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DETERMINANTS OF FARMER PARTICIPATION IN HYBRID MAIZE SEED CONTRACT FARMING: A CASE STUDY OF SEED-CO ZIMBABWE GROWERS

BY

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Abstract

The study investigated and analysed the determinants of farmer participation in hybrid maize seed contracting farming. In carrying out the study there was use of cross-sectional survey data collected from a random sample of 94 Seed Co contracted hybrid maize seed growers for the 2019/20 production season. What motivated the study was high seed grower turnover characterising low seed volumes by seed houses and failure to satisfy national demand of hybrid maize seed annual seed requirements. Factors influencing farmer participation were derived from the binary logistic regression using Statistical Package for Social Sciencitis(SPSS). Findings indicated that gender and region were insignificant factors at 5% level of significance to influence seed grower decision to adopt or disadopt the hybrid maize seed contract arrangement. Availability of labour and farm equipment (mechanization) were found to be significant determinants of farmer participation. Lack of collateral, limited or no access to finance and irrigation facilities by the seed growers negatively influenced participants to adopt the hybrid maize seed contract farming arrangements. Another significant factor revealed by the study is the time taken for maize seed farmers to receive payment for their produce especially in this runaway inflationary environment. Time value of money is really critical. So the longer the time taken to pay the less attractive the hybrid maize seed contract becomes. The results show that there is room to improve if a multi-pronged approach to address the problems is adopted which include, grower capacitation by seed houses in the area of irrigation infrastructural development, farm equipment purchase. Increasing and extending lines of low cost funding through state banks like the Land Bank and also coming up with products that require lowered collateral requirements. On the part of seed growers it is recommended that they be loyal and commit themselves to the obligations of the contract so that consideration can be given to their plight.

Key Words: Contract Farming, Farmer participation, Maize hybrid Seed.

Declaration Page

I declare that this dissertation is my original work except where sources have been cited and acknowledged. The work has never been submitted, nor will it ever be submitted to another university for the award of a degree.

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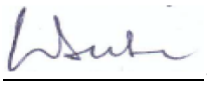
Prof Lighton Dube	 …30/3/22……
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Dedication

This is for you my family, beloved wife Sharon, my lovely son Craig Marlon, beautiful daughters Stacy,Tesal and Ingrid . It was days and nights on of your time without me to see it to the end. I love you.

List of Acronyms and Abbreviations

BLM	Binary Logistic Model
CF	Contract Farming
FAO	Food and Agricultural Organization of the United Nations
GDP	Gross Domestic Product
ISTA	International Seed Testing Association
ODI	Overseas Development Institute
SPSS	Statistical Package for Social Sciences
SSI	Seed Services Institute of Zimbabwe
TIMB	Tobacco Industry and Marketing Board
ZIMSTAT	Zimbabwe Statistical Agency
ZSTA	Zimbabwe Seed Traders Association

Definition of key terms

Contract farming-A production arrangement between a seed house and seed growers.

Maize hybrid- The offspring resultant of crossing two unrelated maize parents.

Seed growers- Contracted seed producers.

Determinants- Factors influencing.

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CHAPTER 1 INTRODUCTION

1.1 Introduction

Improved seeds are one of the most important technologies for intensifying agricultural production and thus contributing to growth in the agricultural sector Overseas Development Institute(ODI), (1992). Zimbabwean farmers have a high adoption rate of hybrid seeds with a long rich history of development of maize hybrids. Although research had kicked on earlier the country managed to register its first single cross hybrid in 1960 and that was SR52 which was a white long season variety. Seed multiplication is a very important component in the seed industry value chain and the most widely used model of seed production in Zimbabwe is contract farming(CF) Thiele, (1999).

This model despite its wide adoption and usage has not been without its myriad of challenges and one of the major problems over the recent past for close to two decades has been the inability to retain seed growers and maintain the elite status where best farmers are admitted (Ndjeunga, 1997). There has been a huge farmer(seed grower) turnover as they move from one seed house to the next across seasons which has resulted in seed houses having to recruit new growers every season and having to battle low production levels due to use of inexperienced growers each year (Wekunda, 2012).

The above and other associated challenges have necessitated the undertaking of this study that seeks to establish the determinants of farmer participation in contract maize seed production and also to find possible lasting solutions in keeping a productive stable grower base and start to enjoy the benefits that accrue from that (Ndjeunga &

Bantian, 2005). This chapter will introduce the major component of the study by describing a brief background of the study exploring the statement of the problem;

purpose, objectives, research questions, significance, limitations of the study as well as a summary provided at the end of the chapter.

1.2 Background to the study

In Zimbabwe, farming is one of the major contributors to the economy and the overall gross domestic product (GDP) at 17%, it contributes 40% to export receipts and up to 70% of the population is directly employed in agriculture (FAO, 2020). Agriculture does play a significant role in the supply chain of agricultural produce for both local and export markets. According to (STATISTICA, 2020) maize is the most important grain by production levels at 1,099.61 million metric tonnes followed by wheat and rice in that order. Maize is required for multiple purposes among them human consumption, an important constituent in the stock feed manufacture, for silage, hay making, for edible oil expression and various industrial uses.

The seed is the single most important input in crop production. It carries the genetic potential of the variety and determines the ultimate productivity of other inputs. The main role of other inputs in crop production is to exploit to a maximum the genetic potential of the seed. Therefore, the seed is and should always be the basic prerequisite of any food security scheme. It is against the background that without seed security there is no food security that issues that relate to the major determinants of farmer participation in this model of hybrid maize seed production are of utmost importance.

One of the definitions of contract farming by (Simons & Winters, 2005) says it is an agreement between farmers and processing or marketing firms . The arrangement includes production and supply of agricultural products under forward in most cases at pre-contract prices . The arrangement can involve the contractor provision of production support through,advancing inputs and the provision of technical extension services. The basis of such arrangements is a commitment on the part of the farmer to provide a specific commodity in quantities and at quality standards determined by the purchaser and a commitment on the part of the company to support the farmer's production and to purchase the commodity (Eaton & Shepherd, 2001).

With effective management, contract farming can be a means to develop markets and to bring about the transfer of technical skills in a way that is profitable for both the sponsors and farmers. The approach is widely used, not only for tree and other cash crops but, increasingly, for fruits and vegetables, poultry, pigs, dairy produce and even prawns and fish (Little & Watts, 1994). Indeed, contract farming is characterized by its "enormous diversity" not only with regard to the products contracted but also in relation to the many different ways in which it can be carried out.

Chambati & Mazwi (2018) sought to understand the impact of contract farming on livelihoods among the small-scale farmers in two study districts of Zvimba and Goromonzi which are located in the Mashonaland Provinces. The study examined different levels of income earned between contract and non-contract tobacco growers, food consumption rates, land use patterns and asset accumulation among other indicators. The asymmetric power relations between farmers and buyer firms was as well examined. Evidence shows that contract farming has improved access to high-yielding input, better extension service, incomes, while also contributing to asset

accumulation when compared to noncontract farming households. Women's participation in contract farming was noted to be low due to lack of access to land as the means of production. The study also confirmed that it is therefore important for government and other relevant stakeholders to come up with a conducive policy environment that encourages the growth of input/credit market to avoid farmer agribusiness exploitation. The study also pointed out that appropriate legislation is required that govern contract farming agreements and implementation.

The CF system should be seen as a partnership between agribusiness and farmers. To be successful it requires a long-term commitment from both parties. Exploitative arrangements by managers are likely to have only a limited duration and can jeopardize agribusiness investments. Similarly, farmers need to consider that honouring contractual arrangements is likely to be to their long-term benefit. CF is becoming an increasingly important aspect of agribusiness, whether the products are purchased by multinationals, smaller companies, government agencies, farmer cooperatives or individual entrepreneurs (Glover & Kusterer, 2016).

In agriculture and gardening, hybrid seed is seed produced by cross-pollinated plants. Hybrid seed production is predominant in modern agriculture and home gardening. It is one of the main contributors to the dramatic rise in agricultural output during the last half of the 20th century (Liu, 2014). The alternatives to hybridization are open pollination and clonal propagation. All of the hybrid seeds planted by the farmer will produce similar plants, while the seeds of the next generation from those hybrids will not consistently have the desired characteristics. Controlled hybrids provide very uniform characteristics because they are produced by crossing two inbred strains. Hybrids are chosen to improve the characteristics of the resulting plants, such as better

yield, greater uniformity, improved colour, disease resistance (Cox & Cherney, 2012). An important factor is the heterosis or combining ability of the parent plants. Crossing any particular pair of inbred strains may or may not result in superior offspring. The parent strains used are therefore carefully chosen so as to achieve the uniformity that come from the uniformity of the parents, and the superior performance that comes from heterosis. Hybrid is produced by crossing between two genetically dissimilar parents. Pollen from male parent will pollinate, fertilize and set seeds in female to produce F1 hybrid seeds (Brandt, 2007).

1.3 Statement of the Problem

In Zimbabwe survival and profitability of a seed business primarily hinges on the production of a certain critical mass of maize seed volumes. A stable seed grower base is one such important factor to be considered in a quest to achieve this. Consistency over several seasons brings with it an experience which in turn increases productivity and technical efficiency of the seed growers. However, only a small proportion of the growers have been consistently contracted with one company over the last couple of years. Many growers have either left Seed Co for other seed houses, have completely left contract hybrid maize production or have gone on sabbatical and then reappear. In response to this problem of high grower turnover, this study seeks to investigate the main reasons behind and suggest possible solutions to make this venture once more competitive and farmers' first contract of choice like its former days.

1.4 Research Objectives

The main objective of the study was to establish the major determinants of farmer participation in hybrid seed maize contract farming particularly in Zimbabwe.

Specific objectives of the study were as follows

1. To determine the socio-economic characteristics of Seed Co's hybrid maize seed growers in Zimbabwe.
2. To establish the determinants that influence the participation of hybrid maize seed producers in contract farming in Zimbabwe.
3. To suggest ways of improving hybrid maize seed grower retention in Zimbabwe.

1.5 Research Questions

1. What are the socio-economic characteristics of Seed Co's hybrid maize seed producers in Zimbabwe?
2. What are the factors that influence the participation of hybrid maize seed producers in contract farming in Zimbabwe?
3. How can hybrid maize seed growers be retained in Seed Co Zimbabwe?

1.6 Assumptions

In carrying out the study the researcher assumed that;

1. Farmers live and operate in a homogeneous environment where they face similar challenges and opportunities.

2.The contributions from research constituted their honest perceptions from participants.

1.7 Significance of the Study

The study contributed to the findings which were significant for numerous stakeholders which include,

- **Government**- this study assisted in coming up with market based policy formulations that can help to improve resource allocation in terms of budgetary support and tax structuring, creation of pro-growth policies and incentives.
- **Academi**a-It built on the existing body of knowledge through narrowing of research gaps.
- **Farmers**-It is a tool that can assist farmers make informed decisions on their cropping programmes such that it leads to an increase in seed volumes.
- **Seed Houses**-it informed on evidence-based production models and structuring of mutually beneficial contracts between seed growers (farmers) and seed companies.

1.8 Delimitation of the Study

The study focused on the factors that influence farmer decision to participate in hybrid maize seed contract farming. The study was carried out among seed producing farmers in Zimbabwe. The period under focus was between 2019/2020 seed production season.

1.9 Limitations of the Study

The research was only limited to the hybrid maize contract farming subsector out of many contract farming arrangements across the whole agricultural strata.

The major source of data used in this study was farmer own records both documented and undocumented which usually suffers biasness as affected by exaggeration, attribution and sometimes selective memory (Greener, 2008).

In addition to the above there was also inability to model most of the factors that do influence farmer agricultural productivity and decisions and that reduced the accuracy of the determinants estimates.

CHAPTER 2 REVIEW OF RELATED LITERATURE

2.1 Introduction

The chapter starts by reviewing literature of the theories that form the basis of the objectives of this study. It further goes on to critically review empirical studies by previous researchers of related studies. Gaps in the current body of knowledge are then identified and it will be followed by the conceptual framework.

2.2 Theoretical Framework

2.2.1 Transaction theory

Transaction cost theory begins from the position that "in the beginning there were markets" (Williamson, 1975, p. 20), and goes on to develop a comparative efficiency framework that sees the emergence of the hierarchical firm as a rational response to growing transactional complexity, (Gedajlovic & Carney 2010). Transaction costs are the costs incurred by trading partners associated with the exchange of goods and services. These include costs involved in collection of market information, negotiations, monitoring and enforcement of business transaction.

Agricultural transactions involve high environmental uncertainty because of the biological nature of production which makes it impossible to precisely control, and therefore, forecast the volume and quality of production (Bogetoft and Olesen, 2002). Agricultural transactions also involve high uncertainty due to the perishability and seasonality of products. Furthermore, rapidly changing consumer tastes increase uncertainty in output markets as the agribusiness firm cannot accurately forecast demand. Complying with these standards implies increased coordination cost as food safety failures can have deleterious consequences to the farmer participation in hybrid

maize seed contract farming in terms of legal liability, reputational damage, consumer confidence and future earnings (Fulponi, 2006)

2.2.2 Profit Maximisation Theory

Profit Maximization Theory In traditional economic model of the firm it is assumed that a firm's objective is to maximise short-run profits, that is, profits in the current period which is generally taken to be a year(Abhishek, 2019). In various forms of market structure such as perfect competition, monopoly, monopolistic competition the traditional microeconomic theory explains the determination of price and output by assuming that firm's aim is to maximise current or short-run profits. This current short-run profit maximisation model of the firm has provided decision makers with useful framework with regard to efficient management and allocation of resources. In this study it is assumed both the firm Seed Co and the growers are profit driven in their choices.

2.3 Empirical Literature

2.3.1 Socio-economic characteristics of Seed Co's hybrid maize seed growers

Hybrid maize farmers' have to face diverse kinds of climate, biological, price and financial characteristic risks. Farmers' risk perceptions and risk attitudes are essential elements influencing farm operations and management decisions. However, this important issue has been overlooked in the contemporary studies and therefore there is a dearth of literature on this important issue (Akhtar, Ullah, Nazir, Iqbal, Raza & Faisaln, 2018). Farmers have to work in an environment intricate by different kinds of vulnerabilities and uncertainties that are always encouraged by natural environment,

market faults and social uncertainties (Tchale & Sauer, 2007).). To evade many types of risks, growers should invest in terms of time and money to develop some approaches and to take different adaptive measures. These investments have more expectation of return, but also at the same time they have more failure of risk (Alderman , 2008). Farming risks arise mainly due to the variability of climate, the density of biological diseases, production seasonality, the different geographical production area and consumer of agricultural production (Mathenge *et al*., 2014)), regular natural catastrophes (World Bank, 2014), the production and prices unpredictability of agriculture products, imperfect input/output markets (Schroeder *et al*., 2013) and the absence of financial facilities along with partial extent and design of risk management strategies such as credit and insurance (Musser & Patrick 2002; Jain & Parshad 2006). Some of these categories may overlap each other. Since farming is a key source of revenue for farmers, therefore it is imperative for agricultural households to recognize and overcome risks (Drollette 2009). The concern about risk in agriculture should be left not only to the agricultural household but also to the whole society, as the risk averse nature of farmers may result in misallocation of resources that lessen overall welfare. Even if the farmer is risk neutral, the presence of risk could have an impact on production decisions due to its impact on expected marginal productivity when randomness occurs inside the production or cost functions (Aye & Mungatana, 2010). Understanding of the risk sources can help farmers in taking wise decisions related to crop management and adaptive measures. To analyze farmers' decision in risky and uncertain conditions, it is necessary to observe how they perceive risk and react in risky situations (Lucas & Pabuayon 2011).

According to Lucas (2011), unlike many parts of sub-Saharan Africa, hybrid seed adoption rates amongst Zimbabwean maize farmers are relatively high, reflecting decades of efforts by the Zimbabwean government and Zimbabwe Seed Company. In the mid-1990s, the government of Zimbabwe began to slowly liberalize the domestic seed market. Western Seed Company, an early entrant in the newly opened market, released its first commercial maize varieties in 1999. Its varieties quickly garnered attention by out-yielding existing Zimbabwe Seed varieties by some 30 percent, especially in the mid-altitude regions that are home to many small-scale Zimbabwean farmers. AGRA and others have invested heavily in seed systems throughout sub-Saharan Africa with the expectation that new market players like Western Seed Company can create new prospects for growth throughout the region, especially for the small-scale farm sector (Ali et al., 2020). The model is clearly replicable, but the key question is whether it really works and adds value to what can be achieved by multi-national and other traditional market participants.

2.3.2 Factors that influence participation of hybrid maize seed farmers in contract farming

Rashikayi (2018) found that one of the most important reasons that influence participation of hybrid maize seed farmers in contract farming is that it is expensive. On the other hand, Bal *et al*., (2017) found that lack of education is one of the reason influencing participation of hybrid maize seed farmers in contract farming. According to Bal *et al,* (2017), small scale farmers are not being educated enough on the importance of adopting hybrid maize farming. This was supported by the study of Mulaudzi & Oyekale (2015) who found that farmers are not educated enough about

the advantages of hybrid maize in contract farming. Thus Mulaudzi & Oyekale (2015) suggest that farmers should be educated such that they know consequences associated with not using maize hybrid in farming. Moreover, Lawrence & Vandecar (2015) found that farmers may not adapt hybrid maize CF because of their experience in contract farming. The author went on to state that it is easier for a farmer to use old methods of farming than to adopt new technologies as they might be complex. This was supported by Gogo (2018) who stated that generally the use of more advanced technology is very complex and therefore farmers may not adopt new technologies for contract farming because of their complex nature.

According to Fang & Belton (2020), maize being the highest yielding cereal crop in the world is of significant importance for countries like Zimbabwe, where rapidly increasing population, food and fodder demand have already out stripped the available food, feed and fodder supplies. Out of total maize production, about 60% is used in poultry feeds, 25% in industries and remaining is used as food for human and animals (Shiferaw *et al*., 2011). Maize crop accounts for 0.5% in gross domestic product (GDP) and 2.7% in agriculture value addition.

In 2016–2017 maize was cultivated on 1 334 thousand hectares, and the production of maize was 6.130 million tonnes, showing an increase of 16.3% from the previous year of 5.271 million tonnes (Byerlee, 2020). Maize enjoys an important position in the existing cropping systems of Zimbabwe. It ranks first ahead of wheat and rice and is grown in almost all the provinces of the country. As propounded by Adhikari *et al*., (2018), the introduction of hybrid maize varieties is mainly attributed to the efforts of private sector.

Hybrid maize varieties are very popular among the farming communities mainly due to their higher yield potential which generates higher returns to the growers. Like other

crops, hybrid maize crop also has to face environment (excessive rainfall, hail storm, flood, lodging of crop, drought), biological (insect/pest diseases related to maize crop), institutional (government support price policy negligible, lack of credit facility, lack of insurance companies, lack of government research institute in producing hybrid seed) and economic issues (higher input and lower output prices, lack of market facilities) (Abid *et al*., 2015; Gorst *et al*., 2015; Abid *et al.*, 2016; Iqbal *et al*., 2016). All these problems lead growers in a very uncertain situation which could result in dissatisfaction and disenchantment among growers. Due to financial constraints and limitation of resources, capability of Zimbabwe to adapt to exposed risks at national as well as at farm level is very limited (Abid *et al*., 2015). Moreover, the public institutions at local level are unable to provide support to farmers because of their limited resources.

The crop loan insurance scheme (CLIS) was launched in Zimbabwe during 2008, however, the scheme is still at an immature stage (Kassam *et al*., 2014; Iqbal *et al*., 2016) and farmers mostly rely on traditional methods to manage farm level risks. Assessing farmers' perceptions and attitudes towards risk are crucial factors shaping farmers' decision when faced with an uncertain situation (Akcaoz & Ozkan 2005). Decisions made by farmers can be analyzed in risky and uncertain situations by considering their risk perceptions and attitudes towards risk (Lucas & Pabuayon 2011).

Previous studies on the impacts of social, economic and demographic factors on farmers' perceptions of risk and risk attitudes showed mixed results. Characteristics of farms and farm household impact risk perceptions and risk attitudes of farmers. Literacy and agricultural experience lead farmers to understand risk sources; their

presence and intensity, their perceived impact and their ability to manage farm risks more efficiently. Earlier literature has found that risk preferences diverge (Flaten et al., 2005) momentously based on age (Kammar & Bhagat 2009; Kisaka-Lwayo & Obi 2012; Ashraf & Routray 2013; Iqbal *et al*. 2016), education (Khan et al 2010; Dadzie and Acquah 2012), income (Einav et al 2010), agricultural experience (Lucas & Pabuayon 2011), off-farm income (Ullah *et al.* 2015), contract farming (Lu *et al* 2017) and farm size (Lucas & Pabuayon 2011; Iqbal *et al*. 2016).

Climate information is of significant importance in managing production risk in agriculture arising from climate variability (Chaudhary & Aryal, 2009). Farmer's access to extension workers enables understanding and management of agricultural risks through the adoption of effective risk management strategies (Arce, 2010). The inadequate information on farmers' risk attitudes and risk perceptions poses a big challenge for researchers and policy makers to develop a comprehensive risk management system at the farm level (Ellis, 2000; Ayinde 2008; Lucas & Pabuayon 2011). Hence, to develop an effective policy to help farmers with risk management at the farm level, risk information at the farm level needs to be considered locally. Hybrid maize is becoming more and more important food stuff in developing countries, and it is a critical issue to analyze farmers' risk perceptions, policy preferences, and behaviors (Leiserowitz, 2005; Deng *et al*., 2017).

2.3.3 Hybrid maize seed contract farming and farmers' productivity and farmer participation in Zimbabwe

Wooded (2003) highlighted that the institutional arrangement of hybrid maize seed contract farming has reduced the transactional cost and improved market efficiency to

benefit the farmers. Deng *et al*., (2017) indicated that in Zimbabwe, the cotton out grower's schemes has commercialized the smallholder agriculture through provision of assured markets, favourable producer prices, critical input provision and knowledge on agriculture technologies to farmers and as a driver to farmers' productivity and farmer participation. The schemes are creditable for playing a key role in increasing profitability of crop farming reducing market risk and above all opening new markets (Larpar, Holloway & Ehui, 2008). Hybrid maize seed contract farming has proved effective in integration of smallholder farmers in that provisions of seasonal finance is made to farmers that they cannot access through normal commercial channels as acknowledged by Wooded (2003). This has lightened the burden of sourcing scarce and expensive inputs to rural farmers.

Furthermore, the system has also promoted infrastructural development in the rural areas for famers industries such as seed, agrochemicals, fertilizer and famers marketing companies. As a result, the adoption of contract farming has created employment especially for the rural poor. Wooded (2003) also appraises hybrid maize seed contract farming for giving the smallholder farmer the opportunity to earn income as evident by a large participation of smallholder farmers in production as a means of acquiring cash.

Hybrid maize seed contract farming is less subjective if smallholder farmers are involved and sponsors have or attainment of political acceptability. As long as the farmer is not a tenant to the sponsor hybrid maize seed contract farming is less likely to be subject to criticism. The advent of land reform and re-destribution programme in the late ninetys in Zimbabwe opened up new opportunities to Seed contractors through participation of more land holders of land that would ordinarily be not have been available to contractors. There is shared risk in contract farming as farmers absorb part

of te production risk that might come as a result of adverse wether conditions such as droughts, floods as well as pest and disease risk. On the other hand Seed maize contractors also risk low seed volumes making exsiting infrastructure have low capacity utilisation.

The emergency and growth of CF (for small-scale farmers) is a response to market failures to allocate productive resources to all sectors of the economy due to perceived information asymmetries (Freguin-Gresh, Anseeuw & D'Haese, 2012). The small-scale farmers are perceived to be risky because they lack assets, collateral, and skills and training to produce cash crops. To alleviate these problems, government, contractor and the regulator each play an important role in mitigating the constraints. Hybrid maize seed contract farming is an intervention that can alleviate imperfect market constraints by improving information flow about markets, technology and other production resources. Small-scale farmers are mainly vulnerable as they do not have access to credit due to lack of collateral, and the level of human capital in this sector is low, thus affecting their uptake of technology use.

Simmons (2002) argued that hybrid maize seed contract farming can directly benefit farmers through improved access to markets, credit, inputs and better use of technology, thus improving their productivity and income. Agribusiness and farmers can also share both production and marketing risks, while also providing employment for the family and the surrounding community (Gorst *et al*., 2015; Abid *et al*., 2016). This way, the standard of living of the community will improve. Hybrid maize seed contract farming is believed to ease information asymmetry problems, which tends to improve farmers' credit worthiness and hence access to financial services from other players. In a broader sense, it has capacity to create direct and indirect finance

additionally for farmers' operations or create an environment for farmers to access other means of capital to finance farm assets and infrastructure.

Hybrid maize seed contract farming seeks to provide farmers with inputs, extension services and markets (Glover, 1994) to enable them to increase productivity and quality of their produce which will then attract better prices, thus raising farm income (Minot, 1986). In studies by Minot (1986) in Kenya the results revealed that it was more beneficial to be under contract farming than being non contract farmers as indictaed by higher incomes in the former group. In a study of resettled farmers in Zimbabwe, Iqbal *et al*., (2016) observed that resettled farmers with access to credit and extension services and other infrastructure had accumulated more assets and had higher incomes than their communal farmer counterparts. Fang & Belton (2020) findings supported the notion that if 'constraints' are removed, and farmers produce cash crops with adequate technical support and market access.

In a study on training for smallholder tobacco producers, Gadzirayi *et al*., (2008) noted that training, access to finance and credit, and the age of farmers resulted in a threefold increase in productivity. Most farmers do not have access to training, good extension services and technical know-how, leading to low yields per hectare. Kumar and Kumar (2008) in a farm level study in India found that hybrid maize seed contract farming improved both employment and on-farm incomes, while non-farm income was high for non-contract farming. They also found that infrastructure constraints affected the performance of contract farmers in relation to productivity. Saigenji & Zeller (2009) investigated the technical efficiency of contract farming in tea production in Vietnam and found that it increased productivity than compared to non-contract farming. They attributed this to the efficient use of inputs and improved technical know-how.

Swain carried out a similar study in India and found the same results. Anim (2010) investigated the effect of extension services in hybrid maize seed contract farming in South Africa based on a sample of 396 maize farmers and found that extension services increased farm productivity. Hybrid maize seed contract farming benefits are unlikely to flow to the poorest members of society because of selection bias (Simmons, 2002). In addition, the very poor do not have access to farm assets for use in production. As such, there is a tendency to exclude the poorest parts of the community which tends to increase inequality within communities. Intervention by governments and development agencies through provision of requisite farming infrastructure could help reduce these risks and improve participation by the poor (Bijman, 2008).

Hybrid maize seed contract farming is viewed as a solution to and marketing problems; however, there is a school of thought that believes that hybrid maize seed contract farming arrangements are basically exploitative arrangements by large agribusinesses mainly because of the unequal bargaining power between small-scale farmers and well-resourced agribusinesses (Baumann, 2000).

The dissenting reason from hybrid maize seed contract farming critics does not override the benefits that can accrue to farmers, especially access to credit, technical support services and assured markets which have positive effects on farmers' productivity and income. In Zimbabwe, Hybrid maize seed contract farming was found to have benefited 4 000 maize farmers producing. In all cases, access to finance, technology and quality inputs were cited as key to the success of the schemes.

Agriculture is a risky business which tends to reduce the flow of farming resources and outputs between firms and farmers. The parties enter into contracts to improve the

coordination mechanisms of producing and marketing the desired crops, which in theory benefits both the firm and the farmer (Prowse, 2012). Prowse (2012) further argued that contracts lower transaction costs which motivate the parties to engage in contract farming activities. Contract farming also provides a framework for risk sharing and management by the parties, thus helping increase agricultural productivity and at the same time fighting poverty (Will, 2013).

2.4 Ways of improving hybrid maize seed grower retention in Zimbabwe

2.4.1 Review of Empirical Studies

In Contract farming model of agricultural production there is a pre-planting arrangement that details out how the crop is to be produced, quantities expected to be delivered, the preplanting prices ,product quality, transportation and bonuses to be awareded if any.There is also committiment by contractor to purchase commodity if all conditions are met (Minot, 2011). Often, the factors influencing participation of farmers in contract farming include lack of bargaining power, which is the negotiation between unequal economically powerful buyers and weaker farmers. There is no ability to negotiate and bargain the contract terms therefore they are left with the only option of accepting or rejecting the contract.

Contract farming has also been critiqued as being a tool for agro industrial firms to exploit an unequal power relationship with growers (Ndjeunga, 2005). While farmers usually enter into contracts voluntarily, they may, over time, invest fixed resources into production or alter their cropping patterns so as to become overly dependent on their contract crops. When this is the case, growers face limited exit options and reduced bargaining power, which may force them to accept less favourable terms.

According to Swain (2012), he found out that the results indicated that generally farmers who participated in contract farming were from better segments of the farming community in terms of educational level, level of mechanisation and better knowhow of the markets as compared to those non participant farmers. These were studies looking at determinants of farmer participation in contract farming of Gherkin and Paddy seed. Binary logit model was used to identify the determinants of farmers' participation in contract farming.

Simmons, *et al*., (2005) analysed the emergence and benefits of contract farming in East Java-seed corn, seed rice in Bali, and broilers in Lombok, Indonesia and observed that there is a wide array of contract types and this was related to the technical requirements of production and the associated costs .There was use of key informant interviews and household survey data. Probit analysis was used to identify factors contributing to smallholder participation in farm contracts and a two-stage estimation process used to measure the effects of farm contracts on gross margins and labour use. Results indicated participation in contracts as influenced by farm size and other factors such as smallholder's age, education, and participation in farm groups. Contracts increased returns to capital for the seed corn and broiler contracts but not for the seed rice contract. All three contracts influenced the types of labour used; however, none of them influenced total farm employment.

Champika & Abeywickrama (2014), evaluated Maize Contract Farming Systems specifically looking at adoption, problems and future prospects observed that that full-time farmers who have higher proportion of agricultural income, higher agricultural land holdings as well as agricultural experience and family labour participation were more prominent in adopting contract farming system. Moreover, statistically significant higher yield by maize contract farmers over non-contract farmers were

achieved due to efficient input delivery mechanism of the buyer. Further, adopters earned about two times higher agricultural income than non-adopters. It revealed that following the whole contract farming model, vertically well integrated value chain management, mutual trust between farmers and buyers and existence of an assured market for buyers were the key factors for the success of the system. Study applied principal component analysis to explain the factors affected in adoption.

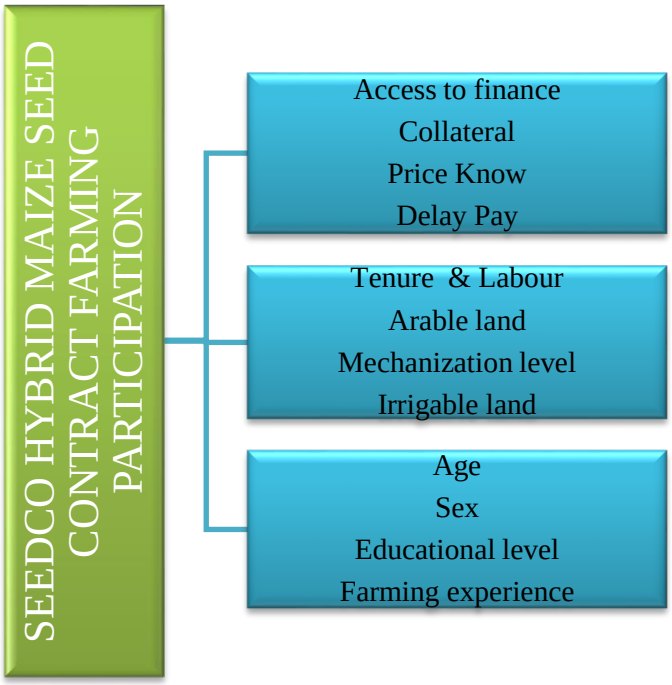
Benfica *et al.*, (2006) used the Goetz approach to investigate the determinants of participation of cotton and tobacco contract farmers in the Zambezi valley of Mozambique, and tested for the existence of threshold effect in land holdings and educational attainment on smallholder earnings from tobacco. Participation in contract farming schemes was statistically significantly linked to household factor endowments and alternative income opportunities.

2.5 Identification of Gaps

Although the International Maize and Wheat Improvement Center and Winters (2005) have carried out some studies that have discussed the issue of contract farming in Zimbabwe, no studies have been carried out to look at specifically determinants of farmer participation in hybrid maize contract farming hence the necessity of this study. Secondly studies on contract farming of seed crops are very scanty most of them are on commercial(commodity) crops hence any policy and interventions are based on generalisations' and not from empirical studies carried out in Zimbabwe. The delays in delivery or payment and quality deterioration emerging from the implementation failure or failure according to contract standards is resulting in loss of the contract's premium prices, non-renewal and termination of contracts.

2.6 Conceptual framework

The illustration below show issues that are perceived to influence seed grower participation in hybrid maize seed contract farming.



Source: Author own experience

Figure 2. 1 Conceptual Framework

2.6.1 Contract Farming

The issue of smallholder farmers in the fight against poverty, the constraints they face and coordination mechanisms needed to improve their operations, are well documented in literature. Various value chain and integration mechanisms have been put forward and this includes contract farming which is the subject of this research study. The term contract farming is at times used interchangeably with 'out-grower scheme'. CF has its roots in information and market imperfections that affect farmers' access to credit and produce markets leading to low productivity and income

respectively. CF offers credit to farmers without the need for collateral as demanded by formal financial institutions, thus helping finance agriculture.

2.6.2 Definition of contract farming

Senanayake (2008) undertook a rigorous critique of definitions by various authors like Minot (1986), Ncocosmos & Tosterink (1985 cited in Senanayake, 2008) and Ayako *et al*. (1989) cited in Senanayake, 2008) and noted that Roy's (1972 cited in Senanayake, 2008) definition that is, the form of arrangements between contractor and farmer could either be written or verbal however one or more aspects of the agreement either of production or marketing arrangement has to be highlighted with regards to the product in question. Senanayake (2008), in agreement with Glover (1990) and Rehber (1998), observed that the futures markets in the definition should be excluded. Bijman (2008) noted that the US Department of Agriculture defines CF as "the growing and marketing of farm products under circumstances that selective terms of the market-quantity, grade, size, inspection, timing or pricing are specified to both the grower and the processor or shipper before production is undertaken". In this study, the objective is to access the effectiveness of the contractual arrangement in terms of impact on production and marketing, a situation well covered in Roy's (1972 cited in Senanayake 2008) definition. The US Department of Agriculture puts emphasis on marketing and is thin on production. The conceptual framework and approach in this study will therefore follow Roy's (1972 cited in Senanayake, 2008) definition. CF affects the production decision of farmers and aligns them to the needs of agribusiness (Oya, 2012) also it is an aspect of intervention by either agribusiness, government or other organisations with a view to influencing farmers' production and marketing of their produce.

2.6.3 Types of contract farming

According to Baumann (2000), there are three types of CF, namely market specification contracts, resource-providing contracts and production management contracts. Market specification contracts guarantee a market for the farmer provided the set product standards are met. Intervention by the contractor is normally limited to grading of the crop at the marketing stage. While a resource-based contract provides the necessary credit in the form of agricultural production inputs and at times working capital. Credit advanced is recouped when the farmer sells produce. Under this contract farmers can also be offered extension services and there is a high chance of technology transfer. Production and management contracts are a combination of the two. In Zimbabwe, tobacco marketing is controlled by Tobacco industry and marketing board (TIMB) which provides a ready market through the auction market system, hence the last two types are more appropriate given their capacity to offer credit to farmers and influence farmers' production activities. The issue of access to credit and market imperfections are brought to the fore by these definitions. Will (2013) identified five contract farming models as discussed below.

- **Informal model**

As implied in the name, small agribusinesses enter into informal contracts with farmers, generally for the production of vegetables on a seasonal basis. Agribusinesses are mainly concerned with quality and hence intervene in the 'sorting, grading and packaging' activities (Bijman, 2008). Support services are normally provided by government and this type of model has a high risk of default by both parties (Will, 2013).

- **Intermediary model**

This is an infusion of an informal and centralised model; basically it involves three parties – the buyer, middleman and the farmer. Vertical coordination problems like the supply of inputs and support services normally arise, and farmers might not benefit from technology transfer and market-related prices as the middleman might strive to maximise his/her margins (Will, 2013; Bijman, 2008).

- **Nucleus estate model**

This model is based on a buyer also being involved in farming from their own estate and contracting other small farmers to mainly supplement supply for their own processing. Tongaat Hulett Sugar uses this model in Zimbabwe's Chiredzi district.

- **Multipartite model**

Various organisations might be involved in this model, ranging from government/statutory bodies, financial intermediaries, agribusiness and farmers. Koranteng (2010) researched one such model, the IDC-KAT River Citrus Development Scheme in South Africa where the financier provided funding through the agribusiness to finance farmers involved in citrus production. In this proposed study, a statutory body like TIMB works with contractors in the production of tobacco with smallscale farmers. The contractors are responsible for sourcing offshore finance and TIMB provides support services like research and development and the platform for the marketing of tobacco.

- **Centralised model**

Vertical coordination is high in this model, and normally characterised by formal contracts that specify production and quality demands, and involves a number of farmers contracted by a processor (Will, 2013). The focus of this study is on resource-

providing models like the last two. Seed houses in Zimbabwe use this type of CF arrangement.

2.7 Hybrid Maize Seed

The major breeding objectives (farmer benefits) from maize hybrids are improved attributes in the following aspects, hybrid vigour resulting from heterosis, increased yields, improved heat and drought tolerance, improved disease tolerance, uniformity, improved root and stalk lodging(standability) among other attributes of economic importance (MacRobert et al., 2014). For farmers to enjoy genetic gains proper good agronomic practises have to be followed coupled with strict adherence to field quality assurance standards as prescribed in the guidelines such as good isolation distances, pest, and weed and disease management. The practises followed are however more strict as one may compare with open pollinated maize seed production. It takes a minimum of six to eight seasons to come up with a variety of hybrid maize. Work by MacRobert, et al.(2014) mentioned that development of parental lines take place in isolation far away from other fields. Selection of germplasm is done from known heterotic groups (known backgrounds) for example, earliness to maturity lines crossed with heat and drought tolerant material to come up with a variety that has both desired attributes. Religious following of field management practises like planting splits, planting patterns, rogueing of off types, timing and quality of detasseling, male out, timing of harvesting, shelling and seed conditioning remain key to the success of the programme.

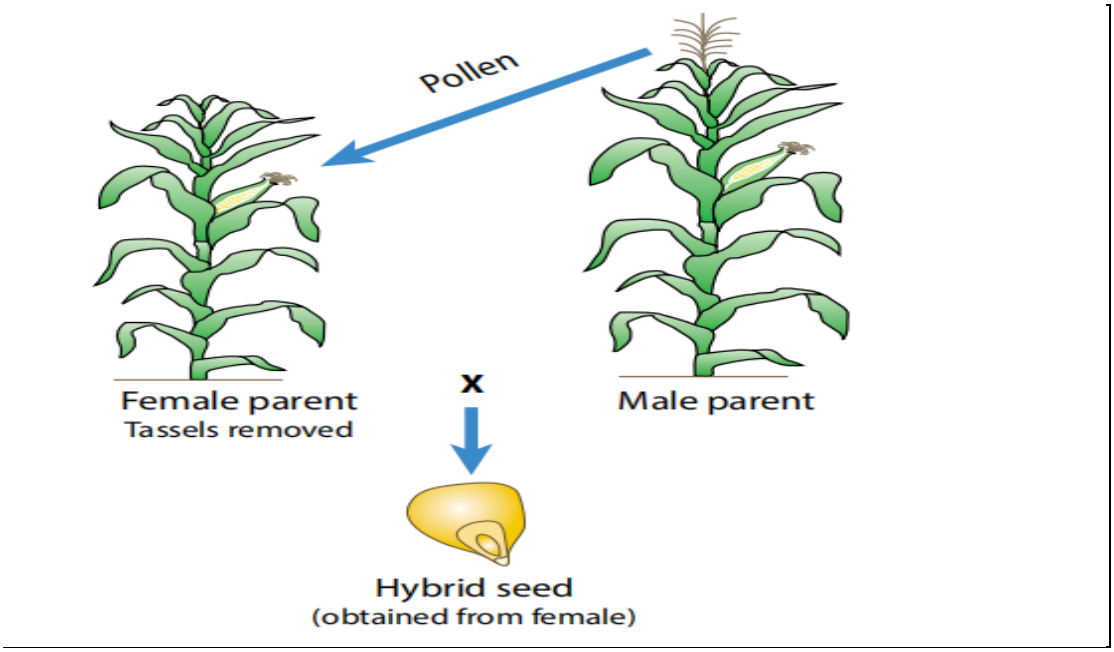
Any errors to some processes and procedures might lead to the seed plot or seed lot being rejected or removed from certification.

2.7.1 What is a maize hybrid

It is the resultant of cross breeding activities between two or more genetically dissimilar lines (MacRobert et al., 2014). Depending on the attributes of choice one maybe considered the seed parent(female) usually yielding lots of seed and the and the plant that provides the pollen to fertilize the female is called the male or pollen parent normally selected because of good pollen production and ability to shed pollen for a much longer duration. The offspring usually inherits desirable characteristics from both parents. MacRobert, et al.(2014) said that depending on the intended use and target production areas, desired hybrids would have at least one or more of the following, such as earliness to maturity, disease tolerance, grain texture, protein content, heat stress tolerance, resistance to both root and stalk lodging, good green mealie taste, long shelf and many more. The various forms of hybrids produced are single crosses, three-way crosses, double crosses and top-crosses being differentiated by their parental composition.

The most commonly used planting patterns are the 6:2, 4:1 and 3:1 female to male ratio.

Figure 2. 2: Hybrid Seed Production



The production of hybrid maize entails use of specific male and female inbred or single cross lines, where upon detasseling is done to the seed parent(female) at flowering. The assigned pollen parent (male) is then allowed to pollinate the silks of the female plants leading to fertilization.

2.8 Summary

The chapter has looked at literature review that is relevant to the area of study on factors that influence farmer participation in contract farming. It discussed the definition of contract farming citing from different authors. The theoretical and conceptual framework that guided contract farming were explained while supporting diagrams to simplify the illustration by way of diagrams were included. The next chapter is going to look at the Methodology of carrying out the research.

CHAPTER 3 METHODOLOGY

3.1 Introduction

This chapter focuses on the research design and methodology as well as approach that was used in gathering data for this research. Areas covered include selection of study population, sampling techniques, data collection and analysis. A brief outline on research methodology employed as well.

3.2 The Research Design

This study employed the descriptive crosssectional design. Primary data was collected using a structured questionnaire for the summer of 2019/2020 maize seed production season.The descriptive research design was adopted primarily because of the nature of this study which is focusing on determinants of farmer participation in hybrid maize contract farming. Descriptive research is derived from a broad class of non-experimental studies with the purpose of describing characteristics of a phenomenon as it is occurring (Schwarzkopf, 2008). Thus descriptive research is a scientific method which involves observing and describing behaviour of a subject without influencing it in any way. Moreover, the descriptive research design was used in this study because it provides accurate and valid representation of the factors or variables that pertain or are relevant to the research question (Wyk, 2012). In relation to this study it allowed one to have an understanding of the key issues influencing farmer decision to adopt or not adopt contract hybrid maize seed contract farming in Zimbabwe.

3.3 Research Strategy

The survey adopted was the overall research strategy in conducting the research. A research strategy is a general plan that helps the researcher in answering the research questions in a systematic way (Saunders, Lewis &Thornhill, 2016). Survey research involves the collection of information from a sample of individuals through their responses to questions. The survey strategy was appropriate for this study because it involved reaching a large number of people to answer a set of questions and was mostly used to assess thoughts, opinions and feelings (Saunders et al., 2016) of the participants among hybrid maize seed growers under Seed Co in this study. Thus the survey strategy allowed the researcher to collect a large amount of data from a sizable population under study. Additionally, the survey method allowed for easy comparison since standardized data was based on a questionnaire and also allowed for more control of the research process (Saunders et al., 2016).

3.4 Population and Sampling

3.4.1 Population of the Study

The population for this study comprised of all 120 registered seed growers under Seed Co Zimbabwe.

3.5 The Study Sample

According to Harvey (2012) a sample is a subset of a wider group of individuals who take part in an investigation. The primary purpose of sampling is that by selecting some elements of a population, the researcher can draw conclusions about the entire

population. The study had 94 farmers as the appropriate sample size. An online sample size calculator called Raosoft® was used at 95% confidence interval and 5% margin of error or significance interval (s.i).

Simple random sampling which is a probability sampling technique was used to select the participants. A random sample is one in which each unit included in the sample will have certain pre assigned chance of inclusion in the sample (Singh & Masuku, 2014).

The study sample size also met the criterion using the central limit theorem. The central limit theorem postulates that if the population is not normal, the sampling distribution of sample means will be normal provided the sample size is sufficiently large. Thus, the sample size must be 30 or more before the sampling distribution of the mean becomes a normal distribution (Filmus, 2010). In addition, (Steyn, 2012) confirms that 94 is a sufficient sample size.

3.6 Data Collection Instruments

Data can either be primary or secondary. According to Steyn (2012), primary data is collected from the main source and secondary data is collected from other sources. Thus, primary data was collected using a structured questionnaire. This was aided through the use of Seed Co seed production Agronomists as enumerators who work from specific allocated districts.

The enumerators underwent training before pretesting the questionnaire as a way to improve their administering technique and help adjust time taken to complete the process.

3.6.1 Description of Variables.

Table 3. 1: Description of variables

Variable	**Description**
Age	Age of grower in completd years
Gender	Sex of grower male or female
Educational level	Highest level of education attained , primary, secondary, tertiary.
Farming experience	Number of years in farming
Tenure	Land owned or leased
Arable land	Total arable land in hactares
Irrigable land	Area that is under functional irrigation in hactares
Mechanisation level	Relates to availability of farm infrastructure, tractors and implements
Collateral	Is it available or not
Inputs provision	Partial or ful package advanced to farmer . Yes/No
Access to finance	Own, SeedCo or other sources Yes/No
Price Know	Knowledge of pre-contract price or no . Yes/No
Delay Pay	Time taken to pay for deliverd seed in days , prompt, 14,30,60.

The pilot study of the research consisted of seed growers a Seed Co that were not part of the sample therefore, defined as a pre-testing of the questionnaires. One of the advantages of conducting a pilot study prior to the main research is that necessary changes can be made on the research instruments so that the main research will have minimal problems (Saunders et al., 2009). The researcher conducted pilot study to 5% of the sample size that are not part of the population.

3.7 Data Collection Procedure

This study used a combination of email, telephone and drop and pick method since movement was restricted due to Covid-19 locked down measures during data collection. It was also as a way to reduce contact between enumerators and participants in fulfilment of the world guidelines on reduction of the spread of the disease.

Step 1: The researcher selected a sample of 94 participants from Seed Co.

Step 2: The researcher explained to the respondents the purpose of the study and requested for their co-operation.

Step 3: The researcher then distributed questionnaires to the selected sample.

Step 4: The researcher asked the key participants to fill-in the questionnaires.

Step 5: The researcher collected the questionnaires from the respondents and thanked them for their participation.

Step 6: The researcher then proceeded to analyse the findings from the respondents using the Statistical Package for the Social Sciences IBM (SPSS) version 20.0 after having gone through data validation and cleaning.

Table 3. 2: Sources of information for the study

Primary sources	**Secondary sources**
Questionnaires	Seed Co Annual reports, Zimstat, ZSTA, ISTA reports.
	Journals, books, articles and documents on Agriculture

3.8 Analysis and Organisation of Data

An econometric model was employed to analyse the data on determinants of farmers' participation in hybrid maize seed contract farming using IBM SPSS 20.0 version software.

3.8.1 Model Specification

The two most common functional forms used in adoption studies are the Binary logistic regression model and the Probit models. The advantage of these models are that the probabilities are bounded between 0 and 1.The dependent variable is dichotomous taking two values, 1 if the event occurs and 0 if it does not. Binary Logistic(BL) regression model was used to identify the determinants of farmers' participation in hybrid maize seed contract farming.

This model revealed the effect of explanatory variables on the decision to participate or not participate in hybrid maize seed contract farming.

The model has the following form;

$$Zi=Log[Pi/1-Pi]=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7+\varepsilon$$

Where:

- Zi=is a binary variable that takes value one (1) for participation in contract farming and zero (0) for non-participation. **β** represents the elasticity of the determinants of farmer participation in hybrid maize seed contract farming, $\mathbf{X_i}$ represents the factor that influence farmer decision(determinant) which are the explanatory variables.

The potential explanatory variables those selected for hybrid maize seed contract farmers are presented in the following table.

The exact binary logistic equation which was used in the study to estimate and assess the determinants of farmer participation in contract hybrid maize seed contract farming is as follows:

$$FCONTRACT=\beta_0+\beta_1AGE+\beta_2GEN\beta+\beta_3EDU+\beta_4EXP+\beta_5TEN+\beta_6ARABLE+\beta_7IRRIGABLE+\beta_8MECH+\beta_9FINACCESS+\beta_{10}PRICEKNOW+\beta_{11}DELAYPAY+\beta_{12}COLATERAL+\varepsilon$$

The model assumes the following that the error term (ε) is normally distributed with mean zero and also, the ε_i are independent of each other.

Table 3. 3: Interpretation and Summary of Explanatory Variables

VARIABLES	**DESCRIPTION**	**MEASUREMENT**	**HYPOTHESIS**
DEPENDENT	**VARIABLES**		
FCONTRACT			
INDEPENDENT	**VARIABLES**		
Age	Number of completed years by the seed grower	Years	+/-
Sex	Gender of farm owner whether male or female	1=male; 0= female	+/-
Education level	Highest level of formal education attained by the seed grower	1=High level 0=Low level	+

Farming experience	Number of years in seed production	Years	+
Tenure	Dummy variable for whether land is owned or leased	1=Yes ; 0= otherwise	+
Arable land	Total cropping area available on farm	Hectares	+
Irrigable land	Dummy variable for whether the farmer has irrigation	1=Yes=otherwise	+
Mechanisation	Level of mechanization	Number of equipment	+
Collateral	Whether collateral is available or not used to secure funding	1=Yes ; 0= No	+/-

Access to finance	Are there alternative sources of funding	1=Yes; 0=No	+
Price know	Is Information relating to pre-contract prices available or not.	1=Yes; =No	+
Delay Pay	In days	1=Prompt 0=otherwise	_

3.8.2 Data Analysis

The IBM SPSS 20.0 version tool was used to analyse quantitative data in this study. Information will be presented in the following ways:

- Tabular Method, which provides a more precise, systematic and orderly presentation of data in rows and columns.
- Semi-tabular Method, which involves the use of both textual and tabular methods.
- Graphical Method, which will visually present findings using charts and diagrams.

3.8.3 Methodological Limitations

The method normally suffers multi-collinearity problem due to the nature of the data and it was important to test for collinearity.

Bivariate analysis was done first and a test for multi-collinearity was also done. Only those variables that were significant after Bivariate analysis were taken to the final model and also with a low variance inflation factor showing no collinearity were also taken into the model. Those with a high variance inflation factor were discarded because it's a sign of collinearity.

3.8.4 Validity

Weiner (2007) confirms that validity refers to the degree to which any measurement approach or instrument succeeds in describing or quantifying what it is designed to measure. Validity is the extent to which any measuring instrument measures what it is intended to measure (Thatcher, 2010). The research used the following types of validity in the questionnaire.

- Face validity

This is concerned with whether at face value; the questions appear to be measuring the construct (Wyk, 2014). The researcher consulted some experts to evaluate the questions.

- Content validity

According to Thornhill (2014), content validity regards the representativeness or sampling adequacy of the content of a measuring instrument. The researcher ensured that each research question was represented in the questionnaire.

- Criterion validity

Criterion validity is used to demonstrate the accuracy of a measure or procedure by comparing it with another measure or procedure which has been demonstrated to be valid. To this regard, the researcher used the questionnaire in a variety of situations in order to see how predictive it was.

- Concurrent validity

According to Weiner (2007), concurrent validity is a measure of how well a particular test correlates with a previously validated measure. Concurrent validity is concerned with whether results of a new questionnaire are consistent with results of established measures.

3.8.5 Reliability

Reliability of measurement refers to its consistency, that is, the extent to which a measuring device will produce the same results when applied more than once to the same sample under similar conditions. The researcher used the following types of reliability.

- Parallel forms of reliability

Parallel forms of reliability are used to assess the consistency of the results of two tests constructed in the same way from the same content domain (Saunders et al, 2009).

- Test-retest reliability

Test-retest reliability is used to assess the consistency of a measure from one time to another (Thatcher, 2010). In order to measure the test-retest reliability, the same test is given to the same test respondents on two separate occasions.

- Inter-rater reliability

Inter-rater reliability is the extent to which two or more individuals (coders or raters) agree. Inter-rater reliability addresses the consistency of the implementation of a rating system (Wyk, 2014).

3.9 Ethical Considerations

The researcher adhered to ethical guidelines.

3.9.1 Informed consent

Before carrying out the research, the researcher informed the respondents about the reason for conducting the research through a consent form. The participants were then allowed to voluntarily participate in the study. No coercion or duress was used in the study. In addition, the respondents had absolute freedom of choice of whether to continue with the research or not.

3.9.2 No harm to participants

In the consent form the researcher ensured the respondents were not going to get any harm because of participating in the research. The researcher strongly emphasised that the information that was going to be obtained was going to be used for academic purposes only. According to Thorner (2010) when conducting a study, the researcher should make sure that there is no harm to the participants.

3.9.3 Confidentiality and anonymity

Confidentiality had to be maintained throughout the study. The researcher had to have a non-disclosure of confidential information agreement with the participants. In addition, the study had to use numbers to reflect the respondents and the real names of the participants were not used. According to Thorner (2010), confidentiality should be maintained for the researcher to be trusted even in the near future.

Table 3. 4: Analytical Framework

SPECIFIC OBJECTIVES	**ANALYTICAL APPROACH**	**DATA REQUIREMENTS**	**TOOLS**
To determine the socio-economic characteristics of hybrid maize seed producers in Zimbabwe.	Descriptive statistics	Socio-economic characteristics of growers(age, sex, seed growing experience, level of education attained)	Question naires

To establish the determinants that influence the participation of hybrid maize seed producers in contract farming in Zimbabwe	Binary logistic regression	Farm factors, technical determinants, irrigation, region collateral, labour, access to finance, gender, payment, mechanisation	Question naires
To suggest ways of improving hybrid maize seed grower retention in Zimbabwe.	Descriptive statistics		Question naires

3.10 Summary

The chapter looked at the research design; the researcher used the survey design to gather data from the research elements. A population of 120 seed growers were used. The actual sample was taken using a random sampling technique using a computer software called Raosoft. In order to gather data, the researcher designed a questionnaire for use by farmers. The research instruments were subjected to validation so that they capture relevant research information. This was achieved through a pilot test. The use of various data presentation methods such as use of tables, bar graphs, regression modes, binary logistic regression, descriptive and narrative statistics was used so that the objectives and research questions of the research could be fully answered.

CHAPTER 4 DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter presents and analyse data collected from the study and the presentation of results is in the form of tables, graphs, charts and models. This chapter also presents the response rate, demographics of the respondents and the research findings which are presented as per objective. The research results shall be compared and contrasted with findings by other researchers in similar studies.

4.2 Response Rate

Response rate is the level at which the targeted sample responds to the administered research instruments. Table 4.1 shows the response rate of the participants.

Table 4. 1 Response Rate

	Questionnaires Distributed	Questionnaires Returned	Not responded
Total	120	94	26
As a Percentage	100%	78.3%	21.7%

The study shows that 94 seed growers responded representing (78.3%) of the sample and 26 seed growers representing (21.7%) of the sample failing to respond. This

response rate was sufficient enough as suggested by Leedy (1993) who recommended an effective response rate of (75%) and above which ensured a good representation of the whole population in the study.

4.3 Data presentation and analysis

4.3.1 Socio-economic characteristics of Seed Co's hybrid maize seed producers in Zimbabwe

Adoption of new technologies, innovations or practices take place within a socio-cultural environment and requires key capital inputs such as labour, finances, and social capital (Ellis, 1993).

4.3.2 Gender

The study revealed that males constituted a bigger proportion of the total number of hybrid maize seed growers with 79.66% as compared to 20.34% women as illustrated in figure 4.1 below. This skewedness in favour of men is consistent with local beliefs that land has to be in the custodianship of men as the heads of households and is in tandem with previous studies on land ownership patterns whereby men have moreaccess to land (Dube & Mugwagwa, 2017)

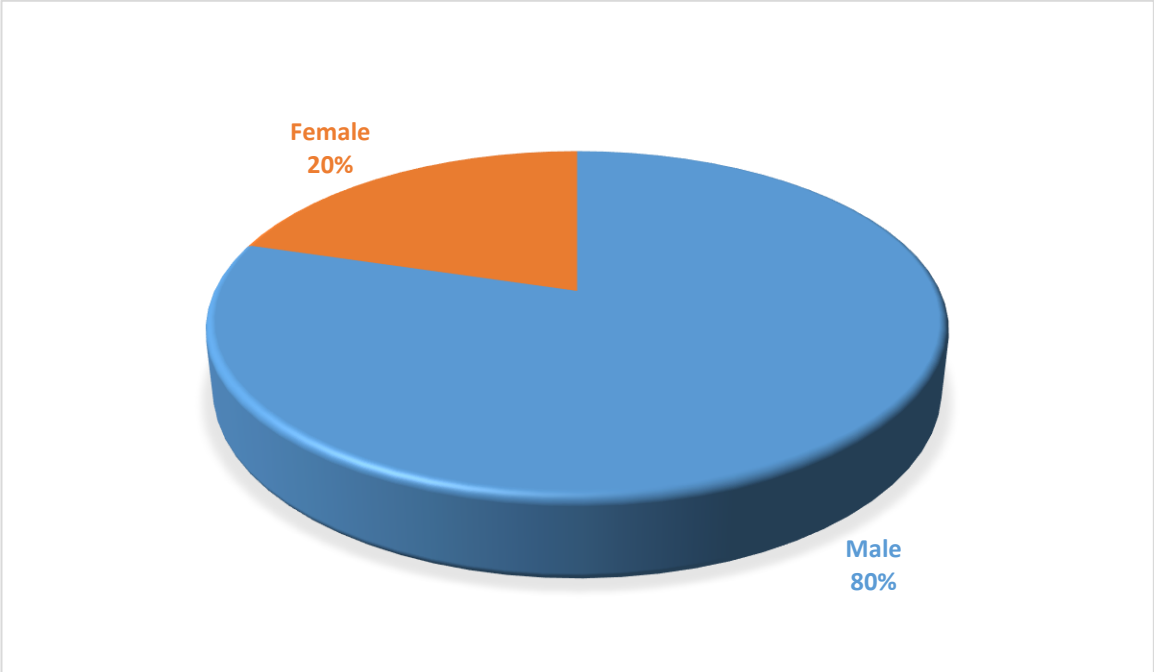


Figure 4. 1 Gender of the respondents

The other reasons could also be attributed to the selection criteria used by Seed Co to recruit hybrid maize seed growers where by the following factors can disadvantage women such as land ownership, availability of farm structures and equipment, access to financial resources which naturally work against this group of the farming community emanating from historical and contemporary disadvantages facing women (Sandra, 2010).

4.3.3 Age of the respondents

Table 4. 2 Age of the respondents

Age category	Frequency	Percentage
40 years and below	10	10.6
41-50	50	53.2
51-60	18	19.2
61-70	13	13.8
71 years and above	3	3.2
Total	94	100

n=94

Analysis of results revealed that the ages of the maize hybrid growers ranged from 32 years to 75 years of age. The average age was 48.3 years. Most of the growers were in the age range 40-50 years with 53.2%. Economically active group that is up to 60 years of age constituted 83% of the hybrid maize seed growers with the remainder in the less economically active bracket of plus 60 years with the balance of 17%. There is less participation of young maize seed growers below the age of 40 years. The study findings by Sandra (2010) is also in agrrement that there is less participation of both women and most young people. These two categories of people lack access to land and resources to utilise the land in the case of those that have.

4.3.4 Education Level

Table 4. 3 Highest level of education attained by grower

Level attained	Frequency	Valid Percent
Secondary	15	16.2
Certificate	20	21.6
Diploma	30	32.4
Degree	18	18.9
Masters	8	8.1
Doctorate(PhD)	3	2.7
Total	94	100

N=94

The results show that 100% of the hybrid maize seed growers are literate as they obtained a minimum of secondary school education. Often times, education enables greater capacity for information analysis and therefore more rational decision-making which is favourable to good change (Adekambi et al.,2010).

Basing on these findings it is clear that the population of seed growers at Seed Co that was selected is made up of well educated participants who are capable of synthesizing and analysing issues in the hybrid maize seed growing contract and quickly make informed decisions.This is also in tandem with other researchers, Nakhumwa (2012) who argued that education is a helpful tool for farmers in analyzing choices and making decisions about forecasts of the anticipated benefits of adopting technologies. Thus it is hypothesized that producers with more education are more likely to be adopters than farmers with less education (Teklewold *et al*., 2006).

4.3.5 Natural Farming Region

Table 4. 4 Distribution of Respondents by farming region.

Region	Frequency	Valid Percent
Natural Region 2	86	91.9
Other Regions	8	8.1
Total	94	100

N=94

The study results showed that most of the seed growers who participated in the study are located in Zimbabwe's natural climatic region 2 characterised by moderate to very high rainfall received annually. Only 8.1% of Seed Co growers are located in other natural farming regions other than region 2 where specialisation is mainly other activities such as plantation crops , cattle ranching and wildlife management . The bulk of Seed Co growers are taking their farming activities in natural region 2 and they accounted for 91.9%. This is consistent with Zimbabwe's climatic region classification which states that natural region 2 is for intensive annual cropping, most of the grains are produced in this region covering much of the Mashonaland provinces. The region is located in the middle of the north of the country. The rainfall ranges from 750 to 1 000 mm/year. It is fairly reliable, falling from November to March/April. Another possible explanation to this finding that most seed growers are found to be in region 2 is that the seed processing plant is located in the same region , so distance to the plant seem to be influencing positively.

4.3.6 Financial Access

Table 4. 5 Proportion of farmers with access to alternative funding to those without.

Financial Access	Frequency	Percent
Available	36	38.3
Not available	58	61.7
Total	94	100

N=94

These results indicate that the majority of the respondents 61.7% have no access to alternative sources of funding other than the inputs and advance payments offered in the hybrid maize seed contract, only 38.3% do have their own sources of funding. The possible explaination to this finding is the fact that most of the land that the farmers have is state land hence not titled . Local financial intsitutions do not consider this as collateral. This is supported by the study of (Akhtar et al.,2018) which established that financial constraints are the most significant characteristics of maize seed growers.

4.3.7 Colateral

Table 4. 6 Proportion of seed farmers with and those without collateral.

Colateral	Frequency	Percent
Have Colateral	14	14.89
No collateral	80	85.11
Total	94	100

N=94

According to the study results most farmers 85.11% indicated that they do not have some form of collateral acceptable by local banks to borrow funding against . Only about 14.89% did indicate that they have acceptable forms of collateral . The reasons to explain could be possibly be multiple ranging from lack of title to the farmland that most of these seed growers occupy. The local finance institutions do not accept or consider government offer letters as bankable documents save for a few who purchased their farms approaximately 2%. The other proportion of seed growers have collateral in the form of titled residential homes or other real estate properties. The rest of the seed producers own properties that are not titled or they fear its too risk to attach their houses. Some banks do not accept movable property for the large sums of money required.

4.3.8 Labour

Table 4. 7 Distributionof seed producers with labour and those without adequate labour.

Labour	Frequency	Percent
Labour available locally	20	21.28
Rely on Outsourcing	74	78.72
Total	94	100

N=94

The study results show that most seed growers 78.72% struggle with labour and only a few have the luxury of recruiting as they so wish at 21.28%. The possible explaination is that most gold mining areas like Mazowe, Bindura,Mhangura also happen to be the main seed producing areas because of good rains , soils dams and size of land holding. There is possibly very stiff completion for labour with the minng activities. The mode of payment which is usually bank transfers at the end of the month

in the local currency seem to be also a very big factor against labour availability on farms. Compunded by liberalization of the mining industry to allow small scale(artisinal mining) this is another possibility to explain this challenge of labour unavailability on farms.

4.3.9 Irrigation

Table 4. 8 Proportion of seed growers with and with no functional irrigation .

Irrigation	Frequency	Percent
Available	82	87.23
Not Available	12	12.76
Total	94	100

N=94

Farmers were asked if they had functional irrigation on their farms irrespective of the fact that this is a pre-requisite on recruitment. A total of 82 seed growers reptresenting 87.23% of the participants indicated that they had functional irrigation whilst only 12 of the respondents had no functional irrigation facilities. The reasons for non functional irrigation could be attributed to mostly vandalisim through theft of aluminium pipes and centre pivot electronic control units. In some instances it was due to equipment damage when there is power surge caused by constant unplanned outages. Irrigation is very critical as it is needed mostly during crop establishment and during critical crop stages like flowering where drought effects can be devastating. MacRobert et al., (2014) also gives the same view that moisture stress during flowering negatively affects synchronisation resulting in very poor yields and and seed quality. The results are skewed towards seed producers with irrigation because it is company policy that any prospective hybrid maize seed grower mjust have functional irrigation

even in high rainfall areas . Another reason to explain this scenario is the fact that SeedCo embarked on a grower transformation initiative meant to capacitate growers with irrigation infrastructure and pay them off over a period of time.

4.3.10 Mechanization

Table 4. 9 Distribution of growers with and without machinery and equipment on farm.

Equipment Availability	Frequency	Percent
Yes	42	44.68
No	52	55.32
Total	94	100

N=94

The use of farm machinery and equipment can not be over emphasised in hybrid maize seed production as it leads to not only timeliness of operations but to quality of work as well. Farmers were asked to indicate if they at least own one piece of equipment and or machinery used in land preparation, planting operations and crop protection equipment like tractor mounted boom sprayers. The bigger percentage 55.32% indicated that they did not have have or they at most owned one in the three categories. The lesser proportion 44.68% owned at least 2 to 3 equipment in the main areas asked ie land preparation, plantimg and crop protection. The use of machinery also results in reduced demand for human physical labour which is now expensive to hire and manage if at all one can get it. The figures show an almost equal set of numbers probably due to various initiatives by government in farmer capacitaion , like the Reserve bank of Zimbabwe facility, Brazil more food programme , and lately the

Agribank facility in year 2019 coupled with the similar facility by SeedCo covering tractors and irrigation mainly.

4.3.11 Delay Pay

Table 4. 10 Seed grower payment lag time

Delay pay-Payment lag time	Frequency	Percent
Prompt	13	13.83
Otherwise	81	86.17
Total	94	100

N=94

These results indicate that the majority of the respondents concur with the view that the time taken before a seed grower is paid after delivery of the produce plays a role in determining whether the farmer continues with contract or not. Only 13.83% of the seed growers indicated that in the year 2019/20 they did were paid promptly and were thus happy to continue growing hybrid maize seed under the contract system. The bulk of the growers 86.17% had reservations as there payments took longer to be effected hence not so happy(Bekele *et al*., 2011).. Delayed payment of seed growers is normally due to various reasons ranging from failure by growers to meet the minimum physical and genetic purity standards as set out in the seeds certification scheme and the Seeds Act: Chapter 13 notice 2000 to cashflow challenges from SeedCo. A study by (Glover & Kusterer, 2016) revealed that there is need for companies to be on time in input delivery and also payments that ways famers will be motivated.

4.4 Discussion and interpretation.

4.4.1 Results of the Binary regression model Determinants of Farmer Participation

Some of the variables fell off and could not make it into the final regression due to the fact that they were not significant when the bivariate analysis test was done and also some fell off due to multi-collinearity.

Table 4. 11: Variables in the final equation

Variables		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Region	.020	.017	1.435	1	.231	1.020	.987	1.055
	Gender	-.071	.070	1.046	1	.307	.931	.812	1.068
	FinAcces	-.206	.019	114.329	1	.000	.814	.783	.845
	Colateral	-.278	.028	96.132	1	.000	.757	.716	.800
	Irrigation	-.736	.075	96.217	1	.000	.479	.414	.555
	Labor	.927	.078	140.064	1	.000	2.528	2.168	2.947
	Mechanisation	.491	.085	33.284	1	.000	1.634	1.383	1.931
	DelayPay	-.132	.038	12.279	1	.000	.876	.814	.943
	Constant	4.086	.200	418.108	1	.000	59.508		

a. Variable(s) entered on step 1: Region, gender, FinAccess, Collateral, Irrigation, Labor, Mechanisation and DelayPay.

Classification Table [a,b]

	Observed		Predicted		
			whether farmer entered into contract		Percentage Correct
			No	Yes	
Step 0	whether farmer entered into contract	No	0	10	.0
		Yes	0	84	100.0
	Overall Percentage				90.1

a. Constant is included in the model.

b. The cut value is .500

Table 4. 12 Hosmer and Lemeshow Test

	Chi-square	Df	Sig.
1	22.337	8	.004

Most of the variables used in the regression to estimate the determinants of farmer participation in hybrid maize seed contract farming were significant at 95% confidence interval and 5% margin of error except two.

4.4.2 Region

The region in which the farmer is located was found not to influence farmer participation. It produced a coefficient of 0.02. The results of the regression revealed that farmer decision to either participate or not participate in the contract arrangement is not influenced by the region from which the farmer is located with a significance of 0.231 and crossing 1 between the lower and upper bound therefore failing the test as one condition. The result is significant at 5% level of significance. A possible explanation could be the availability of irrigation infrastructure on most of the farms that participated in the study. It is also company's policy that a seed grower has to have functional irrigation for one to meet the minimum qualification criterion rendering amount of rainfall received less important. This finding contradicts results found by Khoza *et al*., (2019) who found out that probability of participation declined with each extra kilometre increase in distance away from the processing plant and also Kassie *et al*., (2015) in a study of the dterminants of market participation regimes among maize smallholder producers in Kenya who found that farmer district (location) plays a positive and significant role in deciding whether to produce maize or not. Gen-xing *et al*., (2017) found out that agro-ecological zone played a negative and significant influence to farmer decision in the Mayange sector characterised by long dry seasons.

4.4.3 Gender

Gender of the farmer was found not to influence farmer participation. The variable produced a p-value of 0.307 which is not significant at 5% level of significance and a negative coefficient of 0.07. This means that whether the seed grower is male or female was not found to influence the decision to participate or not participate in the hybrid

maize seed contract farming with Seed Co. However in a study by Nkurunziza & Ngabitsinze (2015) of the determinants of farmer participation in vertical intergration in the coffee value chain in Rwanda male headed households was found positively and significantly influencing decision to participate in coffee cooperatives. This implies that male headed households were more likely to join and participate in farmer's cooperative than female headed households. However this contradicts findings by Kabeto (2014) whose results were negative and significantly affecting farmer participation in red bean markets on the gender variable.

4.4.4 Access to Finance

Access to alternative sources of finance (credit) negatively and significantly affect farmer participation. According to the study findings it was observed that the variable on access to credit facilities negatively influence farmers' decision whether to participate or not with a negative coefficient of 0.206 and a p-value of 0.000. The result was significant at 5% level of significance. Possibly those farmers that have limited or no access to alternative sources of funding will not prefer engaging into this forward contract arrangement since the company partially covers the production costs and bulk of the working capital having to come from the seed growers themselves. Similar findings were obtained in a study to establish the factors influencing adoption of climate smart agriculture practises in Kenya by smallholder farmers, Mutoko (2014). Similar findings by Azumah *et al*., (2016) also support this result. However this refutes findings by Nkurunziza & Ngabitsinze (2015) who found out that farmers who have no access to credit show a positive and significant decision to participate in cooperatives. Cooperatives are one of major source of credits for small scale farmers; therefore small farmers are more likely to become members in order to have access to

credit loan without collateral requirement and high interest rate once they do not have any other source of income apart from farming. Farmers who have access to formal credit are more probable to adopt improved technology than those who have no access to formal credit (Yishak, 2005).

4.4.5 Collateral

Collateral negatively and significantly affects farmer participation. This is closely associated with access to alternative sources of funding where by the study results show that there is a significant negative influence of this factor to the farmer decision to participate or not participate in hybrid maize seed contract farming. Results of the regression showed a negative 0.276 coefficient and a p- value of 0,000. The result is significant at 5% level of significance. This is in support of findings by Ndlovu *et al*., (2015) in a study of contract farming viability on maize and soya in Zimbabwe that Banks require collateral to show security against loans that is why it becomes difficult to lend small scale farmers hence a negative influence. The results are also in tandem with the findings of Swain (2008) that failure of capital markets to finace farmers due to lack of collateral clearly inhibit the adoption of new crops. A possible explanation to this outcome is that farmers without some form of bankable collateral when applying for alternative sources of funding are more likely not to participate, it is a de-motivational factor.

4.4.6 Access to Irrigation

Irrigation availability negatively and significantly affects farmer participation. The outcome of the regression shows a negative and significant influence of the variable on determinants of farmer participation. It has a coefficient of negative 0.736 and a p-

value of 0.000. The result is significant at 5% level of significance. A possible explanation for this result although not expected, is that farmers without some form of irrigation against the risk of droughts are less likely to take up the contract as the exposure to crop failure is huge. This refutes the findings of Dube (2020) who found out that access to irrigation positively and significantly affects farmer market participation as water is a very critical agricultural input allowing increased productivity. It also refutes findings by Napasintuwong (2018) in a study to establish the determinants of farmer participation in contract maize seed production in Thailand. Gen-xing *et al* (2017) found out that lack of access to irrigation and mechanisation resulted in depressed participation by farmers in the crop intensity programme especially in those drier regions.

4.4.7 Labour

There is a significant and positive influence by the predictor variable (Labour) on the dependent with a positive coefficient of 0.927 and a p-value of 0.000 at 95% C.I and 5% margin of error. This can be explained by the fact that seed maize production in Zimbabwe still depends much on manual labour to do critical operations like detasselling, so those farmers who do have a stable and substantial numbers of farm workers are better likely to participate than those who do not have enough labourers to do the manual work. Further to that, this also satisfies the apriori that the more labour on the farm the higher likelihood to participate. The results were in agreement with the findings of Kashavamurthy (2005) in a similar study of a labour intensive contract crop gherkin especially at harvesting that unavailability of human labour tends to negatively influence farmer participation. However it refutes findings by Mutoko (2014) that access to inadequate labour negatively influence adoption of climate smart

agriculture practises. Champika *et al* (2014) found out that household with more family labour were more likely to adopt maize contract farming. Napasintuwong (2018) found a negative and significant influence of availability of labour on farmer decision to participate in maize seed production in Thailand.

4.4.8 Mechanization

The level of farm mechanization positively and significantly affect a farmer participation. The study results show a significant and positive influence of the availability of farm tractors and equipment (mechanisation) as one key factor influencing farmer participation in maize hybrid contract farming with SeedCo. The coefficient from the regression was 0.491 and the p-value was 0.000. The result is significant at 5% level of significance. This result is in tandem with the hypothesised outcome (apriori) that there is a positive influence. The explanation to this outcome is possibly two pronged, one being the fact that the sample already is from a pool of farmers who have been assessed and found to meet the selection criteria, one of them being availability of farm tractors and equipment. The second reason is that land preparation and planting are critical farm operations that need to be done efficiently and timeously so that productivity is enhanced to add on to that, operations in pest control require farm tractors and equipment in this era of precision farming. The result is supported by the findings of Dube (2020) who found out that access to draft power positively affect farmer market participation as draft power is a critical and important agricultural input in production and transportation. However this refutes findings by Napasintuwong (2018) in a similar study in Thailand of farmer participation in maize seed production where the results showed a significant and negative influence of mechanization on farmer participation.

4.4.9 Payment

Payment negatively and significantly affect farmer participation. The study results showed that time taken between delivery of product (seed) and the time it will take before a farmer receive his or her payment is very critical. The results show that this factor has a significant negative influence to farmer decision. The longer it takes for the delivered seed to be paid the more likely seed growers are likely to abscond growing seed. A possible explanation is consideration of the time value of money by the farmers. The result of the regression showed negative coefficient of 0.132 and the p –value to be 0.000. The result is significant at 5% level of significance. These findings are in line with the results of Kashavamurthy (2005) in his study of the factors that influence the farmers for entering into gherkin contract farming where delaying paying farmers produce negatively affected farmers participation all attributed to the contracting firm's policy on payments.

4.5 Summary

Findings from the research have been presented and analysed in this chapter. These findings includes the response rate, the demographic profile and the main research findings of this study. Data was presented in tabular and graphic form. Several types of graphs were used and these include pie charts, bar graphs and several others. The next chapter will give a brief summary and conclusions from the research. The writer will also make some recommendations to the study and direct areas that needs further investigation.

CHAPTER 5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter is going to outline a summary of the study, conclusions derived from the study and research areas recommended for future studies. Objectives of the study are to culminate in a set of suggestions for improving grower retention of Seed Co hybrid maize seed growers and these shall also be outlined.

5.2 Discussion

The research was carried out based on a survey of 94 Seed Co hybrid maize seed growers from all the seed producing districts of Zimbabwe. Simple random sampling technique was used to select participating seed producers. There was use of a structured questionnaire in collectine one season data 2019/20 from seed growers on the following aspects, socio-economic characteristics of the hybrid maize seed growers, land use patterns, Seed contract details, farm structures and equipment.

In the study it was revealed that hybrid maize contract farming is a mature male dominated subsector of agriculture accounting for 80% of the seed producers. Those below the age of 40 years accounted only for 10.6 % representation. The average age of seed grower participants was found to be 48.3 years. The patriarchal male dominance scenario is believed to emerge from inequality in access to land and related productive resources such as capital as they also lack collateral. (Sandra,2010) found out that women and young people lack access to productive resources. A greater percentage of the farmer participants had gone beyond secondary school formal education with 83.8 % and this score was expected to positively influence farmer participation in hybrid maize contract farming. In terms of hybrid maize seed grower distribution by natural farming region 91.9% were found to be located in natural region

2. This is in agreement with the initial expectation that much of the annual row cropping activities happen in this region.

The average number of laborers in employ on seed farms was found to be 63 this is an indication that hybrid maize seed production is a labour intensive enterprise hence labour availability tends to positively influence farmer participation in hybrid seed maize contract farming. Sixty five percent of the seed grower participants indicated that they do have some form of financial access outside the inputs provisions from the hybrid seed production contract and this tend to positively influence farmer participation. Access to irrigation was found to be 83.7%, with 39ha being the average area put under hybrid maize seed in the 2019/20 season. 24.3% held titles to their farming land. The proportion of seed growers that had received some form of training in hybrid maize seed production was established to be at 37.8%.

In order to establish the determinants of farmer participation in hybrid maize seed contract farming, a binary logistic regression was used and this followed early work by Dube (2020) and Dube & Guveya (2016). Study findings showed that the major determinants of farmer participation in hybrid maize seed contract farming by Seed Co hybrid maize seed growers were access to finance, availability of collateral, irrigation availability, labour availability, level of mechanization and turnaround time to pay for delivered hybrid maize seed. Results from the study sample 83.7% had irrigation on their farms, 65% had access to finance with an average of 63 employees. Mechanization and labour coefficients were found to be positive implying that the variables had a significant and positive influence on farmer decision to participate in the hybrid maize contract farming. The following factors , access to finance,

availability of collateral, access or availability of irrigation facilities and time taken to pay seed growers were found to have negative coefficients implying that when these factors are unavailable hybrid maize seed growers tend to disadopt the contract arrangement hence leading to the problem of high grower turnover .

Gender and location of farmer by region produced results that were not stastisticaly significant at the 5% level of significance level.

5.3 Conclusions

This research sought to establish the determinants of farmer participation in hybrid maize seed contract farming. The study found that access to irrigation use, labour availability, level of mechanization, access to finance, availability of collateral and time taken to pay for delivered were the significant determinants of farmer participation in hybrid maize seed contract farming, all other factors held constant. This means that seed houses have to concentrate on these factors in order to reduce high seed grower turnover and improve seed grower retention.

Factors that were found to significantly influence farmer participation include access to irrigation use, labour availability, access to farm equipment, access to finance, availability of collateral and time taken to pay for delivered hybrid maize seed. Addressing these critical issues provides an opportunity for reducing grower turnover whilst increasing on grower retention thereby building a stable seed grower base.

5.4 Implications

The seed industry in Zimbabwe particularly seed houses need to be cognisant of the ever changing seed grower needs and expectations as a direct response to government policy, volatile operating economic environment and change in global trends that often

result in high grower turnover. The solution to high grower turnover is through seed grower retention and this can be achieved through various means such as, a thorugh and robust seed grower selection process whereby only those who meet the minimum selection criteria are recruited. In addition to that, continuous review of internal seed production processes and policy on factors such as labour and mechanization levels of growers as the study has indicated that these are some of the key determinants to farmer participation in maize seed contarct farming. Use of mechanical detasselers for detasselling, grower capaciataion in the areas of appropriate infrastructure and equipment on seed production farms.

On factors such as access to finance as a policy implication finding is that , seed houses can not be left to assist funding of growers alone since the issue of seed low volumes(shortages) is a national chellenge in nature which if not addressed through local seed production it leads to importation of seed from other countries therefore leading foreign currency outflows. Lobbying with government on behalf of seed producers for favourable low cost funding through treasury is also such measure that can be employed. Tax exemptions , rebates and tax holidays on inputs and equipment importation are some of the recommendations that can been proffered.

The policy implication on irrigation is also vital as revealed in the study of the determinants of farmer participation in hybrid maize seed contract farmingand that it is national in nature. The results have suggested tax exemption on irrigation equipment to farmers who wish to import such equipment.

5.5 Recommendations

In light of the findings of this study, the recommendations are a policy framework by Government that address farmer issues in the areas of , access to finance and collateral,

access to irrigation as a mitigatory measure against droughts, labour and mechanisation as a solution to ever rising of human labour. Contractors need also to prioritise payment of produce to cushion farmers against weakening currency. The above factors were found to be very significant in determing farmer participation.

5.5.1 Government

It is therefore recommended that government should create an enabling environment for industry players to be able to perform well. The study has revelaed that labour availability is amajor factor positively influencing farmer decision to adopt hybrid maize seed contract farming. Through the relevant line ministries wages need an upward review that they become competitive enough to attract entrants and retention . Lowering of taxes on farm machinery amd equipment is anticipated to help build capacity . Training in use and mainataince is also a strategic consideration on mechanization.

5.5.2 Seed Houses

Study findings have revealed that access to finance is also a critical determining factor coupled with labour availability and mechanization levels. It is recommended that seed houses should assist in farmer capacitation through intiatives such as acting as gurantours for seed producers as bankable collateral is not usually available to farmers as shown by the results of the study in the descriptive statistics over 85% without collateral. It is anticipated that farmer access to working capital will solve the mechanization challenge as well as the opration costs dilemma and hence positively influence farmer participation in hybrid maize seed contract farming. It is further recommended that Seed houses should pay for the delivered seed in the shortest

possible time as the study showed that delaying paying farmers can be a big demotivator that can influence farmer decision not to participate.

5.5.3 Seed Growers

The study findings revealed that access to functional irrigation infrastructure and high mechanization levels likely to lead farmers to participation in the hybrid maize seed contract farming arrangement , It is imperative that seed producers consolidate their participation through investment in seed processing equipment and machinery and irrigation infrastructure. This recommendation can be achived through pooling of resources on purchasing big machines and advanced technology such as mechanical detassellers. Further recommendations can also be directed towards acquisition of bankable collateral and possibly sceuring titles to their farming land.

5.6 Suggestions for Further Research

The study findings on the determinants of farmer participation in hybrid maize seed contract farming made use of cross-sectional data relating to one particular season , Recommendations are made that use of panel data in future studies would give a more broader analysis of the factors that influence farmer participation with less bias. So it is suggested that panel data be collected for use in further studies that seek to establish the determinants of farmer participation.

Focus on data collection was on SeedCo associated/contracted producers only. Since the main objective of the study is to seek for solutions that are relevant to the seed sector as a whole in helping to retain seed producers there is need for future studies to look at most if not all the registered seed houses ie the formal seed system of Zimbabwe.

References

Abhishek, T. (2019). Profit Maximization Theory and Value Maximization Theory. *International journal of scientific development and research*, 4(6), 284-289.

Abid, M., Scheffran, J., Schneider, U.A. & Ashfaq, M. (2015). Farmers' perceptions of and adaptation strategies to climate change and their determinants: The case of Punjab Province, Pakistan. *Earth System Dynamics*, 6, 225–243.

Abid, M., Schilling, J., Scheffran, J. & Zulfiqar, F. (2016). Climate change vulnerability, adaptation and risk perceptions at farm level in Punjab, Pakistan. *Science of the Total Environment*, 547, 447–460.

Adékambi, S.A., Adegbola, P.Y., & Arouna ,A. (2010). Peasant perceiption and adoption of bio-pesticides and / or botanical extracts in vegetable production in Benin. In African Association of Agricultural Economists (2010). *AAAE Third Conference/AEASA 48th Conference, September 19-23, 2010,* Cape Town, South Africa.

Adhikari, S.P., Timsina, K.P., Brown, P.R., Ghimire, Y.N. & Lamichhane, J. (2018). Technical efficiency of hybrid maize production in eastern terai of Nepal. A stochastic frontier approach. *Journal of Agriculture and Natural Resources*, *1*(1), 189-196.

Akhtar, S., LI, G.C., Ullah, R., Nazir, A., Iqbal, M.A., Raza, M.H., & Faisal, M. (2018). Factors influencing hybrid maize farmers' risk attitudes and their perceptions in Punjab Province, Pakistan. *Journal of Integrative Agriculture*, 17(6), 1454-1462.

Akcaoz, H. & Ozkan, B. (2005). Determining risk sources and strategies among farmers of contrasting risk awareness: A case study for Cukurova region of Turkey. *Journal of Arid Environments*, 62, 661–675.

Alderman, H. (2008). Managing Risk to Increase Efficiency and Reduce Poverty. World bank Report [2017-05-12].https:// openknowledge.worldbank.org/handle/10986/9165.

Ali, A., Beshir Issa, A. & Rahut, D.B. (2020). Adoption and impact of the maize hybrid on the livelihood of the maize growers: some policy insights from Pakistan. *Scientifica*, *2020*.

Arce, C. (2010). Risk management in the agricultural sector: concepts and tools. In: Strengthening the Caribbean Agrifood Private Sector: *Competing in a Globalised World to Foster Rural Development. 18–19 October 2010,* Grenada.

Anim, F.D.K. (2010). Effects of extension services of firms offering contract farming: A case study of small scale maize farmers in Limpopo province of South Africa. *African Journal of Agricultural Research*, 5(7), 514-517.

Ashraf, M & Routray, J.K. (2013). Perception and understanding of drought and coping strategies of farming households in north-west Balochistan. *International Journal of Disaster Risk Reduction*, 5, 49–60.

Aye, G.C. & Mungatana, E. D. (2010). Technical efficiency of traditional and hybrid maize farmers in Nigeria: Comparison of alternative approaches. *African Journal of Agricultural Research*, 5(21), 2909-2917.

Ayako, A.B et al (1989). "Contract Farming And Outgrower schemes in Kenya: Case Studies" in Ayako, AB and ill Glover (eds) Eastern Africa Economic Review. *Special Issue. August. pp.4-14.*

Ayinde, O.E. (2008). Effect of socio-economic factors on risk behaviour of farming households: An empirical evidence of small-scale crop producers in Kwara State. *Nigeria Agricultural Journal*, 3, 447–453.

Azumah, S.B, Donkoh, S.A., & Ehiakpor, D.S (2016)**.** Examining the determinants and effects of Contract Farming on Farm Income in the Northern Region of Ghana . *Ghana Journal of Science, Technology and Development*, 4, (1),1-10.

Baumann, P. (2000). *Equity and efficiency in contract farming schemes: The Experience of agricultural tree crops.* Retrieved from http://www.fao.org .

Bijman, J. (2008). Contract farming in developing countries. *An overview of the literature. Working Paper*, Wageningen University, Department of Business Administration.

Bogetoft, P., and Olesen, H.B. (2002). Ten rules of thumb in contract design: Lessons from Danish agriculture. *European Review of Agriculture Economics* 29: 185–204.

Brandt, S.A., Malhi, S.S., Ulrich, D., Lafond, G.P., Kutcher, H.R. & Johnston, A.M. (2007). Seeding rate, fertilizer level and disease management effects on hybrid versus open pollinated canola (Brassica napus L.). *Canadian Journal of Plant Science*, *87*(2), 255-266.

Byerlee, D. (2020). The globalization of hybrid maize, 1921–70. *Journal of Global History*, 15(1), 101-122.

Chambati, W., & Mazwi, F. (2018). Contract farming arrangements and poor resourced farmers in Zimbabwe.

Champika Jayamini, P.A., & Abeywickrama, L.M. (2014) An Evaluation of Maize Contract Farming System in Sri Lanka: Adoption, Problems and Future Prospects. *Tropical Agricultural Research* , 26 (1), 62 – 73.

Chaudhary, P., & Aryal, K. (2009). Global warming in Nepal: Challenges and policy imperatives. *Journal of Forest and Livelihood*, 8, 5–14.

Cox, W.J., & Cherney, J.H., (2012). Lack of hybrid, seeding, and nitrogen rate interactions for corn growth and yield. *Agronomy Journal*, 104(4), 945-952.

Dadzie, S.K.N., & Acquah, H.D. (2012). Attitudes toward risk and coping responses: The case of food crop farmers at Agona Duakwa in Agona East District of Ghana. *International Journal of Agriculture and Forestry*, 2, 29–37.

Dawes, M., Murota, R., Jera, C., Masara, C., & Sola, P. (2009). Inventory of smallholder contract farming practices in Zimbabwe. The Hague: SNV Netherlands Development Organisation. developments. *The Australian Journal of Agricultural and Resource Economics*, 50, 490–509.

Deng, Y., Wang, M., & Yousefpour, R. (2017). How do people's perceptions and climatic disaster experiences influence their daily behaviors regarding adaptation to climate change?-A case study among young generations. *Science of the Total Environment*, 581, 840–847.

Diao, X., Kennedy, A., Badiane, O., Cossar, F., Dorosh, P., Ecker, O., Hagos, H.G., Headey, D., Mabiso, A., Makombe, T.; Malek, M., & Schmidt, E. (2013). *Evidence on key policies for African agricultural growth.* IFPRI Discussion Paper 01242. Washington, DC: International Food Policy Research Institute.

Dorward, A., Anderson, S., Clark, S., Keane, B., & Moguel, J. (2001). *Asset functions and livelihood strategies: A framework for pro-poor analysis, policy and practice.* Nairobi: International Livestock Research Institute.

Drollette, S.A. (2009). Managing production risk in agriculture. Department of Applied Economics Utah State University, USA. AG/ECON/2009-03RM.

Dube, L. (2020) Factors Influencing Market Participation by Smallholder Farmers in Masvingo and Manicaland Provinces, Zimbabwe. *International Journal Agricultural Economics*. 5, (6), 313-320. Retrieved from doi: 10.11648/j.ijae.20200506.20

Dube, L., & Guveya, E. (2016). Determinants of agriculture commercialization among smallholder farmers in Manicaland and Masvingo Provinces of Zimbabwe. *Agricultural Science Research Journal*, *6*(8), 182-190.

Dube, L., & Mugwagwa, K. E. (2017). Technical efficiency of smallholder tobacco farmers under contract farming in Makoni district of Manicaland province, Zimbabwe: A Stochastic Frontier Analysis. *Scholars Journal for Agricultural and Veterinary Science*, *4*(2), 68-78.

Duvick, D. N. (2001). Biotechnology in the 1930s: the development of hybrid maize. *Nature Reviews Genetics*, *2*(1), 69-74.

Eaton, C., & Shepherd, A. (2001). *Contract farming: partnerships for growth* (No. 145). Food & Agriculture Org.

Einav, L., Finkelstein, A., & Cullen, M.R. (2010). Estimating welfare in insurance markets using variation in prices. *The Quarterly Journal of Economics*, 125, 877–921.

Ellis, F. (1993). *Peasant Economics: Farm Households and Agrarian Development*, Second ed. Cambridge: Cambridge University Press.

Fang, P., & Belton, B. (2020). Maize production, farm size, and tied credit in Southern Shan State, *Myanmar* (Vol.1961). International Food Policy Research Institute.

Fulponi, L. (2006). Private voluntary standards in the food system: The perspective of major food retailers in OECD countries. Food Policy 31, no. 1: 1–13. *Web of Science.*

Flaten, O., Lien, G.M., Koesling, M., Valle, P.S., & Ebbesvik, M.(2005). Comparing risk perceptions and risk management in organic and conventional dairy farming: Empirical results from Norway. *Livestock Production Science*, 95, 11–25.

Freguin-Gresh, S., Anseeuw, W., & D'Haese, M. (2012). Demythifying contract farming: Evidence from rural South Africa. Paper presented at the International Association of Agricultural (IAAE) *Triennial Conference, Foz do Iguaçu, Brazil, 18-24 August.*

Gadzirayi, E.M.C.T., & Foti, R. (2008). Measuring payoffs to agricultural training among small holder tobacco producers. *International NGO Journal*, 3(3), 33-37.

Gedajlovic, E., & Carney, M. (2010). Markets, Hierarchies, and Families: Toward a Transaction Cost Theory of the Family Firm. Baylor University. https://doi.org/10.5465/ambpp.2010.54493635

Gen-xing, P. ,Joseph, J., Lian-qing, L.,Nahayo, A.,Omondi, M., & Xu-lui, Z. (2017) Factors influencing farmers' participation in crop intensification program in Rwanda. *Journal of Integrative Agriculture*,16(6), 1406–1416.

Glover, D. (1990). Contract Farming and Outgrower Schemes in East and Southern Africa. *Journal of Agricultural Economics 41 (3)* September pp.303-315.

Glover, D., &. Kusterer, K. (2016). *Small farmers, big business: contract farming and rural development*. Berlin:Springer-International Publishing Science.

Greener, S. (2008). *Business Research Methods*. London :BookBoon publishers.

Gorst, A., Groom, B., & Dehlavi, A. (2015). Crop productivity and adaptation to climate change in Pakistan. Grantham Research Institute on Climate Change and the Environment Working Paper (189), UK.

International Maize and Wheat Improvement Centre. Maize Improvement Program, (1999). *Development, Maintenance, and Seed Multiplication of Open-pollinated Maize Varieties*. CIMMYT.

Iqbal, M.A., Ping, Q., Abid, M., Muhammad Muslim Kazmi, S., & Rizwan, M. (2016). Assessing risk perceptions and attitude among cotton farmers: A case of Punjab Province, Pakistan. *International Journal of Disaster Risk Reduction*, 16, 68–74.

Jain, R.C.A., & Parshad, M. (2006). Working Group on Risk Management in Agriculture for the 11th Five Year Plan (2007–2012). Government of India Planning Commission, New Delhi.

Kammar, S.K., & Bhagat, R. (2009). Constraints experienced by farmer's in adopting risk and uncertainty management strategies in rainfed agriculture. *Pusa Agricultural Science* 32, 70–74.

Khan, A.N., Khan, S.N., & Ali, A. (2010). Analysis of damages caused by flood-2010 in district Peshawar. *Journal of Science and Technology University of Peshawar*, 36, 11–16.

Kashavamurthy, N.N. (2005). A Study on Contract farming in Gherkin Production. Thesis submitted to the Universi ty of Agricultural Sciences, Dharwad in part ial fulfilment of the requirements for the Degree of Master of Science in Agriculture Extension Education.

Kassie, M., Muricho, G., & Obare, G. (2015). Determinants of Market Participation Regimes among Smallholder Maize Producers in Kenya. International Conference of Agricultural Economists.

Kassam, A., Hongwen, L., Niino, Y., Friedrich, T., Jin, H., & Wang, X.L. (2014). Current status, prospect and policy and institutional support for conservation agriculture in the Asia-Pacific region. *International Journal of Agricultural and Biological Engineering*, 7, 1–13.

Khoza, T.M., Senyolo, G.M., Mmbengwa,V.M., & Soundy, P. (2019). Socio-economic factors influencing smallholder farmers decision to participate in agro-processing industry in Gauteng province, South Africa. http://dx.doi.org/10.1080/23311886.2019.1664193.

Kisaka-Lwayo, M., & Obi, A. (2012). Risk perceptions and management strategies by smallholder farmer's in KwaZuluNatal Province, South Africa. *International Journal of Agricultural Management*, 1, 28–39.

Koranteng, K.Y. (2010). Contract farming model of financing smallholder farmers in South Africa: The case of the IDC-KAT river citrus development scheme. Unpublished Research Report. Bellville: University of Stellenbosch Business School.

Kumar, J., & Kumar, K.P., (2008). Contract farming: Problems, prospects and its effect on income and employment. *Agricultural Economics Research Review, 21, July-December*, 243-250.

Larpar, M.L., Holloway, G., & Ehui, F. (2008). Policy options promoting Market Participation among smallholder, producers. A Case of Philippine.

Leiserowitz, A.A. (2005). American risk perceptions: Is climate change dangerous? *Risk Analysis*, 25, 1433–1442.

Little, P.D., &Watts, M. eds., (1994). *Living under contract: contract farming and agrarian transformation in sub-Saharan Africa*.University of Wisconsin Press.5

Liu, Y., Popp, B., & Schmidt, B., (2014). CUSHAW3: sensitive and accurate base-space and colour-space short-read alignment with hybrid seeding. *PloS one*, *9*(1), p.e86869.

Lucas, M.P., & Pabuayon, I. M. (2011). Risk perceptions, attitudes, and influential factors of rainfed lowland rice farmer's in Ilocos Norte, Philippines. *Asian Journal of Agriculture and Development*, 8, 61.

Lu, W., Latif, A., & Ullah, R. (2017). Simultaneous adoption of contract farming and off-farm diversification for managing agricultural risks: the case of flue-cured Virginia tobacco in Pakistan. *Natural Hazards*, 86, 1347–1361.

Mabaya, E. (2017).Ethiopia Brief-The African Seed Index. 2017(December)

Macrobert, J. F., Setimela, P., Gethi, J., & Regasa, M. W. (2014). *Maize Hybrid Seed Production Manual*. *Book*. https://doi.org/10.13140/RG.2.1.4791.6965

Masara, C., & Dube, L. (2017). Socio-economic factors influencing uptake of agriculture insurance by smallholder maize farmers in Goromonzi district of Zimbabwe. *Journal for Agricultural Economics and Rural Development, 3,* 160-166.

Mathenge, M. K., Smale, M., & Olwande, J. (2014). The impacts of hybrid maize seed on the welfare of farming households in Kenya. *Food Policy*, 44, 262-271.

Minot, N.W (1986). Contract farming and Its Effect on Small Farmers in Lass Developed Countries. *Working Paper No. 31* Department of Agricultural Economics, Michigan State University.

Minot, N. (2011). Contract Farming in sub-Saharan Africa: Opportunities and Challenges—*Smallholder-led Agricultural Commercialization and Poverty Reduction*: *How to Achieve It? 18-22 April 2011*, Kigali, Rwanda (International Food Policy Research Institute)

Miyata, S., Minot, N., & Dinghuan, H.U. (2009). Impact of contract farming on income: Linking small farmers, packers and supermarkets in China. *World Development,* 37(11), 1781–1790.

Moyo, S. (2004). *The land and agrarian question in Zimbabwe.* Paper presented at the Conference on The Agrarian Constraint and Poverty Reduction: Macroeconomic Lessons for Africa, Addis Ababa, 17-18 December.

Mugwagwa, I., Bijman, J., & Trienekens, J. (2020). Typology of contract farming arrangements: a transaction cost perspective. *Agrekon*, *59*(2), 169–187. https://doi.org/10.1080/03031853.2020.1731561.

Mulaudzi, V.S.,& Oyekale, A.S. (2015). Smallholder farmer's adoption intensity of genetically modified maize varieties in Thulamela municipality, Limpopo province, South Africa. *Environmental Economics*, 6(1), 104-112.

Musser, W.N., & Patrick, G.F. (2002). How much does risk really matter to farmers? In: A Comprehensive Assessment of the Role of Risk in US Agriculture. *Springer*, USA.

Mutayoba, V., & Ngaruko, D. (2015). Determinants of Farmers' participation in high value crops in Tanzania. *African Journal of Economic Review*, 3 (2), July 102-116.

Mutoko, M.C. (2014) Adoption of Climate-Smart Agricultural Practices: Barriers, Incentives, Benefits and Lessons Learnt from the MICCA Pilot Site in Kenya. FAO Report.

Nakhumwa, T.O., & Hassan, R.M. (2012). Optimal Management of Soil Quality Stocks and Long-Term Consequences of Land Degradation for Smallholder Farmers in Malawi. *Environmental and Resource Economics*,52,415-433.

Napasintuwong, O. (2018) .Growers' participation in maize seed production contracts in Thailand. The Australasian Agricultural and Resource Economics Society

Ltd on the AgEcon Search website at http://ageconsearch.umn.edu/ University of Minnesota, 1994 Buford Ave St. Paul MN 55108-6040, USA.

Ndlovu, S., Odunze, D., & Van Niekerk, J. A. (2015). Assessment of factors that impact on the viability of contract farming: A case study of maize and soya beans in Mashonaland West and Central Provinces in Zimbabwe. *South African Journal of Agricultural Extension*, 43(2), 78 –90.

Ndjeunga, J. (1997). Constraints to variety release, seed multiplication, and distribution of sorghum, pearl millet, and groundnut in Western and Central Africa. In *Alternative strategies for smallholder seed supply: Proceedings of an international conference on options for strengthening national and regional seed systems in Africa and West Asia* (pp. 34-46).

Ndjeunga, J., & Bantilan, M.C.S. (2005). Uptake of improved technologies in the semi-arid tropics of West Africa: why is agricultural transformation lagging behind? *Electronic Journal of Agricultural and Development Economics, 2*(1), 85-102.

Neocosmos, M., & J. Testerink (1985). *Contract Farming in Swaziland*. A Paper presented to an IDRC Workshop on Contract Farming and Smallholder Outgrower Schemes, Nairobi November 27-30.

Nkurunziza, I., & Ngabitsinze, J.C. (2015). Determinants of Farmer Participation in the Vertical Integration of the Rwandan Coffee Value Chain: Results from Huye District . *Journal of Agricultural Science*, 7(9), 197 - 211.

Overseas Development Institute, (1992). Agricultural tree crops. *Working paper no.139*. London.

Oya, C. (2012). Contract Farming in Sub-Saharan Africa: A survey of approaches, debates and issues. *Journal of Agrarian Change*, 12 (1) (2012), pp. 1-33.

Prowse, M. (2012). Contract farming in developing countries: A Review. *A Savoir*, 12, February.

Raosoft, (2021). Sample size calculator. Retrieved from www.raosoft.com/samplesize html, accessed online on 22/ 01/ 2021.

Rehber, E. (1998). Vertical integration in agriculture and contract farming. Turkey: Uludag University, Department of Agriculture Economics.

Roy, E.P (1972). *Contract Farming and Economic Integration*. Interstate, Danville, Illinois University.

Saigenji, Y., & Zeller, M. (2009). Effect of contract farming on productivity and income of smallholders: The case of tea production in North-Western Vietnam. Stuttgart: University of Hohenheim.

Simmons, P., Winters P., & Patrick I. (2005) An analysis of contract farming in East Java, Bali, and Lombok, Indonesia. *The Journal of Agricultural Economics*, 33,513-525

Saunders, M., Lewis, P., & Thornhill, D. (2009). *Research methods for business students*, 4th edition. London: Pearson Education Prentice Hall.

Senanayake, S.M.P. (2008). Contract farming and out grower schemes in less Developed countries: definitions, typologies and Economic theories.

Schroeder, C., Onyango, T. K. O., Nar, R. B., Jick, N. A., Parzies, H. K., & Gemenet, D. C. (2013). Potentials of hybrid maize varieties for small-holder farmers in Kenya: a review based on Swot analysis. *African Journal of Food, Agriculture, Nutrition and Development, 13*(2) 6-13 .

Shiferaw, B., Prasanna, B.M. & Hellin, J. Crops that feed the world 6. Past successes and future challenges to the role played by maize in global food security. *Food Sec.* **3,** 307 (2011). https://doi.org/10.1007/s12571-011-0140-5.

Suphat, B. (2014). *The art of case study research*. Thousand Oaks CA: Sage.

Tchale, H., & Sauer, J. (2007). The efficiency of maize farming in Malawi. A bootstrapped translog frontier. *Cahiers d'Economie et de Sociologie Rurales, 82*, 33-56.

Teklewold, H., Dadi, L.,Yami, A., & Dana, N. (2006). Determinants of adoption of poultry technology. double–hurdle approach, Debre zeit Agricultural Research Center, Debrezeit, Ethiopia. https://www.Irrd.cipav.org.co .

Thiele, G. (1999). Informal potato seed systems in the Andes: Why are they important and what should we do with them? *World Development*, *27*(1), 83-99.

Wainaina, P.W., Okello, J.J., & Nzuma, J. (2012). *Impact of contract farming on smallholder poultry farmers' income in Kenya.* Paper prepared for presentation at the International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguaçu, 18-24 August.

Wekundah, J.M. (2012). *Why informal seed sector is important in food security*. African Technology Policy Studies Network, Kenya.

Will, M. (2013). *Contract farming handbook: A practical guide for linking small scale producers and buyers through business model innovation.* Frankfurt: Deutsche Gesellschaft fur Internationale Zusammenarbeit.

Williamson, O. (1975). *Markets and hierarchies, analysis and antitrust implications*: A study in the economics of internal organization. New York: Free Press.

Winters, P., Simmons, P., & Patrick, I., (2005). Evaluation of a hybrid seed contract between smallholders and a multinational company in East Java, Indonesia. *The Journal of Development Studies, 41*(1), 62-89.

Wooded, J.J. (2003). Potential of contract as a mechanism for commercialization of Smallholder agriculture. The Zimbabwe Case Study. Harare. Retrieved from www.fao.org

World Bank. (2014). An analytical toolkit for support to contract farming. *Washington, DC: International Bank for Reconstruction and Development/World Bank.*

Ullah, R., Shivakoti, G.P., & Ali, G. (2015). Factors effecting farmer's risk attitude and risk perceptions: The case of Khyber Pakhtunkhwa, Pakistan. *International Journal of Disaster Risk Reduction,* 13, 151–157.

Yishak, G. (2005). *Determinants of adoption of improved maize technology in Damot GaleWoreda, Wolaita, Ethiopia*. (Master's thesis, Alemaya University).

Young, L.M., & Hobbs, J.E. (2002). Vertical linkages in Agri-food supply chains : Changing Roles for Producers, Commodity Groups, and Government Policy. *Review of Agricultural Economics*,24(2), 428-441.

Zikhali, P. (2008). Fast track land reform and agricultural productivity in Zimbabwe. *Working papers in economics no. 322.* Gothenburg: School of Business, Economics and Law, University of Gothenburg.

Zimbabwe National Statistics Agency, (2012). *Census 2012: Preliminary Report.* Harare: ZimStat.

Zimbabwe National Statistics Agency, (2013). *Compendium of statistics 2012.* Harare: ZimStat.

Appendices

Appendix 1 Questionnaire

QUESTIONNAIRE:

DETERMINANTS OF FARMER PARTICIPATION IN HYBRID MAIZE SEED CONTRACT FARMING-A CASE STUDY OF SEED CO ZIMBABWE GROWERS

GOOD DAY…. MY NAME IS …**DUMISANI MAPUNGWANA**. I AM A STUDENT AT **AFRICA UNIVERSITY.** I AM CONDUCTING A STUDY ON **DETERMINANTS OF FARMER PARTICIPATION IN HYBRID MAIZE SEED CONTRACT FARMING-A CASE STUDY OF SEED CO ZIMBABWE**. I WOULD LIKE TO SPEAK TO THE FARM OWNER OR ANY SENIOR MEMBER RESPONSIBLE FOR THE DAILY OPERATIONS HERE. ALL THE INFORMATION YOU GIVE WILL NEVER BE IDENTIFIED AND WILL REMAIN STRICTLY CONFIDENTIAL. THE INTERVIEW WILL TAKE BETWEEN 20 AND 25 MINUTES TO COMPLETE

MAY I START NOW:

GENERAL INFORMATION:DEMOGRAPHY

1. IS THE OWNER OF THIS FARM MALE OR FEMALE?	Male .....1 Female 2	
2. HOW OLD IS THE OWNER OF THIS FARM?	Age in completed years…___ ___.....	
3. WHAT IS THE HIGHEST LEVEL OF EDUCATION COMPLETED BY THE OWNER OF THIS FARM?	None/Never been to school.....1 Primary .....2 Secondary .....3 Certificate .....4 Diploma .....5 Degree.....6 Masters.....7 Doctorate (PHD).....8	

GENERAL INFORMATION:AGRICULTURE

4. IN WHICH NATURAL FARMING REGION IS YOUR AGRICULTURAL LAND LOCATED?	Natural Region 1.....1 Natural Region 2.....2 Natural Region 3.....3 Natural Region 4.....4 Natural Region 5.....5	
5. WHAT LAND USE SECTOR DOES YOUR AGRICULTURAL LAND FALL UNDER?	LSCF.....1 SSCF.....2 Old Resettlement .....3 A1 .....4 A2 .....5 Communal lands 6	
6. DO YOU HAVE ANY EMPLOYEES? *IF YES, LIST THEM BY CATEGORY* *IF NO EMPLOYEES RECORD ZEROS THROUGHOUT*		

	Male	Female
Permanent		
Casual		
Total		

7. SINCE YOU STARTED FARMING BUSINESS, HAVE YOU BORROWED MONEY FOR USE IN FARMING FROM A BANK OR ANY FINANCIAL INSTITUTION?	Yes .....1 No 2	2⇨9
8. DID YOU SERVICE THE LOAN WITHIN THE AGREED REPAYMENT PERIOD?	Yes .....1 No 2	
9. WHAT FORMS OF COLLATERAL DO YOU HAVE THAT CAN BE USED TO ACCESS LOANS FROM BANKS OR OTHER FINANCIAL INSTITUTIONS?	Land itself .....1 Livestock.....2 Machinery 3	
10. AT THE PRESENT MOMENT, WHAT IS YOUR AGRICULTURAL LAND MAINLY USED FOR?	Crop farming only.....1 Both crop and livestock 2	
11. WHAT IS THE TOTAL SIZE OF THE FOLLOWING? A] TOTAL FARMING AREA B] TOTAL AREA UNDER MAIZE SEED PRODUCTION	Total farming area ___ ___ Ha .....1 Total area under Maize seed production ___ ___ Ha.....2	
12. WHAT IS THE TOTAL AMOUNT OF FERTILIZER USED ON THE FOLLOWING? A] TOTAL AREA UNDER MAIZE PRODUCTION B] AREA WITH HYBRID MAIZE SEED	Total area under maize production ___ ___ Kg.....1 Area with hybrid maize seed____ ____ Kg 2	
12A. HOW WOULD YOU RATE THE AMOUNT OF RAINFALL RECEIVED IN THE AREA YOUR FARM IN THE LAST TWO SEASONS?	Below Normal.....1 Normal .....2 Above Normal 3	
13. HAVE YOU RECEIVED FARMERS TRAINING IN THE LAST 5 YEARS EITHER INDIVIDUALLY OR AS A GROUP?	Yes .....1 No 2	2⇨15
14. WAS ANY OF THE TRAINING IN HYBRID MAIZE SEED CONTRACT FARMING	Yes .....1 No 2	
15. WHICH OF THE FOLLOWING BEST DESCRIBES YOUR RIGHTS TO THE AGRICULTURAL LAND?	Owner with title deed.....1 Lease Holder.....2 Lease with an option to purchase.....3 Renting.....4	
16. HOW MUCH OF YOUR FARMING AREA IS UNDER IRRIGATION?	Total area under irrigation ___ ___ Ha.....1	

17. WHAT TYPE OF IRRIGATION IS USED ON YOUR AGRICULTURAL LAND? *(CIRCLE ALL THAT APPLY)*	Drip Irrigation ..... A Overhead Sprinklers ..... B Does not apply ..... E	
18. HAS THE SOIL TYPE OF YOUR AGRICULTURAL LAND EVER BEEN TESTED?	Yes .....1 No 2	2⇨20
19. WHAT SOIL TYPE OCCUPIES THE GREATEST PART OF YOUR AGRICULTURAL LAND ?	Sand soils .....1 Sandy loams .....2 Loam soil .....3 Clay soil 4	
MAIZE SEED CONTRACT FARMING		
20. HOW MANY FARMING SEASONS HAVE YOU BEEN PARTICIPATING IN THIS PROGRAM?	Number of seasons ___ ___ 1	
IF NUMBER OF SEASONS IS MORE THAN ONE **21.** SINCE THE TIME YOU STARTED PARTICIPATING IN HYBRID MAIZE SEED CONTRACT FARMING WITH SEEDCO, HAVE YOU ENGAGED IN MAIZE SEED CONTRACT FARMING WITH ANY OTHER COMPANY BESIDES SEEDCO?...	Yes .....1 No 2	
22. IF YES TO QUESTION 21 ABOVE, ARE THERE ANY REASONS WHY YOU ENGAGED IN ANOTHER COMPANY FOR HYBRID SEED CONTRACT FARMING?	The cost of advanced inputs is too high. .....1 Terms of repayment are not favourable 2 The seed does not suit my soil type .....3 Other reason (Specify)_____ _____ 4	
23. WHAT ARE YOUR REASONS FOR STICKING TO HYBRID MAIZE SEED CONTRACT FARMING FROM SEEDCO? *[MORE THAN ONE ANSWER ACCEPTED HERE]*	Seedco issue out inputs in time.....1 Payments from Seedco are prompt .....2 Officials from Seedco give training.....3 Distance to processing plant is short ....4 Other reason (specify) _____ ..4	
24. THE LAST TIME YOU DELIVERED YOUR SEED TO SEEDCO, WAS THE PAYMENT MADE INSTANTLY, WITHIN 14 WORKING, BETWEEN 15 AND 30 DAYS OR AFTER 30 DAYS?	Payment was Instant .....1 Payment was within 14 days.....2 Payment was btwn 15 and 30 days 3	

<table>
<tr><td></td><td>Payment was after 30 days .....4</td><td></td></tr>
<tr><td>25. ARE YOU AWARE OF ANY OTHER COMPANY OFFERING HYBRID MAIZE SEED CONTRACT FARMING?</td><td>Yes 1
No .....2</td><td></td></tr>
<tr><td>26. WOULD YOU RECOMMEND OTHER FARMERS TO PARTICIPATE IN HYBRID MAIZE SEED CONTRACT FARMING?</td><td>Yes 1
No .....2</td><td></td></tr>
<tr><td>27. WOULD YOU CONTINUE PARTICIPATING IN THE HYBRID MAIZE SEED CONTRACT FARMING FROM SEEDCO?</td><td>Yes 1
No .....2</td><td></td></tr>
<tr><td>28. WHAT AREAS WOULD YOU WANT TO SEE IMPROVED IN THE HYBRID MAIZE SEED CONTRACT FARMING FROM SEEDCO?
[MORE THAN ONE ANSWER ACCEPTED HERE]</td><td>The quality of the seed.....A
The payment terms .....B
Qualification criteria for the programme.....C
Number of trainings offered for the program.....D
Quality of the training offered for the program.....E
Decentralise processing plant .....F
Other (specify)_____
_____ ... E</td><td></td></tr>
<tr><td colspan="3">ASSETS</td></tr>
<tr><td>29. WHICH OF THE FOLLOWING AGRICULTURAL ASSETS DO YOU OWN?
[A] TRACTOR
[B] TRACTOR DRAWN PLOUGH
[C] TRACTOR DRAWN CULTIVATOR
[D] TRACTOR DRAWN PLANTER
[E] TRACTOR DRAWN HARROW
[F] LORRY</td><td><table><tr><td></td><td>Y</td><td>N</td></tr><tr><td>a. Tractor</td><td>1</td><td>2</td></tr><tr><td>b. Tractor Drawn plough</td><td>1</td><td>2</td></tr><tr><td>c. Tractor Drawn cultivator</td><td>1</td><td>2</td></tr><tr><td>d. Tractor Drawn Planter</td><td>1</td><td>2</td></tr><tr><td>e. Tractor Drawn Harrow</td><td>1</td><td>2</td></tr><tr><td>f. Lorry</td><td>1</td><td>2</td></tr></table></td><td></td></tr>
</table>

Appendix 2 AUREC approval letter

AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE (AUREC)

P.O. Box 1320 Mutare, Zimbabwe, Off Nyanga Road, Old Mutare-Tel (+263-20) 60075/60026/61611 Fax: (+263 20) 61785 website: www.africau.edu

Ref: AU1920/21 23 February, 2021
Dumisani Mapungwana
C/O CHANS
Africa University
Box 1320
Mutare

RE: DETERMINANTS OF FARMER PARTICIPATION IN HYBRID MAIZE SEED CONTRACT FARMING: A CASE STUDY OF SEED-CO ZIMBABWE GROWERS

Thank you for the above titled proposal that you submitted to the Africa University Research Ethics Committee for review. Please be advised that AUREC has reviewed and approved your application to conduct the above research.
The approval is based on the following.
a) Research proposal
b) Data collection instruments
c) Informed consent guide

APPROVAL NUMBER AU1920/21
This number should be used on all correspondences, consent forms, and appropriate documents.
· **AUREC MEETING DATE** NA
· **APPROVAL DATE** February 23, 2021
· **EXPIRATION DATE** February 23, 2022
· **TYPE OF MEETING** Expedited
After the expiration date this research may only continue upon renewal. For purposes of renewal, a progress report on a standard AUREC form should be submitted a month before expiration date.
· **SERIOUS ADVERSE EVENTS** All serious problems having to do with subject safety must be reported to AUREC within 3 working days on standard AUREC form.
· **MODIFICATIONS** Prior AUREC approval is required before implementing any changes in the proposal (including changes in the consent documents)
· **TERMINATION OF STUDY** Upon termination of the study a report has to be submitted to AUREC.

Yours Faithfully

MARY CHINZOU – A/AUREC ADMINISTRATORFOR CHAIRPERSON, AFRICA UNIVERSITY

RESEARCH ETHICS COMMITTEE

Appendix 3 SeedCo approval letter

SEED·CO
The African Seed Company

REGISTERED OFFICE:
Seed Co Limited
1 Shamwari Road, Stapleford
P.O. Box WGT 64, Westgate, Harare, Zimbabwe
Telephone: +263 242 308881-8,308892/3/6/7, 308127
Switchboard Cell: +263772020255, +2638677020255
Email: seedco@seedcogroup.co.zw
Website: www.seedcogroup.com/zw

11 January 2021

The Research Ethics Committee
Africa University
Fairview Road
P.O Box 1130
Mutare

Dear Sir/Madam

RE: AUTHORIZATION TO CARRY OUT A RESEARCH PROJECT AT SEED CO LIMITED : MR DUMISANI MAPUNGWANA

We hereby confirm that Mr Dumisani Mapungwana is authorized to do a dissertation in part fulfillment of his Masters Degree at Africa University based on a study of seed growers at Seed Co Limited. The topic of the dissertation is titled 'Determinants of Farmer Participation in Hybrid Maize Seed Contract Farming, a Case of Seed Co Zimbabwe'.

This authority is granted for academic purposes only. Information and data received during the research must not be shared with third parties without the authority of Seed Co.

We wish Mr Mapungwana success in his studies.

Yours faithfully,

DR E.E MHANDU
REGIONAL MANAGING DIRECTOR

80TH ANNIVERSARY EST. 1940

Appendix 4: Urkund report

Curiginal

Document Information

Analyzed document	Final Dissertation Dumisani Mapungwana25 march 2022.docx (D132017714)
Submitted	2022-03-30T12:20:00.0000000
Submitted by	
Submitter email	dumisanima77@gmail.com
Similarity	0%
Analysis address	mukumbik.africa@analysis.urkund.com

Sources included in the report