

Forward Trading as Strategy for Farmers in South Africa to Mitigate the Risks associated with Climate Change

- ***With a specific focus on farmers in the Western Cape, South Africa***

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I hereby declare that the Research Report submitted for the Bachelor of Commerce Honours degree to The Independent Institute of Education is my own work and has not previously been submitted to another University or Higher Education Institution for degree purposes

Abstract:

It is widely acknowledged that the ongoing changes in climatic conditions will have an adverse effect on agricultural production in Africa. This also holds for South Africa, where the country's food supply is heavily dependent on farming. With the current climate changes, sustainable food production is affected. Forward trading is a strategy used in various industries to hedge against risk. The problem of this study therefore relates to whether forward trading can be used as a possible strategy to minimise risk and protect farmers' income in the agriculture sector of South Africa. The methodology used within this study was a qualitative case study design investigating the use of forward trading in the agricultural sector in South Africa. Data was collected by a set of semi-structured interviews with farmers in the Western Cape. It was found that climate change does impact on farming in South Africa through changing weather patterns and the unpredictability of rainfall. It was also found that forward trading can be used as a strategy to hedge against the risks associated with climate change. However, forward trading as strategy was found to be more applicable to larger farms.

Key words: forward trading, climate change, agricultural sector, contracting and risk management

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1) INTRODUCTION:

1.1) Contextualisation

Farming is a very important sector for providing food for the nation as well as employment opportunities. Especially in the case of many developing countries around the world as it is often their main source of economic activity. Climate change has impacted many industries and has resulted in certain treaties and agreements such as the United Nations Framework convention on Climate change which deliberates what the United Nation can do in terms of limiting the global temperature increase and to manage the impacts of climate change as well as the Kyoto Protocol which occurs when developed countries become legally bound to reduce carbon and greenhouse gas emissions (United Nation, 2014). Despite this, it seems as if the consequences of climate change on agricultural sectors may have been underestimated.

Climate change has also had a direct impact on farming in South Africa. Blignauta, Ueckermann & Aronson (2009) states that it is “widely assumed that ongoing changes in climatic conditions will have an adverse effect on agricultural production in Africa” which suggests that there is a need to gain a better understanding of the impact that climate change has on the agricultural sector. Schaffnit-Chatterjee (2010) emphasises the risks associated with farming, including agricultural, price and production risks. Firstly, agricultural risks include two main aspects which is yield and price volatility. Secondly, price risk occurs when there are changes in the input and output price variability. Thirdly, production risk relates to climate change, diseases and water scarcity which often affect the efficiency of production levels. The current climate conditions are against the farmers in terms of the very serious water crisis, which has resulted in a drought in the Western Cape. This drought has directly affected the water availability for farmers within the Western Cape. This may affect the crop yield of the farmers harvest or result in loss of livestock.

Forward trading occurs when agricultural buyers and suppliers set agreements prior to the delivery regarding the quantity and price which may enable farmers with the opportunity to mitigate the risks associated with climate change. Agricultural buyers and suppliers set agreements prior to the delivery regarding quantity and price which is referred to as a forward contract. This allows the farmer to shift the price risk to the buyer; however, the farmer will forfeits the opportunity of getting a greater price on the open market as well as losing autonomy over business activities. Farmers in South Africa need to find viable long term strategies to mitigate these risks using strategies such as forward trading.

1.2) Rationale

The motivation of this study is to review the effects of climate change in both the long and short term agricultural success of South Africa and forward trading as an adequate strategy to mitigate the risk. South Africa's food supply is heavily dependent on farming and with the current climate changes; it has become a top priority to find solutions to the impact of climate change on farming. A possible strategy that provides the opportunity for farmers to reduce the impact of climate change is forward trading. However, the existing body of knowledge lacks information on this topic.

Climate change has generated serious consequences such as water scarcity, decreased availability of natural resources and rising input costs, where South African farmers are now experiencing these consequences. The Western Cape is currently experiencing the worst drought in over 100 years which has negatively affected farmers in the Western Cape. Forward trading can provide farmers with the opportunity to mitigate the risks of climate change by selling their harvest at current market prices. Therefore, when the harvest is complete; the market prices either increased or decreased.

1.3) Research Problem

The problem of this study therefore relates to whether forward trading can be used as a possible strategy to minimise risk and protect farmers' income in the agriculture sector of South Africa.

1.4) Purpose Statement

The purpose of this research is to justify whether farmers in South Africa can use forward trading as a strategy to mitigate the risks associated with climate change.

1.5) Research Question and Sub Question(s):

In what way can forward trading be utilised as a strategy to mitigate the impact of climate change on the agricultural sector of South Africa?

- (i) How does climate change impact on agricultural performance?
- (ii) Can farmers mitigate the risks of climate change by using forward contracts?

- (iii) What lessons can South Africa's agricultural sector learn from international evidence on the use of forward trading?

1.6) Organisation of study

The rest of the assignment is structured as follows: Chapter two focuses on the theoretical background as well as the literature review. Chapter three explains the methodology and the research design. Chapter four covers the findings and interpretation in terms of the literature, relevant theories and interviews, whilst chapter five present some concluding remarks as well as including ethical considerations and limitations.

2) LITERATURE REVIEW

2.1) Introduction:

This study attempted to critically examine the relationship between climate change and the agricultural sector; as well as whether forward trading is a viable strategy to mitigate the risks associated with climate change within the agricultural sector. By creating an understanding of the relationship between climate change and the agricultural sector, it can be investigated whether or not forward trading can help mitigate the risks within the agricultural sector. Forward trading occurs when agricultural buyers and suppliers set agreements prior to the delivery regarding quantity and price. This allows the farmer to shift the price risk to the buyer; however, the farmers may lose the opportunity of getting a greater price on the open market (Schaffnit—Chatterjee, 2010)

Climate change has had a direct impact on farming all over the world, but also in South Africa. Blignaut et al. (2009) states that it “widely assumed that ongoing changes in climatic conditions will have an adverse effect on agricultural production in Africa”. For example, a serious consequence of climate change is the water scarcity and draught problems that are currently experienced in South Africa. This therefore adds to the various other risks that the agricultural sector are already exposed to, such as price, production, market-based and public risks according to Schaffnit-Chatterjee (2010)..

Farmers in South Africa need to find viable long term solutions to mitigate these and other risks. Forward trading which relates to buying and selling commodities that are settled at a future date; is one such strategy that can be implemented to mitigate some of the risks that farmers are exposed to.

2.2) Theoretical Foundation:

2.2.1) A theory of futures trading (Phillips, 1966)

A theory of futures trading suggests that the futures market will allow the division of labour between functions, storage, production, price formation and uncertainty bearing in order to reduce their supply price in the areas which they operate. In addition, this is mainly through specialisation and the increased scale of operations. Furthermore, the theory emphasises that futures trading improves the allocation of resources through time. There are certain activities that are crucial to attain co-ordination, namely, establishment of “buyer-seller communication, transportation, financing, storage, price formation and uncertainty bearing” (Phillips, 1966) where the future market can facilitate this co-ordination through time. Therefore, this will allow handlers, processors and producers of the commodity to transfer price risk and uncertainty bearing functions over to the speculators or buyers. Farmers can use futures trading in order to allocate time more efficiently where they can focus more on productivity. This reduces the stress of selling their produce directly after their harvest. Through the futures market, farmers can efficiently and effectively divide labour between functions, storage, production, price formation and uncertainty bearing. The theory of futures trading can assist farmers in co-ordinating business activities as well as transferring certain risks to agricultural buyers and speculators.

2.2.2) Economic theory of contracts (Nelson & Loehman, 1987)

The economic theory of contracts is applicable to insurance within the agricultural sector where the Pareto-optimal insurance contracts are legally fair; provide full coverage as well as differing for individuals. Pareto optimality is often difficult to attain due to information problems in terms of moral hazard and adverse selection. However, there are certain ‘second best’ alternatives that can be implemented for agricultural insurance. The information collected and application of contract design principles within ‘second best’ alternatives can provide the advantages of insurance at a lower cost than the current practice of public subsidies. The economic theory of contracts is an opportunity for farmers to insure themselves against certain risk by using contracts. The contracts can be for different purposes where they can use a production contract, marketing contract and/or forward contracts. These legal contracts can fully cover the farmers produce which is often a priority for risk-averse farmers. Certain alternatives offer farmers with the opportunity to receive insurance at a lower cost than existing practice of public subsidies.

2.3) Empirical Literature

2.3.1) The impact of climate change on the agricultural sector

Goldblatt (2016) states that farmers and their supply chain need to recognise the increasing needs and the changing of consumer preferences. Declining profitability and water scarcity has caused a shift trend towards intensified agriculture which produces at increased levels of inputs and outputs. Rising input costs, finite natural resources and tenure insecurity pose a threat as well. South Africa is a dual agricultural economy with both well-developed commercial farming and smaller-scale communing farming. Changes in farm production or price which are often driven by climate change, droughts or floods, may change the farmers' short term and long term income (Schaffnit—Chatterjee, 2010).

“Climate change is now affecting every country on every continent. It is disrupting national economies and affecting lives, costing people, communities and countries dearly today and even more tomorrow” (United Nations, 2016). The crops yields will decrease by 5% for every 1 degree that the global temperature increases. Furthermore, 1 degree may not seem high but it can have detrimental effects on the environment. Major crops yields have depleted tremendously at an international level which has resulted in a reduction of 40 megatons of produce between 1981 and 2002 which is a direct result of a warmer climate (United Nations, 2016).

Hatfield, Boote, Fay, Hahn, Izaurralde, Kimball, Mader, Morgan, Ort, Polley, Thomson & Wolfe (2008) states that the critical temperature ranges of crop species differ in terms of their life cycle development. For every plant species, there is a base temperature at which growth commences where there is an optimum temperature at which plants develop as fast as possible. The cardinal temperature of plant species directly influences the crop yield. Plants that have cooler cardinal temperature ranges decrease in crop yields as the temperature increase. However, yield reduction with increasing temperature may also be due to lack of rainfall in certain regions such as the severe drought in the Western Cape. Increases in temperature will have the largest influence prior to or during the critical pollination phases. The sensitivity and ability of crops to compensate during later periods of improved weather depends on the molecular structure of each crop. An economic consequence of excessive rainfall threatens the profits of farmers who paid a premium for early season production of high value crops such as melon, sweet corn and tomatoes (Hatfield et. al., 2008).

Zwane & Montmasson-Clair (2016) posits that there is an absence of a natural political agenda around climate change with a lack of guidelines for local government to translate national climate change. The South African government

has not proposed sources of financial policies for adapting the agricultural sector. Policies fail to recognise that the availability of water supplies may limit the expansion in certain areas. Climate change poses a major threat to South Africa's water supply, food security and various other aspects. Climate is a significant driver of agriculture in South Africa. Therefore, if the climate is changing, this will impact on the efficiency and productivity of farmers in South Africa.

Goldblatt (2016) claims that declining profitability, water scarcity (due to climate change), rising input costs, finite natural resources and tenure insecurity pose a major threat to farmers in South Africa. Furthermore, there are a number of barriers for South African farmers (Zwane et. al., 2016). Technological barriers, where the majority of policies focus on irrigations technology and with the current state of water availability in South Africa; this may prove to be either advantageous or detrimental to the productivity of the agricultural sector. Financial barriers include no prioritisation on the funding to implement proposed climate change strategies. Therefore, if these strategies are not implemented, it may decrease the efficiency of farmers coping with the challenges of climate change. Institutional barriers include very little attention given to the need to capacitate extension services and strengthen weather and climate forecasting within South Africa. Socio-economic barriers stress that the majority of policies are silent on development of infrastructure and the effects of climate change on food security. Infrastructure needs to be updated in order for farmers in South Africa to compete in the global market. Market-related barriers apply to policies that do not view the interaction between climate change, trade and agriculture. Changes of the output and input prices are known as prices risk, whereas unpredictable events are classified as yield or production risks (DraKoln, 2011).

DraKoln (2011) suggests that the reduction in farm productivity and efficiency results from risks negatively impacting on farming operations. Banks usually are reluctant to advance credit to businesses within risky industries. Therefore, farmers have the opportunity to use forward trading and other contracts in order to acquire monetary funds to finance operating expenses. With increased price risks, farmers need to allocate more time and resources to marketing decisions. In addition, farmers can analyse the markets to assess the right price at the right time. Through altering production techniques, diversifying farming operations or by utilising contracts; farmers can shift the risks to buyers. The economic theory of contracts (Nelson, et. al., 1987) claims that contracts are an opportunity for farmers in South Africa to self-insure themselves against certain risks.

South Africa needs to enable a more sustainable approach that looks to alleviate and adapt to climate change. According to Goldblatt (2016), there is around 12% of the country that receive rain in areas of fertile soil. The predictions of climate

change shows that there will be infrequent rainfall but more rain which means there will be periods of heavy rainfall followed by longer periods of limited rainfall. In addition, there is no water surplus in South Africa which will constrain the future development in South Africa. There are a few ways to increase water supply by removing invasive alien plants that can almost use double the amount of indigenous plants. Another method can be to restore and protect wetlands. There are a variety of technical solutions that exist where the agricultural sector can contribute to climate change mitigation and adaptation solutions. However, without policies or regulations, autonomous efforts by farmers will not be significant enough to create a sustainable agricultural sector (OECD, 2015). Therefore, government needs to play an active role in setting policies and regulations around the concept of climate change and its impact on the agricultural sector.

Goldblatt (2016), states that South Africa has a diversity of vegetation, climate and soil types where the climate-soil combinations leave only 12% of the land being suitable for production of rain-fed crops. However, only 3% of the land is truly fertile. The water availability has also diminished drastically as well as there being less than two-thirds of the farms in South Africa, compared to two decades ago due to climate change, either directly or indirectly. There has been a decrease in profits in recent years which could be a reason why there has been a decrease in farmers within South Africa. Therefore the remaining farms have generally improved their irrigation, energy, fertiliser, mechanisation and genetically modified seed input. OECD (2015) suggests that climate change is a challenge faced by the agricultural sector which is negatively affecting both crop and livestock in most countries around the world. Although agriculture is affected by climate change, agriculture contributes a significant share of greenhouse gas emissions which causes climate change. Agriculture contributes around 17% of all greenhouse gases, globally. However, unlike other industries, the agricultural sector has the potential to drastically reduce carbon emissions.

2.3.2) *Forward trading as solution to climate change in the agricultural sector*

Contracts have the potential to reduce farmers' price risks by 90% (Schaffnit-Chatterjee, 2010) or more as well as being able to substantially reduce yield risk. Marketing contracts also have the potential to decrease farmers' output risks where these contracts allow for the control of the production process to be in the hands of the farmer (Schaffnit—Chatterjee, 2010). Forward marketing contracts have the ability to establish a base price prior to harvest which commits the farmer to the delivery of a specific quantity within a predetermined time. Forward contracts occur when agricultural buyers and suppliers set agreements prior to the delivery regarding quantity and price. This allows the farmer to shift the price risk to the buyer, however, the farmers losses the opportunity of getting a greater price on the open market (Schaffnit—Chatterjee, 2010). Forward contracts therefore provide the ability for farmers to establish an exact or base price that links the contract price to the future price. Price risks are therefore eliminated when farmers offset price fluctuations in the contracted crop through the use of hedging in the form of a future contract. Marketing contracts allow farmers to mitigate risks connected to input prices (Schaffnit-Chatterjee, 2010).

DraKoln (2011), states that production contracts enable farmers with the opportunity to eliminate the need for short-term credit in order to finance operating expenses. In addition, production contracts allow for the control of the production process to be in the hands of the buyer (Schaffnit—Chatterjee, 2010). Risk reduction benefits farmers, therefore farmers are expected to accept contracts that offer lower returns than they could expect from independent production. Farmers derive satisfaction from holding full-autonomy over production. However, contracts may force farmers to give up their autonomy. Autonomy allows farmers to have independence and a sense of responsibility however; contractors will compensate farmers for giving up full-autonomy. Farmers place value on both risk reduction and autonomy therefore risk-averse farmers will accept a smaller average income in exchange for decreased income variability.

The economic theory of contracts (Nelson, et.al, 1987) suggests that farmers can make use of 'second best' alternatives that provide the benefits of insurance at a lower price than the existing practice of public subsidies where these alternatives can be used for specific functions such as marketing, production and/or forward contracts. Contracts have the potential to facilitate farm expansion, partially through risk reduction (DraKoln, 2011). The production and market contracts allow farmers to acquire credit easier in order to facilitate expanding operations. Furthermore, South African Banks would rather lend to forward contract producers than to independent producers, even if the two farms have similar

assets as this provides less risk for the banks. Therefore, contract producers have the potential to produce more than independent producers whom have similar levels of wealth. For example, a contract farmer can borrow R1.60 per R1.00 in assets where as independent farmers can only borrow R0.40 per R1.00. Johannesburg Stock Exchange (2011) suggests that an agricultural derivative plays an important role in determining prices in the local market as well as providing an effective price risk management facility. Therefore, farmers can utilise the derivatives market in order to optimise their risk management.

Zwane et. al. (2016) states that government play an important role in the climate change strategies. The notable absence of a strong national political agenda around climate change (and the natural environment more generally) in South Africa means that very little political or fiscal support exists for local programmes.

Adelegan (2009) states that in South Africa, the deregulation of the agricultural market in 1995 led to the creation of the agricultural commodity futures market where the government committed to stay out of the price determination process in the agricultural market. The theory of futures trading (Phillips, 1966) suggests that future trading enables farmers in the South Africa to efficiently co-ordinate their business activities and transfer certain risks to agricultural buyers and speculators through the use of futures or forward trading. An advantage of the derivatives market in South Africa is that it enables farmers to self-insure themselves against the volatility of capital flows. The dependence on banks may be reduced and through introducing the commodity futures, they can improve their seasonal risk management, although it is more efficiently achieved through appropriate regulation and supervision.

It is said to be that futures trading in commodities originated in Japan in the 18th century for silk and rice. In Osaka, Japan, the Dojima Rice Exchange was seen as the world's first organised futures exchange, this started in 1710 (Srinivasan, 2008). Srinivasan (2008) also suggests that in India, the first organised trading in commodities futures was said to have commenced in the latter half of the 19th century within the Bombay Cotton Trade Association Ltd. which was established in 1875. Commodity markets within the pre-independence era were restricted where there were no uniform guidelines or regulations. Trade in the pre-independence era was usually based upon mutual trust and social control. The Bombay Forward Contracts Control Act, enacted by the Bombay State was introduced in 1947. The regulations of organised forward trading and the recognition of exchanges were only introduced after the adoption of the constitution through legislation called The Forward Contracts Act 1952. The very first pork belly contracts emerged in 1961 and was implemented by the Chicago Mercantile Exchange (CME) (DraKoln, 2011). The following is an example of typical contract of a trader buying and selling pork bellies; Pork Belly (PB) 2016

September (Q) at \$1.10563/Pound. The contract is based on the current price multiplied by the definite value of the contract. The commodity trade is based on a margin where the margin may change based on the volatility of the market or the current face value of the contract. Contracts in commodities are customised; therefore price movements have its own distinctive value.

DraKoln (2011) posits that contracts can diminish the majority or all risks associated with output price risk, as well as input price risks. Contracts that provide inputs were around 70% of operating expenses under pork belly production contracts. Pork belly production contracts may contain certain production risks because of the adjustments to base payments to reflect feed productivity and death losses. Empirical data generated through the analysis of pork belly contracts showed that forward production contracts can greatly reduce risks.

Srinivasan (2008) states that, generally, food prices tend to be more volatile than the prices of manufactured goods. This uncertainty often leaves farmers open to the risk of receiving a lower price than the expected price of the farmers yield. Often, this leaves the farmer at risk of being unable to repay back the loan to the bank. An adequate risk management should therefore be an important aspect for farmers. Forward trading could help hedge or mitigate this risk. Hedging Risks can be done by “setting up an investment position which helps to protect against losses from a related investment” (Pettinger, 2008). Investors often weigh up different positions when investing and may hedge against risky investments by buying a safe asset for every risky asset (Pettinger, 2008). Forward trading can reduce the price risk which involves minimising the risks involved in commodities trading. Through future contracts, this risk can be shifted to traders who are willing to accept the risk. Therefore, farmers can utilise future contracts in order to transfer certain risks to potential buyers and speculators. It is possible for a hedger to mitigate risks by taking opposite sides in the futures and cash markets as the two markets usually move in a similar direction. Therefore, the profits of one market will cover the losses of the other market. In the case of a farmer, a commodity seller, the future contracts offer protection from plummeting prices. In addition, the theory of futures trading (Phillips, 1966) claims that future and forward trading can assist farmers in allocating their time more effectively in order to focus more on productivity. Through specialisation and increased scale of operations, farmers in South Africa can utilise future trading to more efficiently divide their labour between functions, storage, production, price formation and uncertainty bearing.

Agricultural contracts allow farmers to shift the risks to the contractor or buyer. Therefore there has been an increase in agricultural production through marketing and production forward contracts. Production contracts allow for the

control of the production process to be in the hands of the buyer. Marketing contracts allow for the control of the production process in the hands of the farmer. These contracts are agreements and obligations between farmers and buyers that have been reached, prior to harvest. The date, price, and production practices are often specified within these contracts. This allows the contractor to have a greater control over the decisions within the production process (DraKoln, 2011). Therefore, farmers lose a substantially amount of autonomy but significantly reduce their price and production risks.

Mitigating risks associated with farming is a necessity for farmers. Schaffnit-Chatterjee (2010) states that farmers in the agriculture sector try to mitigate risks associated with farming. Therefore, forward trading, such as forward and future contracts, are utilised to mitigate these risk in order to diversify production crop sharing. In addition, the derivatives market can be used as a tool to mitigate or transfer the risks linked to price uncertainty. The nature and volume of a harvest is always unknown, therefore farmers decide what and how to produce. Furthermore, hedging the price risk can be done through the derivatives market by using forward and future contracts. If the market prices have decreased, the farmer will therefore gain marginal income due to the decrease in market price, which is desirable position in terms of the farmer. However, if the prices increase then the buyer will be a favourable position as they will save in terms of the marginal increase. However, both positions have benefits for the farmer as the contracts substantially reduces risk during the production phase. Forward contracts can be used to create uniformity in commodities, stabilise volumes of productions, as well as to decrease production costs. Contracts also allow for the coordination of the production of differentiated products. Contracts can have a major impact on farmers and the organisation of farming.

Schaffnit-Chatterjee (2010) states that forward trading and other derivatives are utilised more in the EU than in the United States. The larger farms in both the USA and the EU make use of risk management strategies more than the smaller farms. Around 60% of Polish farmers also show interest in hedging risks. However, this interest of farmers in hedging increases proportionately as the size of the farm increase. This shows that farmers around the world are moving towards farming under contracts to enhance risk management.

DraKoln (2011), states that the growth in contracting has resulted in the diminishing use of the spot or cash market, where farmers have full autonomy and receive prices that are based on certain conditions within the market at the time of sale. Risk-averse farmers put importance of risk reduction who seeks to avoid fluctuating input and output prices. "Agricultural contracts covered 41 percent of the value of U.S. agricultural production in 2005, up from 39 percent in 2003" (Kunkel & Peterson, 2015). The share of production through contracting is

continually increasing. Larger farms are much more likely to utilise contracting as only 6% of small farms use contracts whereas 60% of larger farmers use contracts. Therefore, larger farms in the US and around the world are more likely to use forward trading as a strategy than smaller farms.

Farm production is shifting towards larger farms around the world and contracts rather than smaller farms that use spot markets (DraKoln, 2011). This is a result of increase technological developments. Reduction in financial risks resulting from marketing and production contracts support the shift stated above. Contracts provide benefits for farm operators from reduced risks. However, this is at the expense of autonomy and managerial control where contracting expansion is likely to increase due to the considerable gains to contractors and with the implications for farm size and farm operational risks.

2.3.3) Types of risks due to climate change

The agricultural sectors is a risky industry, farmers can use forward trading to reduce these risks. According to Schaffnit--Chatterjee (2010), there are two important risks that farmers are faced by, namely, yield and price volatility. Climate change creates extreme weather conditions which negatively affect farmers yield. There are certain other risks associated with agricultural, including (Schaffnit—Chatterjee, 2010):

- (i) Production risks – these risks can include climate change, diseases and water scarcity and often effect efficient production levels. Often, this occurs in terms of crop yields and livestock production. These production risks often include climate change, disease, technological changes and natural resource management such as the current water scarcity.
- (ii) Price and market risks – these risks include changes in the input and output price variability as well as in terms of the food produce supply chain. The integration of the supply chain comes with the risk of quality, safety, new products etc.
- (iii) Regulatory risks –Such changes that are made in agricultural or trade policies, changes in the government which can either negatively or positively influence the farmers efficiency and productivity. These policies are often in the form of subsidies, environmental legislation/regulations and/or food security regulations.
- (iv) Technological risks – these are risks associated with new and innovative technologies.
- (v) Financial risks - these risks are subject to credit, interest and exchange rates. This is often a result of the variations in the methods of financing fa farming business.
- (vi) Counter- party risk: All these cash contracts contain counter-party risk which involves the risk of the buyer either not paying on time or showing up. Counter-party risks are reasonable and are extensively accepted in the United States. One advantage of these contracts is time management as farmers may not have enough time to be able to sell their produce. One disadvantage is that these contracts may require larger transaction costs due to finding and negotiating with potential buyers.

2.4) Conclusion:

The review of the literature laid down the theoretical foundation for the study on forward trading as strategy to mitigate risk in the agricultural sector. It also provides the necessary context to the study as it situated the study in the current literature. From the literature overview, the following conclusions can be derived.

Climate change has had a major negative effect on farming in South Africa which has resulted in declining profitability, water scarcity and finite natural resources. South Africa has yet to create an approach to deal with climate change, however, South Africa needs enable a more sustainable approach that looks to alleviate and adapt to climate change in order to create a sustainable agricultural sector in South Africa.

Climate change has had a negative effect on farming as it has resulted in declining profitability and water scarcity and the South Africa government has yet to implement a sustainable approach that looks to alleviate and adapt to climate change. The government plays an important role in providing political and financial support to local farmers, however, farmers in South Africa lack the necessary support from the government where they do not receive much fiscal or political support. South Africa also does not have a water surplus which may inhibit the future development of the agricultural sector. These risks pose a real threat to South Africa's agricultural sector. However, South Africa has an opportunity to develop more forward trading agreements to reduce or mitigate these risks associated with climate change within the agricultural sector.

Although there are contradicting views of forward trading, if implemented correctly, through the use of various contracts, forward trading may be a successful strategy to help mitigate the risk of climate change. An important finding of forward trading is that it is more applicable to larger farms through the use of marketing and production contracts. Production and market contracts have allowed farmers around the world, to obtain credit easier in order to expand operations. Agricultural forward contracts allow farmers to shift the risks to the contractor or buyer. However, farmers lose most of their independence and autonomy.

3) METHODOLOGY:

The following section will attempt to explain why certain methods were used within the study as well as describe the research strategy. The strategy includes the research design and the research plan (methodology).

3.1) Research Design:

3.1.1) Research Paradigm:

Interpretivist paradigm is used to create an in-depth understanding on the phenomenon. This research used an interpretivist (interpretivism) approach. Human beings are fundamentally different from objects and therefore should be analysed in a different way. In addition, human beings are constantly changing as well as the environment in which they live. This environment includes the physical environment which is an important concept within this research as climate change has a direct impact on the physical environment (Du Plooy-Cilliers et. al., 2015). Interpretivism is used to understand and describe human behaviour relating to a certain phenomenon. Therefore, the interpretivistic approach assisted in understanding and describing farmers' behaviour towards climate change and in what way they have dealt with the impact of climate change. In addition, it was used to understand and describe the extent to which climate change has impacted farming in South Africa. This paradigm was also used to explore how forward trading can assist in mitigating the risks associated with climate change. This research approach was in the form of a qualitative study in order to explore how climate change has affected farming in South Africa.

The paradigm of this study was an interpretivistic paradigm which contains subjective, observable facts from the base of the study. This paradigm complemented this study as subjective information held trustworthiness etc. (Maree, 2016). In addition, it holds meaning to a set of individuals whom assign this meaning to climate change and its impact on the agricultural sector. This further increased the trustworthiness of the case study where information gathered in the data collection phase was all based on subjective data. Interpretivism allowed for a qualitative data collection and analysis method which assisted to critically examine the relationship between climate change and the agricultural sector as well as examining the use of forward trading. The use of intersubjective meaning is important when understanding climate change, forward trading and the agricultural sector.

Forward trading can allow farmers to take action in order to review the way that climate change has impacted on the agricultural sector. Subjective research was utilised in the interpretivistic paradigm, therefore, it allowed for the description of climate change and the meaningful interactions between forward trading and the agricultural sector. The interpretivistic paradigm assisted in describing and exploring what way the increasing use of forward trading can help mitigate the risks associated with climate change. Therefore, the interpretivistic paradigm was an appropriate choice for this research study.

3.1.2) *Design approach:*

This study followed a case study approach in which empirical data was used to analyse how forward trading can mitigate the risks associated with climate change in South Africa. Yin (2009: 18) states that a case study is an empirical inquiry around a climate change which is set within its real-world context; this is especially the case when the boundaries are not clearly evident between climate change and the agricultural sector. Therefore, a case study complemented this research study in order to obtain an understanding of the relationship between climate change, forward trading and the agricultural sector.

The case study approach allowed me, as the researcher to analyse literature from global facts and then analyse and compare the data from a South African perspective and focus on the agricultural sector. The case study and the set of interview were utilised in answering the research questions and assisted in solving the research problem optimally. The case study and the set of interviews were an ideal strategy to address the research purpose. These were in the form of subjective qualitative methods.

Inductive Approach was utilised within this research study where theoretical concepts were inferred from the collected data and the analysis of the specific study (Du-Plooy Cilliers et. al., 2015). This study made use of an inductive approach by building on a new theory. The idea was to critically examine whether or not forward trading is used as strategy for farmers in South Africa to mitigate the risks associated with climate change in order to build a greater understanding of the impact of climate change on the agricultural sector. An inductive approach view smaller sample sizes as more appropriate, therefore, this study contained a relatively small sample size. This research study also took the form of an applied research type where this study looked to critically examine a solution (forward trading) to a social problem (climate change) within the agricultural sector. Applied research was also evident as this research study may provide new areas of potential research (Du-Plooy Cilliers et. al. 2015).

Qualitative researchers do not convert their observations or their participants of the study into numerical form as well as not separating out part of the interaction from the whole. The ultimate aim was to explore, understand and describe a phenomenon through human beings. Therefore, the ultimate aim of this study was to explore, understand and describe climate change through the perspective of farmers in the Western Cape and if forward trading could be used as strategy to mitigate the impact of climate change. The research was also done in a continuous and cumulative process. In addition, the

concept of the design coherence of the qualitative data collection method was always aligned with the research question/problem, the purpose of the study, the goals of the study and methods within the interpretivist paradigm which was chosen for this research proposal. This above statement is also crucial to ensure the trustworthiness of the qualitative research study (Du Plooy-Cilliers et. al., 2015).

3.2) Research Plan (Methodology):

3.2.1) Population:

Target Population- The target population is everyone which resides within the population parameters while the accessible population which is who we can actually reach and include in the study and this is often partially of the Intended (target) population with reference from Du Plooy-Cilliers et.al. (2015). The target population of this study was farmers within South Africa. The target population was chosen in order to understand whether farmers are utilising forward trading as strategy to mitigate the risks associated with climate change.

Accessible populations- The accessible population of this study consisted of farmers in the Western Cape. Due to time and geographical constraints, this studies accessible population consisted of farmers in the Western Cape. However, this will generate an understanding of the benefits and limitations of forward trading for South Africa as a whole.

Units of analysis- the population of a study consists of all units that possess the attributes or characteristics of which the researcher is concerned with. This is where all the information is gathered within the specific population. The population should be aligned with the research question and the research purpose (Du-Plooy Cilliers et. al., 2015). The unit of analysis within this study will consist of farmers in the Western Cape. Within this study; interviews were conducted with 3 farmers within the Western Cape. Therefore, the units of analysis will be human beings and the social phenomenon of climate change.

3.2.2) Sampling:

A sample is referred to as the subset of the population that is considered to be representative of the population. There are two types of sampling, namely probability and non-probability sampling (Du Plooy-Cilliers et. al., 2015).

Stratified purposive sampling was used for this research proposal as it was difficult to reach all organisations and social artefacts within the population where generalising the results was not the aim of the research study, rather to understand and describe the phenomenon of climate change and the concept of forward trading as a strategy to mitigate the risks associated with climate change (Du Plooy-Cilliers et. al., 2015). Stratified purposive sampling is a hybrid approach which the aim was to select groups that display differences on the meaning of climate change and forward trading within the agricultural sector. However, each group selected were still relatively homogeneous in order to compare subgroups (Nieuwenhuis, 2016; 86).

The sample within this study was chosen with a certain purpose in order to fully represent a phenomenon or group to specific criteria. The criteria are as follows (Nieuwenhuis, 2016; 85):

- The sample was chosen in accordance with the stated research question and the conceptual framework. Therefore, farmers in the Western Cape were ideal for purpose of this research.
- The sample was able to establish rich information on climate change, the agricultural sector and forward trading. Farmers form part of the agricultural sector, therefore, information provided was from personal experience on climate change.
- The sample was chosen in order to generate transferability. Information gathered from the farmers was subjective and trustworthy which generated a degree of transferability.
- The sample was able to generate credible descriptions of climate change and the agricultural sector. As stated above, the sample of farmers have had personal experience with climate change and within the agricultural sector. Therefore, these descriptions and understanding retain credibility.

- Ethical preconditions will be considered when selecting the sample. The ethical consideration outlined in the conclusion were utilised to select the sample.
- The feasibility of the sample will be taken into consideration. The feasibility was also considered as certain limitations reduced the sample size.

The sample of the case study included textual data that has been published between the years 2008-2017 (excluding seminal data).

The sample of the interviews was with three farmers from three separate food industries. The farmers in this study were from the wheat, barley, canola and meat producing sectors; within the agricultural sector. The sample chosen was ideal for this research study as it assisted in understanding and describing climate change and its impact on the agricultural sector as well as providing information on whether forward trading is a strategy used by farmers in the Western Cape.

3.2.3) Data-collection methods:

This study consisted of qualitative data collection methods. The following section will explain the collection method that was used to collect the data to assist in answering the research question. The collection method within this study was a review of the literature and a set of interviews with farmers in the Western Cape. The specific questions within the interviews were constructed in such a way to explore how forward trading can be used as a strategy to mitigate the risks associated with climate change. Therefore, the methodology was in the form of a case study in order to critically examine the presence of forward trading in the agricultural sector around the world. This resulting case study was then applied to a South African perspective. The study also included interviews with several farmers within the Western Cape to identify the presence of forward trading as a strategy to mitigate the risks associated with climate change.

Interviews take place when the interviewer will ask the selected participants questions in order to gather data and to learn about the ideas, views and beliefs around climate change, forward trading and the agricultural sector. Farmers will provide subjective data on the relationship between climate change and the agricultural sector and whether forward trading is currently being used as a strategy to mitigate the impact of climate change. Qualitative interviews were used to view the world through the participants' eyes which can generate valuable information. A semi-structured interview was utilised within this study which was based on a certain line of inquiry generated by the researcher. This interview consisted of initial open-ended questions (and specific yes/no questions) where these questions will be followed by supplementary probing questions (Nieuwenhuis, 2016; 92-93).

The case study design allowed this study to critically examine the presence of forward trading within the agricultural sector globally. It also established whether forward trading has assisted farmers around the world to mitigate the risk around the world. These results were then applied to a South African perspective. The interviews with farmers in the Western Cape were used to understand the way forward trading has helped farmers in South Africa mitigate the risks associated with climate change. In addition, the case study was not confused with the literature review where the literature review attempted to describe past and current research on whether or not forward trading is being used as a strategy to mitigate the risks associated with climate change. However, when using textual data in a case study; the focus was on all available written communication that may shed more light on forward trading within the agricultural sector and whether or not it is being

used to mitigate the risks associated with climate change (Nieuwenhuis, 2016; 88).

3.2.4) Data-analysis methods:

As the data collection methods are going to be qualitative, the data therefore, was analysed through the means of a qualitative data-analysis method. The data analysis methods for this study took the form of a thematic analysis through the use of coding. In addition, certain themes and criteria from the literature were utilised within the data-analysis phase. The nature of qualitative data analysis and interpretation is that it is (Du Plooy-Cilliers et. al., 2015):

- (a) Textual – through analysing texts and existing literature, such as the responses in interviews, questionnaires and observations, in other words, the interpretation of somethings meaning. Interviews with the respective farmers in South Africa created an interpretation and understanding of climate change and how it has effected farming South Africa
- (b) Iterative – a continuous cycle in which the researcher will repeat the analysis and interpretation process over and over again in an attempt to isolate and refine the embedded meaning of the texts under investigation. This perspective allowed this study to identify and explain the embedded meanings of whether or not climate change has a real and definite effect on the agricultural sector.
- (c) Hermeneutic – the focus is on the subjective understanding rather than the quantitative explanation of human behaviour. This benefited this study as understandings of human behaviour around climate and forward trading as a strategy to mitigate risks associated with climate change.
- (d) Subjective – this means understanding the subjective experience of participants using a systematic and rigorous data analysis.
- (e) Constructed and symbolic – this includes inquiries into the construction of reality, where individuals construct their own world on subjective experience.

The data analyses within this study began by systematically organising the data. Key underlying assumptions were also identified where planned

strategies and the conceptualisation assumed that there was a possible pattern that was revealed when analysing the case study which is often referred to as pattern matching. This allowed for the generation of certain key aspects surrounding climate change, forward trading and the agricultural sector. However, when the actual collection phase began, certain changes occurred within these patterns. Furthermore, the data sources were integrated and different sources weren't treated independently. The interviews were analysed in a multi-perspectival manner where the study also considered the perspective of the participant and all the groups of the participants and their respective interactions (Nieuwenhuis, 2016; 108). Themes were also established to critically examine forward trading as strategy for farmers in South Africa to mitigate the risks associated with climate change. Themes assisted in creating a logical and systematic flow of the interpretation of the findings.

There were interviews with a small group of farmers; therefore a case study methodology was implemented. The data analysis was a thematic content analysis of the transcripts in the form of thematic coding. Thematic content analysis was utilised in this study to systematically compress an abundance of texts into less categories in terms of the explicit rules of coding (Nieuwenhuis, 2016; 111). Coding is process that was used to read through textual data and divide it into analytical units. This enables the study to go through the data with relative ease. Content analysis was a useful tool within this study as it allowed for the discovery and description of whether forward trading is strategy for farmers in South Africa to mitigate the risks associated with climate change.

4) Findings and Interpretation:

Some farmers use different short-grow cultivars of wheat and barley which has a shorter grow time. In addition, a couple of farmers also do not use till planting machines which allows the soil to keep more moisture.

Some farmers have silos on the farms where he keeps grain if the prices are not good. This allows them to gain the best prices for their produce. Furthermore, all the farmers agreed that there is a lot of new technology in place that can help them change and adapt their farming methods.

Forward trading is a possible strategy but it is more applicable to big farms. The farmers need to know the market, which is why the bigger farmers do better with forward trading as they got the volume to trade for the best prices. Some farmers sell all their produce after their harvest as they are waiting for during the year when there are better prices. While other farmers will sell their produce before they even plant which they say is the one of the only ways to get the best price. The following findings and interpretations were based on a review of the literature and through interview with farmers in the Western Cape.

4.1) Changing weather patterns

Famers short-term income are often affected by changes in farm production or price which are often driven by climate change such as droughts or floods (Schaffnit—Chatterjee, 2010). Declining profitability, rising input costs and water scarcity due to climate change poses as a major threat to farmers in South Africa. In addition, South Africa has no water surplus which may hinder future developments. In the last two decades, a third of the farmers operating in the agricultural sector have left the industry, either directly or indirectly linked to climate change. In addition, climate change can have a drastic impact on a farmer's profitability such as being unable to plant due to the diminished availability of water (Goldblatt, 2016). This could be a possible reason for the decrease in farmers within South Africa. Furthermore, climate change poses major challenges in the agricultural sector negatively effecting both crops and livestock in most countries around the world. However, the agricultural sector contributes a significant share to greenhouse gas emissions which are linked to climate change (OECD, 2015). The changing weather patterns and the unpredictability of rainfall is the major impact of climate change on farmers within the Western Cape. There has been periods of heavy rainfall which is often followed by long periods of drought which leaves the farmers in a state of uncertainty around the timing of planting and harvesting. There are certain areas where farmers plant winter cultivars but receive more rainfall in the summer time. This can impact the yield and profitability of the harvest.

“...there is more rainfall in the summer time; however, this farm is in a winter rainfall area”

“...received more rainfall in the summer time...this is difficult for as I plant winter cultivars”

“We get heavy rainfall over a short period and we have intense droughts over a long period”

4.2) New ways of thinking

Farmers in the Western Cape, as a result of climate change, have adjusted their ways of thinking and have implemented innovative technology to help alleviate the pressures of climate change. It is important to note that there is an absence of a strong national political agenda around climate change in South Africa which means that very little political or fiscal support exists for local programmes (Zwane et. al., 2016). In addition, without policies or regulations, autonomous efforts by farmers will not be significant enough to create a sustainable agricultural sector (OECD, 2015). Therefore, this supports the notion of forward trading as a strategy on the premise that it is an innovative way of thinking in terms of protecting the farmer from unnecessary risks which are not covered through policies and regulations. The decrease in rainfall also impacts the availability of water and crops for livestock. Some farmers have more than one farm in different areas to hedge against the risk of the changing weather patterns. This allows for a degree of loss where the loss on one farm will be offset by the profits on the other. In addition, having more than one farm allowed the farmers to spread their risks across all their farms which is another strategy to enhance risk management.

“...farmers need to change their way of thinking and start using new technology”

“...we get less rain during our planting season”

“I have farms in different areas so if I lose on the one farm, I can make a profit on the other farms. “

4.3) The use of a planter and short grow cultivars

Farmers have started to use planters instead of plough in order to retain more moisture within the soil. The planter also helps farmers to decrease their inputs costs. Some farmers have opted to sell some of their livestock as they do not have enough drinking water available. This is directly linked to the current drought that the Western Cape is currently experiencing. In addition, farmers have started plant short grow cultivars which has a shorter grow time. This also enhances the productivity of farms as shorter growth time will increase the rate of outputs.

“I only use planters and I never plough which helps to keep more moisture in the soil”

“I had to sell some of my sheep as I do not have enough water”

“...bought my first plant... helps as it keeps the soil more moist”

“...store more food throughout the year for times when there is no food available for livestock”

“...different cultivars of wheat and barley which has a shorter grow time”

“...planter does not get a bigger harvest but the input costs are lower”

“To only be a ‘planting’ farmer is a high risk, the farmers with livestock have backup”

4.4) The use of silos

Many farmers have silos to keep their produce fresh for when the prices are better as well as having grain for the livestock when their harvests don't yield enough produce. Certain farmers rely on their livestock for income during periods of drought where they cannot plant their crops. As the Western Cape has been experiencing a severe drought, many farmers are unable to plant their crops which drastically impacts on their profitability, especially in the case of famers who do not have livestock.

"...on my barley and wheat, you never know, food you can buy but water, you cannot"

"...due to drought, I did not plant wheat or barley, this year I put my sheep in the fields which creates a better income from the livestock"

"Droughts are never easy...I spread my risk across all my farms"

"...silos on the farms where I keeps grain if the prices are not good"

4.5) Forward trading is more applicable to larger farms

Agricultural contracts have the potential to reduce the farmers' price risk by around 90% (Schaffnit-Chatterjee, 2010) as well as significantly reducing yield risk. These price risks are eliminated when farmers offset price fluctuations in the contracted crop through the use of hedging in the form of a future contract (Schaffnit-Chatterjee, 2010). Production contracts enable farmers to reduce or eliminate the need for short-term credit in order to finance operating expenses (DraKoln, 2011).. In addition, it's advantageous for farmers to use the derivative market in South Africa as it enables them to self-insure themselves against the volatility of capital flows. Therefore, farmers are able to reduce their dependence on banks (Adelegan, 2009).

Food prices are generally more volatile than the prices of manufactured goods. Therefore, farmers are often open to the risk of receiving a lower price than the expected price of the farmers yield. Often, this leaves the farmer at risk of being unable to repay back the loan to the bank. Adequate risk management should be an essential aspect for farmers. Forward trading could help hedge or mitigate this risk (Srinivasan, 2008).

It is important to note that farm production around the world is experiencing a shift trend towards larger farm using contracts, rather than smaller farms using the spot and cash markets which is direct result of increase technological developments (DraKoln, 2011). Forward trading and other derivatives are utilised more in the EU than in the United States, however, larger farms in both the USA and the EU utilise risk management more than smaller farms. In addition, around 40% of the USA agricultural production was produced under agricultural contracts in 2005 (Kunkel et. al., 2015). Furthermore, around 60% of polish farmers show interest in risk management, however, this interest in risk management increase proportionately as the size of the farm increases (Schaffnit-Chatterjee, 2010).

The economic theory of contracts (Nelson, et. al., 1987) claims that farmers in South Africa can use contracts that are legal and provide full coverage in order to self-insure against potential risks. In recent years, farmers are spending less time working and more time analysing the market in order to get the best prices for their produce. Larger farms are more likely to utilise forward trading as a strategy as they are able to leverage their volume of crops to trade for the best price. Certain farmers use the method of selling their produce before they have even planted their crops which is often a good way to get the best price.

"I have not sold all my barley and wheat after this harvest, but I am waiting for during the year for better prices"

“Forward trading is a possible strategy but it would only work for big farmers, as soon as you have 1000 tons of wheat, you can argue about the price”.

“...today's farmers are not workers anymore, I spend 60% of my time in trading and looking for the best price for my product”

“I do use forward trading...some years, my harvest is sold before I even plant which is the only way to get the best price”

5) Conclusion

There is a limited amount of research on forward trading as a risk management strategy in the agricultural sector. Consequently, there is a lack of understanding of how farmers may utilise the strategy to hedge against the risks associated with climate change. Furthermore, the relevance and impact of the phenomenon of climate change on the agricultural sector in South Africa requires a deeper understanding. Thus, the fundamental contribution of this study is to add to the body of existing knowledge on the real impact of climate change and the use of forward trading as risk management strategy in the agricultural section. Furthermore, by providing a deeper understanding of these issues, the potential use of forward trading by farmers, as a strategy may be considered.

Climate change has had and will have an impact on farming in South Africa. It is important to note that this impact is significant in terms of the changing rainfall patterns in the Western Cape. This trend has resulted in a problem for farmers as they are unable to foresee the adequate provision of water for the survival of their crops and livestock. As a result, climate change has prompted new ways of thinking. This is accredited to the introduction of efficient and innovative technologies by farmers, in an attempt to alleviate the pressures of climate change. Consequently, farmers are seen to utilise a planter rather than a plough, thus enabling the soil to hold more moisture. In addition, climate change has sparked the use of short grower cultivars by farmers in the Western Cape as it consists of a shorter growth period. Furthermore, in an attempt to alleviate the pressures of climate change, Western Cape farmers utilise silos in order to retain their produce for when the market price is more appealing. The use of silos extends further as to also ensure readily available grain for their livestock in times of insufficient yields.

With reference to the research presented in this study, it can be said that forward trading can indeed be used as a strategy to mitigate the impact of climate change on the agricultural sector. However, this conclusion is applicable on the premise based on the identified trend; that the use of forward trading as a strategy is more prominent in the case of larger farms as their volume of produce reduces their risks significantly.

5.1) Ethical considerations

Ethics is described as a personal moral code of conduct which sets a standard for attitudes and behaviour, this is crucial in a research proposal as ethics affect all stakeholders in research (Du Plooy-Cilliers et. al., 2015). There are a few aspects which this research study looked at in order for the research findings to be ethical. In this research study, there was a conscious effort not to falsify information nor distort result with regards to all areas of the research study. The research study also withheld any bias thoughts to have an influence on my interpretation as well as not misusing information (Du Plooy-Cilliers et. al., 2015). Careful consideration within the research was conducted in order to generate ethical findings; these included:

- Creating a personal ethical code of conduct
- Learning from other researchers who made ethical mistakes
- Review the harm of unethical behaviour to others
- Ensured that all literature used was properly referenced/ all sources will be acknowledged.
- Not artificially manipulating the findings to suit the purpose of the research study
- Ensured written consent from human participants and voluntary participation
- The right to privacy was implemented for human participation
- The participants were informed of the purpose of the research

5.2) *The limitations of this study*

There were certain time and geographical constraints within this study. The time constraints meant that this study was unable to reach the desired amount of farmers in order to generalise the study to a broader population. The geographical constraints limited the accessible population as this research study was only able to access farmers within the Western Cape. There were also monetary limitations in order to access farmers outside the Western Cape. Case study design also poses certain limitations such as the lack of generalisability where findings cannot be generalised to the populations as well as non-standardisation of measurement. However, case studies also have certain strengths such as in-depth insight and high construct validity (Mouton, 2005).

5.3) Enhancement of trustworthiness and rigour:

Trustworthiness is a key aspect of an interpretivistic paradigm and a qualitative research design. There are four specific criteria that are linked to trustworthiness (Nieuwenhuis, 2016; 123-125):

Credibility

This was enhanced through an early familiarity with the farmers that were interviewed as well as through a well-defined purposive sampling, a detailed case study and interview with the respective farmers within the Western Cape. Credibility was also enhanced through a thick description of climate change and its impact on the agricultural sector as well as forward trading as a strategy to mitigate the impact of climate change in the agricultural sector.

Transferability

When conducting qualitative research within this study; generalisation was not the purpose of the research. While conducting the interviews, considerations were made on how familiar the participants are to climate change and forward trading. The study also provided a deeper understanding of climate change and forward trading. This enhanced the transferability of the study.

Dependability

Dependability was utilised rather than reliability where dependability is realised through the implementation of the research design and the research design itself. The research design of this study was scrutinised in an effort to increase the dependability.

Confirmability

Confirmability is the degree of neutrality where the findings of the study are not based on the researchers' bias. Every effort was made to ensure that bias was withheld from all research findings.

5.4) Recommendations/suggestions on further research

Further research is necessary to get a deeper understanding of the problem as the sample was limited. A further study could be done in the Eastern Cape (or any other province) where the findings can be compared to review the links between the use of forward trading in the Eastern Cape and the Western Cape to mitigate the impact of climate change in the agricultural sector. This will assist in alleviating the geographical constraints. The study can also be conducted over a longer period of time to understand and describe the long term effects of climate change on the agricultural sector. This study showed that forward trading is strategy to help mitigate the impact of climate change on the agricultural sector, therefore, further research can be done to review whether forward trading is a viable long-term strategy. Further research can be conducted in variety of other produce such as grapes, oranges and apples.

REFERENCE LIST:

Adelegan, O.J. (2009) The Derivatives Market in South Africa: Lessons for sub-Saharan African Countries, IMF Working Paper/09/196, International Monetary Fund. Accessed: 27 August 2017 at <https://www.imf.org/external/pubs/ft/wp/2009/wp09196.pdf>

Blignauta, Ueckermann & Aronson 2009 *Agriculture production's sensitivity to changes in climate in South Africa*, South African Journal of Science 105, January/February 2009. Accessed: 4 May 2017 at <http://www.sajs.co.za/sites/default/files/publications/pdf/4-28-1-PB.pdf>

Drakoln, N. 2011 Commodities: Pork Bellies, Investopedia, LLC. Accessed 27 May 2016 at <http://www.investopedia.com/university/commodities/commodities16.asp>

Du Plooy-Cilliers, F. Davis, C. and Bezuidenhout, RM. 2015 *Research Matters*, Cape Town, South Africa; Juta and co Ltd.

Goldblatt, A. 2016 *AGRICULTURE: FACTS & TRENDS South Africa*, WWF, South Africa. Accessed: 5 may 2017 at http://awsassets.wwf.org.za/downloads/facts_brochure_mockup_04_b.pdf

Hatfield, J., K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, and Wolfe, D. (2008) The effects of climate change on agriculture, land resources, water resources, and biodiversity in the United States, The U.S. Climate Change Science Program and the Subcommittee on Global Change Research, Washington, DC., USA. Accessed: 16 September 2017 at https://www.usda.gov/oce/climate_change/SAP4_3/CCSPFinalReport.pdf

Johannesburg Stock Exchange (2011) Exchange Traded Agricultural Derivatives, SAFEX Commodity Derivatives, Johannesburg Stock Exchange. Accessed: 12 August 2017 at <https://www.jse.co.za/content/JSEEducationItems/Introduction%20to%20Agricultural%20Derivatives.pdf>

Kunkel, P.L. & Peterson, J.A. (2015) *FARM LEGAL SERIES: Agricultural Production Contracts*, © 2015, Regents of the University of Minnesota. Accessed 14 June 2017 at <https://www.extension.umn.edu/agriculture/business/taxation/farm-legal-series/agricultural-production-contracts/docs/agricultural-production-contracts.pdf>

Maree, K. (2016) *First Steps in Research (2nd edition)*, Hatfield, Pretoria, South Africa; Van Schaik Publishers.

Mouton, J. (2005) *How to succeed in your Master's & Doctoral Studies*, pp 149-150.. Pretoria: Van Schaik

Nelson, C.H. & Loehman, E.T. (1987) Further Toward a Theory of Agricultural Insurance, *American Journal of Agricultural Economics*, Volume 69, Issue 3, Pages 523–531.

Nieuwenhuis, J. Qualitative research designs and Data-gathering techniques; Analysing Qualitative Data. In Maree, K. (Ed). (2013) *First steps in Research*. Pretoria: Van Schaik

OECD (2015) Agriculture and Climate Change, Trade and Agricultural Directorate, OECDagriculture. Accessed: 20 September 2017 at <https://www.oecd.org/tad/sustainable-agriculture/agriculture-climate-change-september-2015.pdf>

Pettinger, T. (2008) Definition of Hedging, EconomicsHelp.org. Accessed: 12 September 2017 at <https://www.economicshelp.org/blog/138/finance/what-is-hedging-and-speculation/>

Phillips, J. (1966) The Theory and Practice of Futures Trading, *Review of Marketing and Economics*, vol. 34, issue 02, Pages 43-61, Econpapers.

Schaffnit--Chatterjee, C 2010 *Risk management in agriculture towards market solutions in the EU*, Deutsche Bank AG, DB Research, D-60262 Frankfurt am Main, Germany. Accessed: 20 May 2017 at <https://www.agriskmanagementforum.org/sites/agriskmanagementforum.org/files/Documents/Deutsche%20Bank%20Research%20-%20Risk%20Management%20in%20Agriculture%20091710.pdf>

Srinivasan, S. (2008) Future Trading in Agricultural Commodities: Is the government ban on commodities trading logical? Working Paper No. 193, Centre for civil society. Accessed: 15 August 2017 at https://www.google.co.za/url?sa=t&rct=j&q=&esrc=s&source=web&cd=5&cad=rja&uact=8&ved=0ahUKEwiay_uqyf_VAhXLJcAKHQJzCEMOFgg-MAQ&url=https%3A%2F%2Fccs.in%2Finternship_papers%2F2008%2FFutures-Trading-in-Agricultural-Commodities-193.pdf&usq=AFQjCNF0vdydjjeqZkAjUmScQSe7Vtt2g

United Nations (2016) Take urgent action to combat climate change and its impacts, UN Web Services Section, Department of Public Information, United Nations. Accessed: 24 September 2017 at <http://www.un.org/sustainabledevelopment/climate-change-2/>

United Nations (2014) UN and Climate change: towards a climate agreement, © UNITED NATIONS 2016. Accessed: 13 June 2017 at <http://www.un.org/climatechange/towards-a-climate-agreement/>

Yin, R. K. 2009 *Case study research: Design and methods (4th Ed.)*. Thousand Oaks, CA: SAGE.

Zwane, M. & Montmasson-Clair, G. 2016 *Climate Change Adaptation and Agriculture in South Africa*, Trade and Industrial Policy Strategies for WWF-SA, South Africa. Accessed: 5 may 2017 at https://www.tips.org.za/images/WWF_PFU_Policy_brief.pdf

Annexures

Interview Questions/Email Correspondence

- 1) With what livestock and/or crops do you farm?
- 2) What do you think is the biggest climate change-induced threat to the sustainability of the agriculture sector?
- 3) Do you, as a farmer, think that climate change impacts the agricultural sector within South Africa? Please elaborate.
- 4) How has the extreme weather patterns caused you to adapt your farming methods?
- 5) Does climate change and/or water scarcity impact on your crop yield or livestock? If so, how does this impact on the profitability of your farm?
- 6) What is your experience with droughts/floods/extreme temperatures in recent years and how did you manage?
- 7) What policies are currently in place to help reduce the negative impact of climate change? If there are policies in place, do they help the agricultural sector? Could you recommend any policies to be put in place to help protect farmers from climate change?
- 8) Do you think forward trading is a possible strategy that farmers can use to hedge or mitigate the risks associated with climate change?
- 9) Do you make use of forward trading in order to mitigate certain risks?

Permission Letter

TO WHOM IT MAY CONCERN

Mr Logan Collier is a post-graduate student at Varsity College, Rondebosch, Cape Town. As part of the requirements for the B Com honours degree in Management of the Independent Institute of Education, he has to complete a first research assignment. His topic relates to forward trading as strategy to mitigate the risk attached to climate change in the agricultural sector of South Africa.

As part of his study he intends to embark on interviews with, as well as email correspondence to some farmers in the Western Cape. The aim of this letter is to confirm that Mr Collier has the permission of the institution to conduct the interviews/email correspondence. We greatly appreciate any support given to him in this regard.

Yours sincerely



Elizabeth Stoltz (Supervisor)

Contract Lecturer: Varsity College, Cape Town

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30 August 2017