge sharing among stakeholders in agriculture promote cost-effective practices for drought management. By leveraging each other's experiences and research insights, farmers and organizations can optimise resource utilization and reduce the financial impact of drought on agricultural operations.

Develop Climate-Resilient Crop Varieties: Agricultural practitioners and researchers should prioritise the development of crop varieties that are more resilient to water scarcity and can maintain productivity under drought conditions. Breeding programmes should focus on identifying and developing drought-tolerant crops suitable for the Cape Winelands District's climate.

Increase Awareness and Education: Raising awareness among farmers about the potential impact of drought on their operations and the available tools and strategies for cost management is crucial. Workshops, seminars, and training sessions can be organized to educate farmers about the importance of financial planning, budget control, and the use of costing tools.

Encourage Sustainable Land Management Practices: Adopting soil conservation and sustainable land management practices can help retain soil moisture, reduce water runoff, and enhance overall farm resilience. Training programs and incentives should be provided to encourage farmers to implement these practices.

Facilitate Technology Adoption: Policymakers and agricultural organizations should facilitate the adoption of technology and innovative tools that improve water efficiency, such as smart irrigation systems, soil moisture sensors, and precision farming techniques. Providing support and training for farmers to adopt and use these technologies effectively will contribute to better water management.

By incorporating these recommendations into their policies, practices, and research efforts, relevant stakeholders can contribute to the resilience and sustainability of commercial farms in the Cape Winelands District, Western Cape, and mitigate the adverse effects of drought on the agricultural sector. While some recommendations may extend beyond the specific focus of a study, it remains crucial for researchers in their respective fields to explore a wide

range of potential solutions and strategies. Even if certain recommendations do not align directly with the primary objectives of a study, they can still provide valuable insights and directions for future research and practical implementation. Cross-disciplinary collaboration and a holistic approach to addressing challenges, such as drought in agriculture, often yield the most innovative and effective solutions. Therefore, researchers should remain open to investigating diverse avenues to advance knowledge and benefit stakeholders in the agricultural sector.

6.6 LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

To ensure the credibility and dependability of the findings, it is imperative to acknowledge the constraints of this study. One notable limitation was the restricted sample size of respondents. A more extensive and diverse participant pool could offer a more comprehensive understanding of the effects of drought with regards to the cost implications and operations of commercial farms in Cape Winelands District, Western Cape. Moreover, the data collected in this study relied on self-reported responses from farmers, potentially introducing response bias. To enhance the study's robustness, future investigations could incorporate objective measures alongside self-reported data. Another limitation stems from the study's narrow focus on the Cape Winelands District in the Western Cape, which might limit the generalizability of the results to other regions with varying agricultural characteristics and water availability challenges. To build upon the insights gained and further contribute to understanding the financial implications of drought on commercial farmers, future research should consider exploring the following areas:

Longitudinal studies: Conducting longitudinal studies would offer a deeper understanding of the long-term financial impact of drought on commercial farmers. Tracking financial trends over several years can unveil patterns and trends that may not be apparent in cross-sectional studies.

Comparative studies: Comparative studies across different regions or countries facing similar water scarcity challenges could yield valuable insights into the effectiveness of various strategies and costing tools used by farmers.

Climate change and agricultural impact: Investigating the link between climate change and its influence on agriculture, as well as exploring adaptive strategies employed by farmers, can provide comprehensive insights into the challenges posed by changing climatic conditions.

Policy analysis: Analysing existing policies and regulations related to water management and agricultural practices can identify areas for improvement and highlight best practices that can be adopted in other regions.

By addressing these limitations and pursuing new avenues of research, scholars and policymakers can collaborate to develop sustainable and effective strategies that support commercial farmers in water-scarce regions. This collaborative effort will contribute to the resilience and prosperity of the agricultural sector in the face of drought and other climate-related challenges.

6.7 CONCLUSION

Addressing the critical factors negatively affecting farmers is of utmost importance to enhance their performance and foster a favourable business environment. This research significantly contributes to the academic fields of management accounting and agribusiness by deepening an understanding of the repercussions of drought on the cost implications and operations of commercial farms in the Cape Winelands District, Western Cape. This study brings about valuable theoretical implications for scholars, shedding light on the specific challenges faced by farmers due to water scarcity and its impact on their financial management. For practitioners in the agricultural sector, this research offers valuable insights and potential pathways to improve entrepreneurial ventures. By understanding the cost implications of drought and implementing the strategies and costing tools identified in this study, farmers can enhance their financial resilience and work towards alleviating household poverty. The findings of this research function as a guide for farmers to adopt water-saving practices, invest in drought-resilient infrastructure, and make informed financial decisions.

Additionally, this study has significant policy implications. Policymakers can use the findings to update existing policies and design new measures that support the entrepreneurial performance of commercial farm businesses. By aligning policies with the challenges and opportunities identified in this research, governments and relevant institutions can create an enabling environment for sustainable agricultural practices, particularly in the face of water scarcity. Furthermore, this research contributes to the body of knowledge in management accounting and agribusiness literature, particularly within the African context. The study brings attention to a research context that has been under-researched and overlooked in academia. By exploring the effects of drought on commercial farms in the

Cape Winelands District, this study fills a gap in the existing literature and opens avenues for further research in similar regions facing water-related challenges.

In conclusion, this research provides theoretical, practical, and policy implications that can lead to tangible improvements in the performance of commercial farms and the overall agricultural sector in the Cape Winelands District and similar regions. By addressing the impact of drought on farmers' cost management and operations, this study offers valuable insights that can pave the way for more resilient, sustainable, and prosperous agricultural practices in water-scarce regions.

REFERENCES

About Mechanics. 2023. What Is Crop Farming? (with pictures). [online] Available at: https://www.aboutmechanics.com/what-is-crop-farming.htm#google_vignette [Accessed 10 September 2023].

Adeoye-Olatunde, O.A. and Olenik, N.L. 2021. Research and scholarly methods: Semi-structured interviews. *Journal of the American College of Clinical Pharmacy,* 4(10):1358-1367.

Adom, D., Hussein, E.K. and Agyem, J.A. 2018. Theoretical and conceptual framework: Mandatory ingredients of a quality research. *International Journal of Scientific Research,* 7(1):438-441.

Afriansyah, E.A., Puspitasari, N., Luritawaty, I.P., Mardiani, D. and Sundayana, R. 2019, December. The analysis of mathematics with ATLAS. ti. In Journal of Physics: Conference Series (Vol. 1402, No. 7, p. 077097). IOP Publishing.

Agustini, M.Y.D.H. 2018. Survey by knocking the door and response rate enhancement technique in international business research. *Problems and Perspectives in Management,* 16(2), pp.155-163.

Almasi, H. and Tavakkoli, J. 2019. The effectiveness of drought risk management strategies in western Iran. *International Journal of Disaster Risk Reduction,* 40, p.101159. Available at: doi:https://doi.org/10.1016/j.ijdrr.2019.101159 [Accessed 3 May 2020].

Al-Khanbashi, M. 2020. Using the matrix as a qualitative data display for landscape research and a reflection based on the social constructivist perspective. *Modern approaches to the visualization of landscapes,* pp.103-118.

Alase, A. 2017. The interpretative phenomenological analysis (IPA): A guide to a good qualitative research approach. *International Journal of Education and Literacy Studies,* 5(2), pp.9-19.

Anon. 2023. Thematic Analysis: Definition, Process and Benefits II Thematic analysis advantages and disadvantages | Koshal Research Support. [online] Available at: https://www.kressup.com/thematic-analysis-definition-process-benefits.html [Accessed 10

Sep. 2023].

Antwi-Boampong, A. 2020. Towards a faculty blended learning adoption model for higher education. *Education and Information Technologies,* 25(3), pp.1639-1662.

Anguera, M.T., Blanco-Villaseñor, A., Losada, J.L., Sánchez-Algarra, P. and Onwuegbuzie, A.J. 2018. Revisiting the difference between mixed methods and multimethods: Is it all in the name? *Quality & Quantity*, 52, pp.2757-2770.

Araujo, J., Abiodun, B. and Crespo, O. 2014. Impacts of drought on grape yields in Western Cape, South Africa. *Theoretical and Applied Climatology,* 123(1-2), pp.117-130.

Arora, N.K. 2019. Impact of climate change on agriculture production and its sustainable solutions. *Environmental Sustainability,* 2(2), pp.95-96.

Aye, W.N., Wen, Y., Marin, K., Thapa, S. and Tun, A.W. 2019. Contribution of mangrove forest to the livelihood of local communities in Ayeyarwaddy region, Myanmar. *Forests,* 10(5), pp.414.

Azungah, T. 2018. Qualitative research: Deductive and Inductive Approaches to Data Analysis. *Qualitative Research Journal,* [online] 18(4), pp.383–400. Available at: doi:https://doi.org/10.1108/QRJ-D-18-00035 [Accessed 3 June 2020].

Badu, J., & Dubihlela, J. 2024. The Effect of Recurrent Deficiencies in PCAOB Inspections on Audit Quality within the Big Four Audit Firms in South Africa. *Dinasti International Journal of Economics, Finance &Amp; Accounting*, *4*(6), 690–704. https://doi.org/10.38035/dijefa.v4i6.2118

Baudoin, M.-A., Vogel, C., Nortje, K. and Naik, M. 2017. Living with drought in South Africa: lessons learnt from the recent El Niño drought period. *International Journal of Disaster Risk Reduction,* 23, pp.128–137. Available at: doi:https://doi.org/10.1016/j.ijdrr.2017.05.005 [Accessed 3 June 2020].

Beckman, J. and Countryman, A.M. 2021. The importance of agriculture in the economy: impacts from COVID-19. *American Journal of Agricultural Economics,* 103(5):1595-1611.

Begna, T. 2023. Impact of drought stress on crop production and its management options. *Asian J Plant Sci Res,* 13(7):90.

Beins, B. 2019. *Research methods: a tool for life.* Cambridge, United Kingdom; New York, Ny: Cambridge University Press.

Bekele, W.B. and Ago, F.Y. 2022. Sample size for interview in qualitative research in social sciences: A guide to novice researchers. *Research in Educational Policy and Management,* 4(1), pp.42-50.

Bernstein, H. 2013. Commercial Agriculture in South Africa since 1994: 'Natural, Simply Capitalism'. *Journal of Agrarian Change,* 13(1), pp.23-46.

Bhardwaj, P. 2019. Types of sampling in research. *Journal of Primary Care Specialties,* 5(3), pp.157-163.

Bianchi, L. 2021. Exploring ways of defining the relationship between research philosophy and research practice.

Botai, C., Botai, J., Dlamini, L., Zwane, N. and Phaduli, E. 2016. Characteristics of Droughts in South Africa: A Case Study of Free State and North West Provinces. *Water,* 8(10), pp.439.

Botai, C.M., Botai, J.O., De Wit, J.P., Ncongwane, K.P. and Adeola, A.M. 2017. Drought Characteristics over the Western Cape Province, South Africa. *Water,* [online] 9(11), pp.876. Available at: https://www.mdpi.com/2073-4441/9/11/876/htm [Accessed 18 Mar. 2020].

Botzen, W.W., Deschenes, O. and Sanders, M. 2019. The economic impacts of natural disasters: A review of models and empirical studies. *Review of Environmental Economics and Policy.*

Booyens, I. 2020. Tourism innovation in the Western Cape, South Africa: Evidence from wine tourism. New directions in South African tourism geographies, pp.183-202.

Bureau for Food and Agricultural Policy. 2018. Agricultural outlook 2018 - 2027.

Bhunia, P., Das, P. and Maiti, R. 2020. Meteorological drought study through SPI in three drought prone districts of West Bengal, India. *Earth Systems and Environment,* 4(1), pp.43-

55.

Braun, V. and Clarke, V., 2022. Conceptual and design thinking for thematic analysis. *Qualitative Psychology,* 9(1), p.3.

Cao, J., Zhu, L., Han, H. and Zhu, X. 2018. *Modern emergency management.* Singapore: Springer Singapore.

Carrão, H., Naumann, G. and Barbosa, P. 2016. Mapping global patterns of drought risk: An empirical framework based on sub-national estimates of hazard, exposure and vulnerability. *Global Environmental Change,* 39, pp.108–124. Available at: doi:https://doi.org/10.1016/j.gloenvcha.2016.04.012 [Accessed 9 Sep. 2020].

Castleberry, A. and Nolen, A. 2018. Thematic analysis of qualitative research data: Is it as easy as it sounds? *Currents in Pharmacy Teaching and Learning,* [online] 10(6), 807–815. Available at: doi:https://doi.org/10.1016/j.cptl.2018.03.019 [Accessed 3 Sep. 2020].

Cheteni, P. and Mokhele, X. 2019. Small-scale livestock farmers' participation in markets: Evidence from the land reform beneficiaries in the central Karoo, Western Cape, South Africa. *South African Journal of Agricultural Extension,* 47(1), pp.118-136.

Chu, H. and Ke, Q. 2017. Research methods: What's in the name? *Library & Information Science Research,* 39(4), pp.284-294.

Clancy, L. 2019. Study limitations - International Science Editing examples. [online] International Science Editing. Available at: https://www.internationalscienceediting.com/study-limitations/ [Accessed 10 May 2021].

Clark, V.L.P. and Ivankova, N.V. 2015. Mixed methods research: A guide to the field (Vol. 3). Sage publications.

Coetzee, C. and Van Niekerk, D. 2018. Should all disaster risks be reduced? A perspective from the systems concept of the edge of chaos. Environmental Hazards, 17(5), pp.470–481. Available at: doi:https://doi.org/10.1080/17477891.2018.1463912 [Accessed 3 Sep. 2020].

Connelly, L.M. 2013. 'Demographic data in research studies.' *MedSurg Nursing,* 22(4):269+, Available at: https://link.gale.com/apps/doc/A341687270/AONE?u=capetech&sid=googleScholar&xid=bf75eb99 [Accessed 21 Sep 2022] [Accessed 3 May 2020].

Cozannet, G., Kervyn, M., Russo, S., Ifejika Speranza, C., Ferrier, P., Foumelis, M., Lopez, T. and Modaressi, H. 2020. Space-based earth observations for disaster risk management. *Surveys in Geophysics,* 41:1209-1235.

Creswell, J.W. and Poth, C.N. 2016. *Qualitative inquiry and research design: Choosing among five approaches.* Sage publications.

Creswell, J.W. and Clark, V.P. 2011. *Mixed methods research.* SAGE Publications.

Dawadi, S., Shrestha, S. and Giri, R.A. 2021. Mixed-methods research: A discussion on its types, challenges, and criticisms. *Journal of Practical Studies in Education,* 2(2), pp.25-36.

De Freitas. 1994. Theories on Progressive Desiccation and Desertification: Reassessing the Drought Hazard. *Weather and Climate,* 14(2), pp.11.

Delibasis, K., Aronis, C., Fanariotis, M., Maglogiannis, I. 2020. Novel Cost Function Definition for Minimum-Cost Tractography in MR Diffusion Tensor Imaging. In: Vlamos P. (eds) GeNeDis 2018. *Advances in Experimental Medicine and Biology,* vol 1194. Springer, Cham. Available at: https://doi.org/10.1007/978-3-030-32622-7_12 [Accessed 18 May 2020].

Delibasis, K., Aronis, C., Fanariotis, M. and Maglogiannis, I. 2020. *Novel Cost Function Definition for Minimum-Cost Tractography in MR Diffusion Tensor Imaging.* In GeNeDis 2018: Computational Biology and Bioinformatics (pp. 135-150). Springer International Publishing.

Dementyev, V.V. and Kwilinski, A. 2020. Institutional component of production costs. *Journal of Institutional Studies,* 12(1), pp.100-116.

Department of Agriculture, Forestry and Fisheries (DAFF). 2017. Draft Conservation Agriculture Policy, 2017. Available at: <https://goo.gl/VuJZCU> [Accessed 06 June 2018].

Department of Agriculture, Forestry and Fisheries. 2019. Annual Performance Plan FOR THE 2019/20 FISCAL YEAR. Department of Agriculture, Forestry and Fisheries.

Department of Water and Sanitation (DWS) 2017. Government Gazette, 12 December 2017, Vol. 630, No. 41317. Available at: <https://archive. opengazettes.org.za/archive/ZA/2017/governmentgazette-ZA-vol-630-no-41317-dated-2017-12-12.pdf> [Accessed 29 November 2022].

Dettori, M., Arghittu, A., Deiana, G., Castiglia, P. and Azara, A. 2022. The revised European Directive 2020/2184 on the quality of water intended for human consumption. A step forward in risk assessment, consumer safety and informative communication. *Environmental Research,* 209, p.112773. Available at: doi:https://doi.org/10.1016/j.envres.2022.112773 [Accessed 3 June 2023].

Diamond, J. 2003. Farmers and Their Languages: The First Expansions. *Science,* 300(5619), pp.597-603.

Dlakavu, S.I.M.A.M.K.E.L.E. 2021. Rememorying of slavery: South African wine farms and intangible slave memory. *Imbiza Journal for African Writing,* 1(1), pp.90-97.

Elum, Z.A., Modise, D.M. and Marr, A. 2017. Farmer's perception of climate change and responsive strategies in three selected provinces of South Africa. Climate Risk Management, 16, pp.246–257. Available at: doi:https://doi.org/10.1016/j.crm.2016.11.001 [Accessed 3 June 2020].

Etikan, I. and Bala, K. 2017. Sampling and sampling methods. *Biometrics & Biostatistics International Journal,* 5(6), p.00149.

Engle, J.L. and Follette, V.M. 2018. An experimental comparison of two Acceptance and Commitment Therapy (ACT) values exercises to increase values-oriented behavior. *Journal of Contextual Behavioral Science,* 10, pp.31-40.

Fanadzo, M., Ncube, B., French, A. and Belete, A. 2021. Smallholder farmer coping and adaptation strategies during the 2015-18 drought in the Western Cape, South Africa. *Physics and Chemistry of the Earth,* Parts A/B/C, p.102986. Available at: doi:https://doi.org/10.1016/j.pce.2021.102986 [Accessed 3 June 2020].

Felipe, J. and F. Gérard Adams. 2005. ‘A theory of production’ 1 the estimation of the cobb-douglas function: a retrospective view. *Eastern Economic Journal,* 31(3), pp.427–445.
Fetters, M.D. and Freshwater, D. 2015. Publishing a methodological mixed methods research article. *Journal of Mixed Methods Research,* 9(3), pp.203-213.

Fenibo, E.O., Ijoma, G.N. and Matambo, T. 2021. Biopesticides in sustainable agriculture: A critical sustainable development driver governed by green chemistry principles. *Frontiers in Sustainable Food Systems,* 5, p.619058.

Garbers, Y. and Konradt, U. 2014. The effect of financial incentives on performance: A quantitative review of individual and team-based financial incentives. *Journal of Occupational and Organizational Psychology,* 87(1), pp.102-137.

Gbejewoh, O., Keesstra, S. and Blancquaert, E. 2021. The 3Ps (profit, planet, and people) of sustainability amidst climate change: A South African grape and wine perspective. *Sustainability,* 13(5), pp.2910.

Gebre, G.G., Isoda, H., Rahut, D.B., Amekawa, Y. and Nomura, H. 2019. Gender differences in agricultural productivity: evidence from maize farm households in southern Ethiopia. *GeoJournal*. doi:https://doi.org/10.1007/s10708-019-10098-y [Accessed 9 Sep. 2020].

Gerber, N. and Mirzabaev, A. 2017. Benefits of action and costs of inaction: Drought mitigation and preparedness–a literature review. Drought and water crises: Integrating science, management, and policy, 95.

Ghaleb, A., Refae, G., Kaba, A. and Eletter, S. 2021. The Impact of Demographic Characteristics on Academic Performance: Face-to-Face Learning Versus Distance Learning Implemented to Prevent the Spread of COVID-19. *The International Review of Research in Open and Distributed Learning,* 22(1):91–110. Available at: doi:https://doi.org/10.19173/irrodl.v22i1.5031 [Accessed 9 May 2022].

Gizaw, M.S. and Gan, T.Y. 2017. Impact of climate change and El Niño episodes on droughts in sub-Saharan Africa. *Climate Dynamics,* 49(1):665-682.

Graw, V., Ghazaryan, G., Dall, K., Delgado Gómez, A., Abdel-Hamid, A., Jordaan, A., Piroska, R., Post, J., Szarzynski, J., Walz, Y. and Dubovyk, O. 2017. Drought Dynamics and Vegetation Productivity in Different Land Management Systems of Eastern Cape, South Africa—A Remote Sensing Perspective. *Sustainability,* 9(10), pp.1728.

Green Cape. 2017. *Market Intelligence Report*. Cape Town: Green Cape.

Green Cape. 2020. *Sustainable Agriculture: Mark ii et Intelligence Report 2020.* Cape Town: Green Cape.

Hammarberg, K., Kirkman, M. and de Lacey, S. 2016. Qualitative research methods: when to use them and how to judge them. *Human Reproduction,* 31(3), pp.498-501.

Hammer, C.S. 2011. The importance of participant demographics. *American Journal of Speech-Language Pathology,* 20(4), pp.261.

Harris, D. 2019. *Literature Review and Research Design: A Guide to Effective Research Practice* (1st ed.). New York: Routledge. Available at: https://doi.org/10.4324/9780429285660 [Accessed 19 May 2020].

Harrington, R.J., Ottenbacher, M.C., Marlowe, B. and Siguda, U. 2019. Wine Tourism in South Africa: Valued Attributes and Their Role as Memorable Enticements. Wine Tourism Destination Management and Marketing: Theory and Cases, pp.445-461.

Hayashi Jr, P., Abib, G. and Hoppen, N. 2019. Validity in qualitative research: A processual approach. *The Qualitative Report,* 24(1), pp.98-112.

Heale, R. and Twycross, A. 2015. Validity and reliability in quantitative studies. *Evidence-Based Nursing,* 18(3), pp.66-67.

Hendra, R. and Hill, A. 2019. Rethinking response rates: new evidence of little relationship between survey response rates and nonresponse bias. *Evaluation Review,* 43(5), pp.307-330.

Hennink, M. and Kaiser, B.N. 2022. Sample sizes for saturation in qualitative research: A systematic review of empirical tests. *Social Science & Medicine,* 292, p.114523.

Hettiarachchi, H. 2016. Safe use of wastewater in agriculture: Good practice examples. Dresden, Germany: United Nations University, Institute for Integrated Management of Material Fluxes and of Resources (UNU-FLORES).

Hussain, M.I., Muscolo, A., Farooq, M. and Ahmad, W. 2019. Sustainable use and management of non-conventional water resources for rehabilitation of marginal lands in arid and semiarid environments. *Agricultural Water Management,* 221, pp.462–476. Available at: doi:https://doi.org/10.1016/j.agwat.2019.04.014 [Accessed 3 June 2020].

Hürlimann, C. and Hürlimann, C. 2019. Research philosophy and ethics. Valuation of Renewable Energy Investments: Practices among German and Swiss Investment Professionals, pp.111-126.

Jones, S.H., St. Peter, C.C. and Ruckle, M.M. 2020. Reporting of demographic variables in the Journal of Applied Behavior Analysis. *Journal of Applied Behavior Analysis,* 53(3), pp.1304–1315. Available at: doi:https://doi.org/10.1002/jaba.722 [Accessed 4 May 2021].

Jooste, B. 2016. The Western Cape's agricultural sector has rallied around those farmers worst affected by the drought. *Agriprobe,* 13(1), pp.05-06.

Jung, K., Song, M. and Park, H.J. 2019. The dynamics of an interorganizational emergency management network: Interdependent and independent risk hypotheses. *Public Administration Review,* 79(2), pp.225-235.

Kanta Kafle, S. 2017. Disaster Risk Management Systems in South Asia: Natural Hazards, Vulnerability, Disaster Risk and Legislative and Institutional Frameworks. *Journal of Geography & Natural Disasters,* 7(3). Available at: doi:https://doi.org/10.4172/2167-0587.1000207 [Accessed 3 June 2020].

Kamanzi, A. and Romania, M. 2019. Rethinking Confidentiality in Qualitative Research in the Era of Big Data. *American Behavioral Scientist,* 63(6), pp.743–758. Available at: doi:https://doi.org/10.1177/0002764219826222 [Accessed 3 June 2020].

Kasperson, R.E., Kates, R.W. and Hohenemser, C. 1985. Hazard management. chapter, 3, pp.43-66.

Kasperson, R.E. 2019. Corporate management of health and safety hazards: a comparison of current practice. Routledge.

Karmen, P., Marin Ferrer Montserrat, DE Groeve Tom and Clark, I. 2017. Science for Disaster Risk Management 2017: Knowing better and losing less.

Kenyaprime. 2020. Drought in South Africa: causes, effects and possible way out 2020. Available (online) at: https://kenyaprime.com/drought-in-south-africa-causes-effects-and-possible-way-out-2020/ [Accessed 06 March 2021].

Kidd, S. 2022. The importance of confidentiality. *BDJ Team,* 9(1):25–25. Available at: doi:https://doi.org/10.1038/s41407-022-0796-z [Accessed 29 May 2023].

Kiger, M.E. and Varpio, L. 2020. Thematic Analysis of Qualitative data: AMEE Guide no. 131. *Medical Teacher,* [online] 42(8):1–9. Available at: doi:https://doi.org/10.1080/0142159X.2020.1755030 [Accessed 9 April 2022].

Killam, L. 2013. Research terminology simplified: Paradigms, axiology, ontology, epistemology and methodology. Laura Killam.

Kirongo, A. and Odoyo, C. 2020. Research philosophy design and methodologies: A systematic review of research paradigms in information technology.

Koporcic, N. and Törnroos, J.Å. 2019. Qualitative Case Studies. In Understanding Interactive Network Branding in SME Firms (pp. 103-110). Emerald Publishing Limited.

Korstjens, I. and Moser, A. 2018. Series: Practical guidance to qualitative research. Part 4: Trustworthiness and publishing. *European Journal of General Practice,* 24(1), pp.120-124.

Kling, C. and Mackie, C. n.d. 2019. Improving data collection and measurement of complex farms. *The National Academics of Science Engineering Medicine,* pp.83-84.

Kraus, S., Mahto, R.V. and Walsh, S.T. 2023. The importance of literature reviews in small business and entrepreneurship research. *Journal of Small Business Management,* 61(3), pp.1095-1106.

Kvale, L. and Pharo, N. 2021. Understanding the Data Management Plan as a Boundary Object through a Multi-stakeholder perspective. International Journal of Digital Curation, 16(1), p.16. Available at: doi:https://doi.org/10.2218/ijdc.v16i1.746 [Accessed 3 June 2022].

Lv, F., Song, J., Giltrap, D., Feng, Y., Yang, X. and Zhang, S. 2020. Crop yield and N2O emission affected by long-term organic manure substitution fertilizer under winter wheat-summer maize cropping system. *Science of the Total Environment,* 732, pp.139321.

Lavell, A. and Maskrey, A. 2014. The future of disaster risk management. *Environmental Hazards,* 13(4), pp.267-280.

Liu, Y. and Chen, J. 2021. Future global socioeconomic risk to droughts based on estimates of hazard, exposure, and vulnerability in a changing climate. *Science of the Total Environment,* 751, pp.142159.

Liu, L. 2016. Using generic inductive approach in qualitative educational research: A case study analysis. *Journal of Education and Learning,* 5(2), pp.129-135.

Lovino, F. and Tsitsianis, N. 2020. The methodology of the research. In Changes in European energy markets (pp. 79-95). Emerald Publishing Limited.

MacDonald, J.M., Korb, P. and Hoppe, R.A. 2013. Farm size and the organization of US crop farming (No. 1477-2017-3987).

Magaldi, D., Berler, M. 2020. Semi-structured Interviews. In: Zeigler-Hill, V., Shackelford, T.K. (eds) Encyclopedia of Personality and Individual Differences. Springer, Cham. Available at: https://doi.org/10.1007/978-3-319-24612-3_857 [Accessed 10 June 2021].

Mahajan, S.K. 2014. Theory of production [PowerPoint Slides]. Retrieved from lecture notes in classroom. Institute of Technology Nirma University, Gujarat.

Mariem, S., Soba, D., Zhou, B., Loladze, I., Morales, F. and Aranjuelo, I. 2021. Climate change, crop yields, and grain quality of C3 cereals: A meta-analysis of [CO2], temperature, and drought effects. *Plants,* 10(6), pp.1052.

Masaba, S., Mungai, D.N., Isabirye, M. and Nsubuga, H. 2017. Implementation of landslide disaster risk reduction policy in Uganda. *International Journal of Disaster Risk Reduction,* 24, pp.326–331.

Masipa, T.S. 2017. The impact of climate change on food security in South Africa: Current realities and challenges ahead. *Jàmbá: Journal of Disaster Risk Studies,* 9(1), pp.1-7.

Marlow, C.R. 2023. Research methods for generalist social work. Waveland Press.

Macharia, T.P., Thinguri, R. and Gacheru, E. 2020. The influence of Family Lifestyle on Youth Delinquency. *Journal of African Interdisciplinary Studies,* 4(2), pp.16-24.

Mbabe, W., Ajayi, O., Bagula, A., Leenen, L. and Schoeman, N. 2021, May. A workflow system for managing ethical clearance in research work. In 2021 IST-Africa Conference (IST-Africa) (pp. 1-9). IEEE.

Meissner, H., Scholtz, M. and Palmer, A. 2014. Sustainability of the South African Livestock Sector towards 2050 Part 1: Worth and impact of the sector. *South African Journal of Animal Science,* 43(3), pp.282.

Mellor, J.W. and Malik, S.J. 2017. The Impact of Growth in Small Commercial Farm Productivity on Rural Poverty Reduction. *World Development,* 91:1–10.

Meyer, P., Davids, T., Westhuizen, D., Louw, M. and Vermeulen, H. 2016. The impact of the drought on South African consumers and the agricultural sector. *Bureau for Food and Agricultural Policy,* pp.26-28.

Mizuta, K. 2015. Ricardo's Theory of Capital Accumulation: Population, Free Trade, Agricultural Improvement and Introduction of Machinery, The Annual Bulletin of The Malthus Society, 24: 1-24 (in Japanese).

Morse, J.M. 2008. "What's your favorite color?" Reporting Irrelevant Demographics in Qualitative Research. *Qualitative Health Research,* 18(3):299-300. Available at: Doi:10.1177/1049732307310995 [Accessed 19 May 2021].

Moon, M.Y., Cho, H., Choi, K.K., Gaul, N., Lamb, D. and Gorsich, D. 2018. Confidence-based reliability assessment considering limited numbers of both input and output test data. *Structural and Multidisciplinary Optimization,* 57, pp.2027-2043.

Moser, A. and Korstjens, I. 2018. Series: Practical guidance to qualitative research. Part 3: Sampling, data collection and analysis. *European Journal of General Practice,* 24(1), pp.9-18.

Mohajan, H.K. 2017. Two criteria for good measurements in research: Validity and

reliability. Annals of Spiru Haret University. *Economic Series,* 17(4), pp.59-82.

Mohajan, H.K. 2018. Qualitative research methodology in social sciences and related subjects. *Journal of Economic Development, Environment and People,* 7(1), pp.23-48.

Mohajan, H.K. 2020. Quantitative research: A successful investigation in natural and social sciences. *Journal of Economic Development, Environment and People,* 9(4), pp.50-79.

Morgan, J., Neufeld, S.D., Holroyd, H., Ruiz, J., Taylor, T., Nolan, S. and Glegg, S. 2023. Community-Engaged Research Ethics Training (CERET): developing accessible and relevant research ethics training for community-based participatory research with people with lived and living experience using illicit drugs and harm reduction workers. *Harm Reduction Journal,* 20(1), p.86.

Makwana, D., Engineer, P., Dabhi, A. and Chudasama, H. 2023. Sampling Methods in Research: A Review.

Marengo, J.A., Cunha, A.P., Cuartas, L.A., Deusdará Leal, K.R., Broedel, E., Seluchi, M.E., Michelin, C.M., De Praga Baião, C.F., Chuchón Angulo, E., Almeida, E.K. and Kazmierczak, M.L. 2021. Extreme drought in the Brazilian Pantanal in 2019–2020: characterization, causes, and impacts. *Frontiers in Water,* 3, pp.639204.

Mazhar, S.A., Anjum, R., Anwar, A.I. and Khan, A.A. 2021. Methods of data collection: A fundamental tool of research. *Journal of Integrated Community Health* (ISSN 2319-9113), 10(1), pp.6-10.

Maziriri, E.T., Madinga, W. and Lose, T. 2017. Entrepreneurial barriers that are confronted by entrepreneurs living with physical disabilities: A thematic analysis. *Journal of Economics and Behavioral Studies,* 9(1 (J)), pp.27-45.

Meza, I., Eyshi Rezaei, E., Siebert, S., Ghazaryan, G., Nouri, H., Dubovyk, O., Gerdener, H., Herbert, C., Kusche, J., Popat, E., Rhyner, J., Jordaan, A., Walz, Y. and Hagenlocher, M. 2021. Drought risk for agricultural systems in South Africa: Drivers, spatial patterns, and implications for drought risk management. *Science of The Total Environment,* [online] 799, pp.149505. Available at: doi:https://doi.org/10.1016/j.scitotenv.2021.149505 [Accessed 2 May 2023].

Miksa, T., Oblasser, S. and Rauber, A. 2021. Automating research data management using

machine-actionable data management plans. *ACM Transactions on Management Information Systems (TMIS),* 13(2), pp.1-22.

Mohd, S.R. 2018. Ethical Considerations in Qualitative Study. *International Journal of Care Scholars,* 1(2), pp.30–33. Available at: doi:https://doi.org/10.31436/ijcs.v1i2.82 [Accessed 10 May. 2021].

Morokong, T., Sibulali, A., Murdoch, J. and Barends-Jones, V. 2021. Western Cape Agricultural Sector Profile: 2021. Western Cape: Western Cape Department of Agriculture, pp.8–12.

Morokong, T. and Pienaar, L. 2019. A Macro-Economic Report on the Africa Agenda: Western Cape Agriculture. ResearchGate: Berlin, Germany.

Motulsky, S.L. 2021. Is member checking the gold standard of quality in qualitative research? *Qualitative Psychology,* 8(3), pp.389–406. Available at: doi:https://doi.org/10.1037/qup0000215 [Accessed 18 April. 2022].

Muzari, T., Shava, G.N. and Shonhiwa, S. 2022. Qualitative research paradigm, a key research design for educational researchers, processes and procedures: A theoretical overview. *Indiana Journal of Humanities and Social Sciences,* 3(1), pp.14-20.

National Agricultural Statistics Service. 2008. Agricultural Statistics 2008. Washington: United States Department of Agriculture.

National Agricultural Statistics Service. 2008. Agricultural Statistics 2008. Washington: United States Department of Agriculture.

Ncube, B. 2020. Smallholder farmer drought coping and adaptation strategies in Limpopo and Western Cape provinces. Water Research Commission. *WRC Report,* (2716/1), pp.20.

Nembilwi, N., Chikoore, H., Kori, E., Munyai, R.B. and Manyanya, T.C. 2021. The Occurrence of Drought in Mopani District Municipality, South Africa: Impacts, Vulnerability and Adaptation. *Climate,* 9(4), pp.61. Available at: doi:https://doi.org/10.3390/cli9040061 [Accessed 28 Sep. 2022].

Ninh, L.K. 2020. Economic role of education in agriculture: evidence from rural Vietnam. *Journal of Economics and Development,* ahead-of-print(ahead-of-print). Available at:

doi:https://doi.org/10.1108/jed-05-2020-0052 [Accessed 30 May 2022].

Nix, H.A. 1980. Strategies for crop research. In Proceedings of the Agronomy Society of New Zealand, 10, pp.107-110.

Nichols-Casebolt, A. 2012. Research integrity and responsible conduct of research. OUP USA.

Noble, H. and Smith, J. 2015. Issues of validity and reliability in qualitative research. *Evidence-based Nursing,* 18(2), pp.34-35.

Nyatuame, M. and Agodzo, S. 2017. Analysis of extreme rainfall events (drought and flood) over Tordzie Watershed in the Volta Region of Ghana. *Journal of Geoscience and Environment Protection,* 5(9), pp.275-295.

Orimoloye, I.R., Belle, J.A., Orimoloye, Y.M., Olusola, A.O. and Ololade, O.O. 2022. Drought: A common environmental disaster. *Atmosphere,* 13(1), pp.111.

Otzen, T. and Manterola, C. 2017. Sampling techniques on a population study. *Int. J. Morphol,* 35(1), pp.227-232.

Ozuem, W., Willis, M. and Howell, K. 2022. Thematic analysis without paradox: sensemaking and context. *Qualitative Market Research: An International Journal,* 25(1), pp.143-157.

Partridge, A. and Morokong, T. 2018. Western Cape Agricultural Sector Profile: 2018. Western Cape: WCDoA.

Partridge, A. and Morokong, T. 2019. Introducing the annual Western Cape Agricultural Sector Profile. *Agriprobe,* 16(3), pp.33-35.

Paltasingh, K.R. and Goyari, P. 2018. Impact of farmer education on farm productivity under varying technologies: case of paddy growers in India. *Agricultural and Food Economics,* 6(1). doi:https://doi.org/10.1186/s40100-018-0101-9

Pandey, P. and Pandey, M.M. 2021. Research methodology: tools & techniques. New Delhi: Bridge Center.

Pervin, N. and Mokhtar, M. 2022. The Interpretivist research paradigm: A subjective notion of a social context. *International Journal of Academic Research in Progressive Education and Development*, 11(2), pp.419-428.

Pienaar, L.O.U.W. and Boonzaaier, J.O.H.A.N.N. 2018. Drought policy brief Western cape agriculture. Western Cape Department of Agriculture (WCDoA) and the Bureau for Food and Agricultural Policy (BFAP), Elsenburg.

Portal, F. 2021. What is a Commercial Farmer- South Africa. [online] Farming Portal. Available at: <https://farmingportal.co.za/index.php/agri-index/86-other/103-what-is-a-commercial-farmer-south-africa> [Accessed 11 July 2021].

Prabnakorn, S., Maskey, S., Suryadi, F.X. and de Fraiture, C. 2019. Assessment of drought hazard, exposure, vulnerability, and risk for rice cultivation in the Mun River Basin in Thailand. *Natural Hazards,* 97(2), pp.891-911.

Quarantelli, E.L. 2006. Catastrophes are different from disasters: Some implications for crisis planning and managing drawn from Katrina. Understanding Katrina: Perspectives from the social sciences.

Radović, V. 2020. Emergency Management/Response. Climate Action, pp.391-404.

Rahman, M.S. and Rahman, M.A. 2019. Impacts of climate change on crop production in Bangladesh: a review. *Journal of Agriculture and Crops,* 5(1), pp.6-14.

Rahman, M.M., Tabash, M.I., Salamzadeh, A., Abduli, S. and Rahaman, M.S. 2022. Sampling techniques (probability) for quantitative social science researchers: a conceptual guidelines with examples. *Seeu Review,* 17(1), pp.42-51.

Rivera, C., Tehler, H. and Wamsler, C. 2015. Fragmentation in disaster risk management systems: A barrier for integrated planning. *International Journal of Disaster Risk Reduction,* 14, pp.445–456.

Resnik, D.B. 2021. Standards of evidence for institutional review board decision-making. *Accountability in Research,* 28(7), pp.428-455.

Rose, D.A., Murthy, S., Brooks, J. and Bryant, J. 2017. The evolution of public health emergency management as a field of practice. *American Journal of Public Health,* 107(S2), pp.S126-S133.

Rose, J. and Johnson, C.W. 2020. Contextualizing reliability and validity in qualitative research: toward more rigorous and trustworthy qualitative social science in leisure research. *Journal of Leisure Research,* [online] 51(4), pp.1–20. Available at: https://www.tandfonline.com/doi/abs/10.1080/00222216.2020.1722042 [Accessed 19 May 2021].

Ross, P.T. and Bibler Zaidi, N.L. 2019. Limited by our limitations. *Perspectives on Medical Education,* 8, pp.261-264.

Roh, Y., Heo, G. and Whang, S.E. 2019. A survey on data collection for machine learning: a big data-ai integration perspective. *IEEE Transactions on Knowledge and Data Engineering,* 33(4), pp.1328-1347.

Rose, J. and Johnson, C.W. 2020. Contextualizing reliability and validity in qualitative research: Toward more rigorous and trustworthy qualitative social science in leisure research. *Journal of Leisure Research,* 51(4), pp.432-451.

SafarianZengir, V., Sobhani, B. and Asghari, S. 2020. Modeling and monitoring of drought for forecasting it, to reduce natural hazards atmosphere in Western and North Western part of Iran, Iran. *Air Quality, Atmosphere & Health,* 13, pp.119-130.

Saunders, M.N., Lewis, P., Thornhill, A. and Bristow, A. 2015. Understanding research philosophy and approaches to theory development.

Salami, H., Shahnooshi, N. and Thomson, K. 2009. The economic impacts of drought on the economy of Iran: An integration of linear programming and macroeconometric modelling approaches. *Ecological Economics,* 68(4), pp.1032-1039.

Schreiner, B.G., Mungatana, E.D. and Baleta, H. 2018. Impacts of Drought Induced Water Shortages in South Africa: Economic Analysis. [online] Water Research Commission. Available at: www.wrc.org.za [Accessed 19 Sep. 2020].

Shah, A.A., Gong, Z., Pal, I., Sun, R., Ullah, W. and Wani, G.F. 2020. Disaster risk management insight on school emergency preparedness–a case study of Khyber

Pakhtunkhwa, Pakistan. *International Journal of Disaster Risk Reduction,* 51, pp.101805. Available at: doi:https://doi.org/10.1016/j.ijdrr.2020.101805 [Accessed 3 June 2021].

Sharma, N.K. 2022. Instruments Used in the Collection of Data in Research. *SSRN Electronic Journal,* 1(1). Available at: doi:https://doi.org/10.2139/ssrn.4138751 [Accessed 3 June 2023].

Sharma, P.J. and Sharma, A. 2023. 2 Spatiotemporal Drought Analysis. Integrated Drought Management, Volume 2: Forecasting, Monitoring, and Managing Risk, p.17.

Shephard, R.W. 2015. *Theory of cost and production functions.* New Jersey: Princeton University Press.

Sileyew, K.J. 2019. *Research Design and Methodology.* Cyberspace. IntechOpen, pp.1-12.

Sileyew, K. 2020. *Research Design and Methodology.* [online] Cyberspace. Available at: <DOI: http://dx.doi.org/10.5772/intechopen.85731> [Accessed 14 November 2019].

Shaw, D. and Satalkar, P. 2018. Researchers' interpretations of research integrity: A qualitative study. *Accountability in Research,* 25(2), pp.79-93.

Sibley, C.G. 2021. Sampling procedure and sample details for the New Zealand Attitudes and Values Study. PsyArXiv (OSF Preprints). Available at: doi:https://doi.org/10.31234/osf.io/wgqvy [Accessed 9 July 2022].

Sisodia, A. 2019. Sampling Methods. *Think India Journal,* 22(22), pp.96-110.

Smale, N., Unsworth, K., Denyer, G. and Barr, D. 2018. The history, advocacy and efficacy of data management plans. bioRxiv, p.443499.

Smit, B. and Scherman, V. 2021. Computer-assisted qualitative data analysis software for scoping reviews: A case of ATLAS. ti. *International Journal of Qualitative Methods,* 20, p.16094069211019140.

Smith, S.G. and Sinkford, J.C. 2022. Gender equality in the 21st century: Overcoming barriers to women's leadership in global health. *Journal of Dental Education,* 86(9), pp.1144–1173. Available at: doi:https://doi.org/10.1002/jdd.13059 [Accessed 13 May 2023].

Snyder, H. 2019. Literature Review as a Research methodology: An Overview and Guidelines. *Journal of Business Research,* [online] 104(1):333–339. doi:https://doi.org/10.1016/j.jbusres.2019.07.039 [Accessed 1 April 2020].

South African History Online. 2019. The Western Cape Farm Workers Strike 2012-2013. [online] Available at: https://www.sahistory.org.za/article/western-cape-farm-workers-strike-2012-2013 [Accessed 9 Feb. 2019].

Soratto, J., Pires, D.E.P.D. and Friese, S. 2020. Thematic content analysis using ATLAS. ti software: Potentialities for researchs in health. Revista brasileira de enfermagem, 73.

Sousa, D. 2014. Validation in qualitative research: General aspects and specificities of the descriptive phenomenological method. *Qualitative Research in Psychology,* 11(2), pp.211-227.

Small, M.L. 2021. What is “qualitative” in qualitative research? Why the answer does not matter but the question is important. *Qualitative Sociology,* pp.1-8.

Smith, J.A. and Fieldsend, M. 2021. Interpretative phenomenological analysis. American Psychological Association.

Squires, V.R., Gaur, M.K. and Springerlink (Online Service). 2020. Food Security and Land Use Change under Conditions of Climatic Variability: A Multidimensional Perspective. Cham: Springer International Publishing, Imprint Springer.

Stats SA. 2020. Stats SA releases Census of Commercial Agriculture 2017 Report. [online] Statistics South Africa. Available at: <http://www.statssa.gov.za/?p=13144> [Accessed 24 March 2020].

Stokes, P. 2017. *Research methods.* UK: Macmillan Education.

Svoboda, J., Lososová, J. and Zdeněk, R. 2020. Analysis of costs and their effectiveness in the EU agrarian sector. *Agris on-line Papers in Economics and Informatics,* [online] 16(4):161-173. Available at: <http://www.custoseagronegocioonline.com.br> [Accessed 3 March 2020].

Suri, H. 2020. Ethical considerations of conducting systematic reviews in educational research. *Systematic reviews in educational research: Methodology, perspectives and application,* pp.41-54.

Taherdoost, H. 2022. Understanding cybersecurity frameworks and information security standards-a review and comprehensive overview. *Electronics,* 11(14), pp.2181.

Taherdoost, H. 2022. What are different research approaches? Comprehensive Review of Qualitative, quantitative, and mixed method research, their applications, types, and limitations. *Journal of Management Science & Engineering Research,* 5(1), pp.53-63.

Taherdoost, H. 2016. Sampling methods in research methodology; how to choose a sampling technique for research. How to choose a sampling technique for research (April 10, 2016).

Talanow, K., Topp, E.N., Loos, J. and Martín-López, B. 2021. Farmers' perceptions of climate change and adaptation strategies in South Africa's Western Cape. *Journal of Rural Studies,* 81, pp.203–219.

Tammeleht, A., Rodríguez-Triana, M.J., Koort, K. and Löfström, E. 2019. Collaborative case-based learning process in research ethics. *International Journal for Educational Integrity,* 15, pp.1-22.

Tamminen, K.A. and Poucher, Z.A. 2020. *Research philosophies. In The Routledge international encyclopedia of sport and exercise psychology* (pp. 535-549). New York: Routledge.

Tatli, H. and Dalfes, H.N. 2020. Long-Time Memory in Drought via Detrended Fluctuation Analysis. *Water Resources Management*, 34(3), pp.1199–1212. Available at: doi:https://doi.org/10.1007/s11269-020-02493-9 [Accessed 3 June 2021].

Tatum, M. 2020. What are the different types of farms? Available (online) at: https://www.wisegeek.com/what-are-the-different-types-of-farms.htm [Accessed on 31/01/2021].

Terry, G. and Hayfield, N., 2020. 38. Reflexive thematic analysis. Handbook of qualitative research in Education. Edward Elgar Publishing Limited, pp.430-441.

The Conversation. 2019. How Western Cape farmers are being hit by the drought. [Online] Available at: https://theconversation.com/how-western-cape-farmers-are-being-hit-by-the-drought-91700 [Accessed 17 Feb. 2019].

The State of Food and Agriculture. 2020. [online] FAO. Available at: http://www.fao.org/3/cb1447en/CB1447EN.pdf [Accessed 30 Nov. 2020].

Theofanidis, D. and Fountouki, A. 2018. Limitations and delimitations in the research process. Perioperative Nursing-Quarterly scientific, online official journal of GORNA, 7(3 September-December 2018), pp.155-163.

Thomas, D., Twyman, C., Osbahr, H. and Hewitson, B. 2007. Adaptation to climate change and variability: farmer responses to intra-seasonal precipitation trends in South Africa. *Climatic Change,* 83(3), pp.301-322.

Tshikovhi, M. and van Wyk, R.B. 2021. South Africa's increasing climate variability and its effect on food production. *Outlook on Agriculture,* 50(3), pp.286-293.

Turton, A.R. 2005. The political aspects of institutional developments in the water sector: South Africa and its international river basins (Doctoral dissertation, University of Pretoria).

Udemezue, J.C. and Osegbue, E.G. 2018. Theories and models of agricultural development. *Ann. Rev. Res,* 1(5), pp.1-4.

Ukessays. 2018. *Economic factors that determine the price of goods.* Available (online) at: https://www.ukessays.com/essays/economics/economic-factors-that-determine-the-price-of-goods-economics-essay.php [Accessed on 06/02/2021].

Unganai, L. and Kogan, F. 1998. Drought Monitoring and Corn Yield Estimation in Southern Africa from AVHRR Data. *Remote Sensing of Environment,* 63(3), pp.219-232.

UNDRR. 2021. Strategic framework 2022 – 2025. United Nations Office for Disaster Risk Reduction. UNDRR Publications.

Varpio, L., Paradis, E., Uijtdehaage, S. and Young, M. 2020. The distinctions between theory, theoretical framework, and conceptual framework. *Academic Medicine,* 95(7),

pp.989-994.

Vaismoradi, M. and Snelgrove, S. 2019. Theme in qualitative content analysis and thematic analysis.

Wu, B., Ma, Z. and Yan, N. 2020. Agricultural drought mitigating indices derived from the changes in drought characteristics. *Remote Sensing of Environment,* 244, p.111813. Available at: doi:https://doi.org/10.1016/j.rse.2020.111813 [Accessed 17 July 2021].

Water Research Commission Drought Factsheet 1. 2015. Background to current drought situation in South Africa. Cape Town: Water Information Network South Africa.

Water Affairs and Forestry. 2009. South Africa Yearbook 2008/09. [online] The Department of Water Affairs and Forestry.

Western Cape Government Agriculture. 2017. Informing the Western Cape agricultural sector on the 2015-2017 drought. Western Cape Province: Department of Agriculture.

Western Cape Department of Agriculture. 2014. 1 Western Cape Provincial Profile: Emphasis on Agricultural Sector. Western Cape: Western Cape Department of Agriculture.

Western Cape Government Provincial Treasury. 2018. Municipal Economic Review and Outlook 2018. [online] Western Cape: Western cape Government, pp.30–31. Available at: https://www.westerncape.gov.za/assets/departments/treasury/Documents/Research-and-Report/2018/2018_mero_revised.pdf [Accessed 27 Aug. 2019].

Wilhite, D. 1987. Chapter 25. The role of government in planning for drought: where do we go from here? Drought Mitigation Center Faculty Publications. 87.

Wilhite, D. and Glantz, M. 1985. Understanding: The Drought Phenomenon: The Role of Definitions. *Water International,* 10(3), pp.111-120.

Wilhite, D. A. 2011. Quantification of Agricultural Drought for Effective Drought Mitigation and Preparedness: Key Issues and Challenges. Drought Mitigation Center Faculty Publications. 82.

Wilhite, D.A., Sivakumar, M.V.K. and Pulwarty, R. 2014. 'Managing drought risk in a changing climate: The role of National Drought Policy'. *Weather and Climate Extremes, 3,*

pp.4–13. Available at: doi:10.1016/j.wace.2014.01.002 [Accessed 3 April 2020].

Winkler, K., Gessner, U. and Hochschild, V. 2017. Identifying Droughts Affecting Agriculture in Africa Based on Remote Sensing Time Series between 2000–2016: Rainfall Anomalies and Vegetation Condition in the Context of ENSO. *Remote Sensing,* 9(8), pp.831.

Wolski, P. 2018. How severe is Cape Town's “Day Zero” drought? *Significance,* 15(2), pp.24-27.

World Health Organization. 2013. Emergency Response Framework.

Ziegenfuss, J.Y., Easterday, C.A., Dinh, J.M., JaKa, M.M., Kottke, T.E. and Canterbury, M. 2021. Impact of demographic survey questions on response rate and measurement: A randomized experiment. *Survey Practice,* 14(1), pp.1–11. Available at: doi:https://doi.org/10.29115/sp-2021-0010 [Accessed 16 June 2022].

Zwane, E.M. 2019. Impact of climate change on primary agriculture, water sources and food security in Western Cape, South Africa. Jàmbá Journal of Disaster Risk Studies, 11(1). Available at: doi:https://doi.org/10.4102/jamba.v11i1.562 [Accessed 3 June 2020].

Zyl, J. 1993. Drought and the Economy. *Sabinet Gateway,* 10(4), pp.47-58.

Haigh, T., Hayes, M., Smyth, J., Prokopy, L., Francis, C. and Burbach, M., 2021. Ranchers' use of drought contingency plans in protective action decision making. Rangeland Ecology & Management, 74, pp.50-62.

Meza, I., Rezaei, E.E., Siebert, S., Ghazaryan, G., Nouri, H., Dubovyk, O., Gerdener, H., Herbert, C., Kusche, J., Popat, E. and Rhyner, J., 2021. Drought risk for agricultural systems in South Africa: Drivers, spatial patterns, and implications for drought risk management. *Science of the Total Environment*, *799*, p.149505.

Liu, X., Guo, P., Tan, Q., Zhang, F., Huang, Y. and Wang, Y., 2021. Drought disaster risk management based on optimal allocation of water resources. Natural hazards, 108, pp.285-308.

Naheed, S., 2021. Understanding disaster risk reduction and resilience: A conceptual framework. In Handbook of disaster risk reduction for resilience: New frameworks for building resilience to disasters (pp. 1-25). Cham: Springer International Publishing.

Li, J., Wang, Z., Wu, X., Chen, J., Guo, S. and Zhang, Z., 2020. A new framework for tracking flash drought events in space and time. *Catena*, *194*, p.104763.

Bandurska, H., 2022. Drought stress responses: coping strategy and resistance. Plants, 11(7), p.922.

Jacques, C., Salon, C., Barnard, R.L., Vernoud, V. and Prudent, M., 2021. Drought stress memory at the plant cycle level: A review. *Plants*, *10*(9), p.1873.

Smith, A. 1776. An Inquiry into the Nature and Causes of the Wealth of Nations. London: W. Strahan and T. Cadell.

Ricardo, D. 1817. Principles of Political Economy and Taxation. London: John Murray.

Marshall, A. 1890. Principles of Economics. London: Macmillan and Co.

Boretti, A., 2022. Covid19 pandemic as a further driver of water scarcity in Africa. GeoJournal, 87(2), pp.787-814.

APPENDIX A: ETHICS APPROVAL

P.O. Box 1906 • Bellville 7535 South Africa •Tel: +27 21 4603291 • Email: fbmsethics@cput.ac.za
Symphony Road Bellville 7535

Office of the Chairperson Research Ethics Committee	Faculty: **BUSINESS AND MANAGEMENT SCIENCES**

The Faculty's Research Ethics Committee (FREC) on **18 February 2020**, ethics **Approval** was granted to **Akhona Ntsheyiya (214120260)** for a research activity for **Master of Management Accounting** at Cape Peninsula University of Technology.

Title of dissertation/thesis/project:	**Cost implication of drought on operations of commercial farm businesses in Stellenbosch, Western Cape** Lead Supervisor (s): Dr. H. Benedict

Comments:

Decision: Approved

	**18 February 2020**
Signed: Chairperson: Research Ethics Committee	**Date**

Clearance Certificate No | 2020FOBREC742

APPENDIX B: LETTER TO THE RESPONDENT

Cape Peninsula University of Technology

29 April 2019

To whom it may concern

Dear Respondent

The importance of time in our days cannot be overemphasized. At the same time, sharing your time with someone can be very enriching, rewarding and fulfilling. I would like to introduce our Master's student **AKHONA NTSHEYIYA** who is currently working on a Masters Research project for a degree in the field of Management Accounting at the Cape Peninsula University of Technology. She is seeking your permission to share approximately 10-15 minutes of your valuable time to conduct her questionnaire-based interviews. Granted, such permission will enable the student to carry out surveys across the sector for the project entitled, 'Cost implication of drought on operations of Commercial farm businesses in Stellenbosch, Western Cape.

The main objective is to investigate the cost effects of drought on operations of commercial farm businesses on agro-commodities to mitigate the effect of drought in Western Cape.

The researcher and the supervisor pledge, that all the survey data will be aggregated and organisational information will be treated with the strictest confidence; and that you are under no obligation to participate. All the information obtained will be used for research thesis and research publication purposes only. The final report will not include any identifying information of your organisation. Please feel free to contact student and/or supervisor with regards to any queries you might have. Your participation in the research project will be most appreciated.

This information is given in good faith. Should you need any information, do not hesitate to contact our offices.

Yours sincerely

Professor Lawrence Obokoh
HOD: Cost & Management Accounting
Tel: 021 650 3389/3054
e-mail:Obokohl@cput.ac.za

FACULTY OF BUSINESS
COST & MANAGEMENT ACCOUNTING
30 APR 2019
Cape Peninsula University of Technology

PO Box 1906 Bellville 7535 South Africa
086 123 2788

APPENDIX C: INTERVIEW QUESTIONS

COST IMPLICATION OF DROUGHT ON OPERATIONS OF COMMERCIAL FARM BUSINESSES.

Dear Participant:

Your response in this investigation is completely voluntary. All the information you give will be kept confidential. We do not share information from this investigation with anyone. There are no risks associated to your participation to this survey as you are protected from any type of harm as far as your participation is concerned. The aim of this research is to investigate the cost implication of drought on operations of commercial farms. This research will help to identify how critical commercial farms are affected by drought as well as looking on how these effects of drought can be mitigated to their minimum level. The findings of this research will be of importance to everyone affected by drought especially commercial farms. If you agree to participate in this interview, please answer all the following questions as best as you can. It should take you 15 to 20 minutes to complete the survey.

SECTION A – Demographic information of respondents

1. E4. How long has the farm been operating?
2. Are you the owner or a manager of the farm?
3. Gender – Male/Female
4. Please indicate the head/owner's age category?
   Under 30 years
   30-39 years
   40-49 years
   50 and over
5. What is the head/owner's highest level of education?
6. How many years have you been in the industry?
7. Which commodity does the farm mainly produce?

Section B – Estimated production cost effects of drought on commercial farms in the Cape Winelands District, Western Cape.

1. Have you experienced drought since the inception of this farm? If yes, does your production level meet the demand of your product during the drought period?
2. What is your estimated production cost during the normal and drought period?

3. Has drought resulted in an increase on your production inputs? If yes, do you increase the selling price to cover your costs or how do you recoup the loss?

Section C – The cost implications of drought on commercial farmer's yielding outputs in the Cape Winelands District, Western Cape.

1. How often have you experienced drought in your farm?
2. What is your source of irrigation?
3. What is your estimated farm output quantity produced during the normal period and drought period per annum? (In units)

Section D – the strategies used by farms in the Cape Winelands District, Western Cape to counter the effects of drought differ.

1. What strategies do you use to ensure that your cost of production is effective?

Section E – Costing tools are in place to keep the cost under control from the effects of drought in Cape Winelands District, Western Cape.

1. What costing tools are in place to keep the cost under control from the effects of drought in Cape Winelands District, Western Cape?
2. What actions does management take if costs exceed the budget?

APPENDIX D: MOU

Cape Peninsula University of Technology

MEMORANDUM OF UNDERSTANDING BETWEEN POSTGRADUATE STUDENT AND SUPERVISOR

We, the undersigned, have read and agree to the general terms of the CPUT Memorandum of Understanding (MoU)* between research students and supervisors, and submit the following additional points of agreement in relation to the details of the intended work.

**Notes on MoU provided on page 6 of this document*

Research programme:

Post-doctoral	Doctoral	100% Masters X	50% Masters

1. **STUDENT DETAILS:**

Full name of student:	Ntsheytya Akhona
Student number:	214120260
Full-time or part-time:	Full-Time
Thesis title: Cost Implication of drought on operations of commercial farm businesses in Stellenbosch, Western Cape.	
Email:	akhonaacho@gmail.com
Telephone no:	0783009437
Faculty:	Business and Management Sciences

2. **SUPERVISOR DETAILS:**

Title, Initials, Surname:	Dr: OH. Benedict
Staff no:	30083110
Telephone no:	Ext 3283
Faculty:	Business and management sciences
Department or Unit:	Financial accounting and taxation

3. **SUPERVISOR'S EXPECTATIONS AND ARRANGEMENTS**

Supervisor's expectations:
After discussion, the supervisor should set out what he/she expects of the student in terms of reaching certain milestones or goals during the course of the research.
Expected date of submission of HDC 1.2 to FRC which should be within 6 months of initial registration: End of February 2020
Other expected milestones or goals: To graduate by April ~~2020~~ 2021 Student related milestones: Chapter 2 complete by 31 March 2020, Chapter 3 complete by 30 April 2020 Chapter 4 complete by 30 May 2020, Chapter 5 complete by 31 July 2020, Chapter 6 complete by 30 September 2020, Final submission end of November 2020.
Supervisor's plans and commitments:

The supervisor should record his/her plans for providing supervision, including the pattern and intended frequency of meetings, contributions from other researchers etc:
My plan is to render professional research supervision services to the students and to avail myself whenever the student wants to consult. I will refer the student to read academic that I deem fit and helpful.
Supervision arrangements:
(a) Expected absence of supervisor(s) on leave/ sabbaticals/ conferences (giving arrangements for supervision if away for more than 2 months in any one year)
N/A
(b) Field work: Outline arrangements for field work:
N/A
(c) Laboratory work:
N/A
(d) Outline lab arrangements (if any) and supervision arrangements for lab work:
N/A
(e) Estimated timing of formal seminars:
N/A
(f) Access to computers and software:
N/A
(g) Responsibility for payment of costs (printing, stationary, copying, etc):
Student is responsible for all such costs.
(h) Any departmental commitments by the student and details of remuneration:
Student is not a CPUT staff member, therefore any form of obstacle(s) should not be envisaged with reference to the research related matters and expectations.
(i) Courses and classes: List any class, workshop or course that the student must attend as a pre-requisite and costs associated with this. Clarify the responsibility for costs associated with these (if any).
The student is made aware of the workshops to attend on a timeously basis.

Co-Supervisory roles (if applicable): The role of co-supervisors should be clarified. It should be noted that any co-supervisory suggestions and proposals by the student should be discussed with the supervisor.
N/A

Funding plans: Specify any approved financial assistance to be provided, or organized, by the supervisor(s) to support this study (e.g. bursaries, teaching allowance etc.).
N/A
If, on withdrawing or being refused re-registration, the student becomes contractually obliged to repay any of the above, **this should be noted.** Funding from external agencies may stipulate such

a provision.
N/A

4. EXPECTATIONS AND PLANS OF THE STUDENT

After discussion, the student should set out any expectations and requests to the supervisor and the department	
To graduate in the April 2021 graduation ceremony	
Comment by the supervisor on this:	
The student and supervisor should record their agreed plan and broad timetable for the completion of the thesis. The candidate should be informed on the Faculty's maximum time limits for completion.	
Agreed intended date of completion:	

5. INTELLECTUAL PROPERTY ISSUES AND ETHICS

Intellectual property: CPUT policy on intellectual property (IP) is available on request. Students and supervisors should make themselves aware of University policies relating to both ethics and IP.
(a) **Authorship:** Points on authorship must be noted here by the supervisor, including arrangements about the order of listing of co-authors:
(b) **Ownership of intellectual property rights developed in the course of the research:** The IP emanating from research conducted at CPUT is (in general) owned by the University but additional points on this to be noted below:
N/A
(c) **Patents:** Should any patents emanate from this study, in whose name(s) will this be registered.
N/A

Assessment of ethics in research: The supervisor and student should discuss the ethical issues involved in the research project and record their conclusions here. The student should confirm here that she/ he is aware of the requirement to complete and submit an ethics form prior to collecting or analysing data.
The student is aware of ethical clearance that is required.

6. SIGNATURES:

Student signature:		Date: 20/02/2020

Supervisor signature:		Date: 20 February, 2020

7. CONFIRMATION BY THE HoD

I have reviewed this completed MoU and am satisfied that it reflects the shared understanding of the supervisor and the student and that the department is able to meet the obligations to candidates set out in this MoU:	
Name:	
Signed:	
Date:	

NOTES ON MEMORANDUM OF UNDERSTANDING

INTRODUCTION

The purpose of this MoU is:

- to provide a clear outline of what each party to the student-supervisor relationship may expect from the other,
- to clarify, from the start, the agreed roles and responsibilities of both candidate and supervisor, and
- to ensure that the supervision experience is as mutually productive as possible.

It is intended to promote the development and maintenance of a sound and productive relationship between the two parties. The resolution of any disputes that might arise between postgraduate students and their supervisors will be strongly informed by the content of this document.

For this reason, this document *extends* – and does not replace – any other agreements between the University and its students or staff and should therefore be read in conjunction with the general rules governing enrolment of students and the conditions of employment for staff.

INSTRUCTIONS:

The MoU must be completed and signed by master and doctoral students within three (3) weeks of initial registration (or within the first three (3) weeks of the term in which the student starts the dissertation/ project in 50 % master's degrees).

Both supervisor and student are strongly urged to read the guidelines in the booklet *Postgraduate Studies @ CPUT* prior to completing this agreement.

Three (3) copies of the MoU should be made: one for the supervisor, one for the student and one for the HoD.

CODE OF PRACTICE

This section defines the expected behaviour and attitude of all members of the university involved in postgraduate education and research. Students and staff should uphold the highest standards of professional and ethical conduct, in particular, relating to:

Academic standards: All parties must be committed to the relevant study and research programmes, striving for excellence. For students this requires attendance at, and contribution to, all the forms of learning (lectures, tutorials, laboratories, seminars, field trips etc) which make up their programme. Staff, in turn, must be committed to creating learning and research environments that encourage such scholarship.

Interpersonal Behaviour: All individuals should treat others with respect, and no-one should be subjected to unfair discrimination.

University Rules and Guidelines: All individuals should commit themselves to obeying all University rules and regulations.

Safety and Security: Staff and students must commit themselves to acting responsibly, safely, and with consideration for the welfare of all others with whom they come in contact, and to ensuring that security, both of people and property, is not compromised by their actions or inattentiveness.

Assessment and Examinations: Staff have the responsibility to treat all students fairly and impartially when assessing their work. Students must behave with integrity and absolute honesty. Incidents of plagiarism or cheating must be reported and dealt with appropriately.

Use of Resources: All parties must use institutional resources responsibly and diligently, accepting the necessity for accountability.

GUIDELINES FOR SUPERVISOR-STUDENT WORKING RELATIONSHIPS

Students and supervisors working together:

The completion of the research is primarily the responsibility of the student. The supervisor should ensure that the necessary facilities to carry out the project are made available to the student for a reasonable time, such time being sufficient to enable the project to be completed. Any changes to the research programme must be agreed between the student and the supervisor

The supervisor and the student must agree to meet regularly, with an agreed programme of meeting times (which may be flexible), and the supervisor will give timely feedback on the student's progress and will return any work submitted by the student within a reasonable time, normally three (3) weeks.

Research outputs and intellectual property:

Intellectual property (IP) generated in the course of postgraduate study belongs to the University. It may also be subject to confidentiality based on contracts and agreements pertaining to the research. The student must be made aware of such conditions by the supervisor and both must adhere to them.

The research project may produce novel outcomes and the student may be required to assign IP generated in the course of the project to the University or, if requested by the University to do so, to a third party designated by the University, including but not limited to a research sponsor. The student and supervisor will be entitled to share in any financial benefits which may accrue to the University and/ or the Department as a result of exploitation of project IP by the University, according to guidelines specified in CPUT policies.

The student must undertake not to enter into any agreement with a third party concerning the project (including but not limited to IP agreements and/ or secrecy agreements), without obtaining prior consent from the supervisor and, where necessary, the university authorities.

Bearing in mind such issues of IP or confidentiality, the student must discuss any proposed publication or presentation on the project with the supervisor prior to submission or presentation, and the supervisor will in turn discuss any proposed publication or presentation with the student.

APPENDIX E: ETHICAL CONSIDERATIONS FOR A QUESTIONNAIRE

Cape Peninsula University of Technology

Faculty of Business and Management Sciences
Ethical considerations for a questionnaire
Cape Peninsula University of Technology

Tick One Box: ☐ Staff Project
☑ Postgraduate Project (Masters and Doctoral level)
☐ Undergraduate Project (ND & BTech level)

The following two bullets are for research projects based and/or originating from an external university, organisation and/or entity.

☐ External research study (Y= Yes / N = No)
☐ External ethics approval has been given (Y= Yes / N = No)

Title of Project: COST IMPLICATION OF DROUGHT ON OPERATIONS OF COMMERCIAL FARM BUSINESSES IN STELLENBOSCH, WESTERN CAPE.

Name of researcher(s): AKHONA TATSHEMIYA

Name of Supervisor(s) (if appropriate): _____

		YES	NO	N/A
1	Will you describe the main experimental procedures to participants in advance, so that they are informed about what to expect?	✓		
2.	Will you tell participants that their participation is voluntary?	✓		
3.	Will you obtain written consent for participation?	✓		
4.	If the research is observational, will you ask participants for their consent to being observed?			✓
5.	Will you tell participants that they may withdraw from the research at any time and for any reason?	✓		
6.	With questionnaires will you give participants the option of omitting questions they do not want to answer?	✓		
7.	Will you tell participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	✓		
8.	Will you debrief participants at the end of their participation (i.e. give them a brief explanation of the study)?	✓		

If you have ticked No to any of Q1-8, you must ensure that the reasons for this are made explicit in your project proposal. [Note N/A = Not applicable].

		YES	NO	N/A
9.	Will your project involve deliberately misleading participants in any way?		✓	
10.	Is there any realistic risk of participants or researchers experiencing either physical or psychological distress or discomfort? If yes, give details on a separate sheet and state what you will tell them to do if they should experience any problems (e.g. who they can contact for help).		✓	

If you have ticked Yes to Q9 or Q10 you should ensure that your proposal describes in sufficient detail the appropriate procedures and provides a scientific justification for their inclusion. You should also identify alternative methodologies and outline the reasons why they were deemed inappropriate.

			YES	NO	N/A
11.	Does your project involve work with animals? **If yes, you should also investigate whether you require approval from the S.A. Health Professions Council and/or related organisation? Provide the answer to this in your proposal**			✓	
12.	Do participants fall into any of the following groups? **If they do, refer to professional body guidelines and include some reference to these in your proposal.**	Children (under 16 years of age)		✓	
		Schoolchildren of all ages.		✓	
		People with learning or communication difficulties		✓	
		Patients		✓	
		People in Custody		✓	
		People engaged in illegal activities (e.g. drug taking)		✓	

		YES	NO
13.	Does your study include administering a Psychometric test(s)? **If yes, name the test (s) and describe your or your supervisor's competence to administer such tests.**		✓
		YES	NO
14.	Will your study involve *any* contact with *any* external institution? **If yes, your proposal will not normally be approved unless you submit a letter of confirmation from the person responsible for this institution that they are happy for you to conduct your study on their premises and/or contact their staff and/or people who use the service.**		✓

There is an obligation on the lead researcher to bring to the attention of the Faculty of Business and Management Sciences Ethics Committee any issues with ethical implications not clearly covered by the above check list.

PLEASE TICK **EITHER** Statement **A** OR Statement **B** BELOW **AND PROVIDE THE DETAILS REQUIRED** IN SUPPORT OF YOUR APPLICATION. THEN PRINT OFF AND SIGN THE FORM

	Please Tick
Statement A: I consider that this project has **NO** significant ethical implications to be brought before the Faculty of Business and Management Sciences Ethics Committee .	✓

	Please Tick
Statement B: I consider that this project may have ethical implications that should be brought before the Faculty of Business and Management Sciences Ethics Committee, and/or it will be carried out with children or other vulnerable populations. **If you select this Statement please ensure that you outline clearly the ethical issues in your proposal.**	

If you ticked Statement B then please provide all the further information listed below in a separate attachment.

1. Your Name
2. Title of project
3. Purpose of project and its academic rationale.
4. **Full** description of methods and measurements
5. Participants: recruitment methods, number, age, exclusion/inclusion criteria
6. Consent and participant information arrangements, debriefing. **Please attach intended information and consent forms.**
7. A clear but concise statement of the ethical considerations raised by the project and how you intend to deal with them.
8. Estimated start date and duration of project.

This form (and any attachments) should be submitted to the Faculty of Business and Management Sciences Ethics Committee where it will be considered. **If any of the above information is missing, your application will be returned to you.**

I (student and/or supervisor) am familiar with the ethical practices in research.

I am familiar with the Cape Peninsula University of Technology Guide to Post Graduate Studies and Guidelines for Research Proposals.

Signed ....
Print Name......AKHONA [illegible]
Student Number...214120260.........
Date.....29|09|2019..............
(Undergraduate/Postgraduate researcher(s)/student

Signed ....
Print Name.................................
Date...................
(Lead Researcher or Supervisor)

Signed ....
Print Name.................................
Date...................
(Head of Department)

APPENDIX F: EDITING CERTIFICATE

NERESHNEE GOVENDER COMMUNICATIONS (PTY) LTD

REGISTRATION NUMBER: 2016/369223/07
DR NERESHNEE GOVENDER (PhD)
neresh@ngcommunications.co.za
0847022553
WRITING PRACTITIONER • EDITOR • COPYWRITER • TRAINER

PhD-Management Sciences: Marketing (gender and media); *PG DIP - Higher Education - Academic Developers (Cum laude;)* M-Tech Public Relations; B-Tech Public Relations *(Cum laude)*; B-Tech Journalism *(Cum laude)*; *N-Dip Journalism*

22/10/2023

AKHONA NTSHEYIYA

CPUT

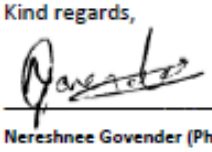
RE: EDITING CERTIFICATE

FOCUS AREA: COST IMPLICATION OF DROUGHT ON OPERATIONS OF COMMERCIAL FARM BUSINESSES IN CAPE WINELANDS DISTRICT, WESTERN CAPE

Dissertation submitted in partial fulfilment of the requirements for the degree - Master of Management Accounting in the Faculty of Business and Management Sciences at the Cape Peninsula University of Technology.

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

Kind regards,



Nereshnee Govender (PhD)