To explore farmer preferences and the adoption of improved maize varieties in Zimbabwe. a case study of Seedco product advancement trials done across five regions

FOR THE MASTER OF SCIENCE DEGREE IN FOOD SECURITY AND SUSTAINABLE AGRICULTURAL PRODUCTION/POLICY

Bindura University of Science Education

Faculty of Agriculture and Environmental Science

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June 2025

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Degree: Master of Science Degree in Food Security and Sustainable Agriculture

Project Title: Evaluating the Evolution, Performance, and Adoption of SeedCo Maize Varieties in Zimbabwe: A Review and Comparative Case Study of SeedCo Product Advancement Trials Across Five Regions in Zimbabwe

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We, the undersigned, hereby certify that we have supervised, reviewed, and recommend to the Bindura University of Science Education the acceptance of the research project titled:

" **Evaluating the Evolution, Performance, and Adoption of SeedCo Maize Varieties in Zimbabwe: A Review and Comparative Case Study of Seedco Product Advancement Trials Across Five Regions in Zimbabwe"**, submitted by: **Sithole Tariro Sandra** (Registration Number: **B232424B**) In partial fulfilment of the requirements for the **Master of Science Degree in Food Security and Sustainable Agricultural Production/Policy**.

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DECLARATION

I hereby declare that the research project entitled "**Evaluating the Evolution, Performance, and Adoption of SeedCo Maize Varieties in Zimbabwe: A Review and Comparative Case Study of SeedCo Product Advancement Trials Across Five Regions in Zimbabwe**" submitted to Bindura University of Science Education, Department of Agricultural Economics, Education and Extension is a record of an original work done by me under the guidance and supervision of A.C Mupeyi and this work is submitted in partial fulfilment of the requirements for the award of a Master of Science Degree in Food Security and Sustainable Agriculture. The results embodied in this thesis have not been submitted to any University or Institute for the award of any degree of diploma.

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DEDICATION

This work is dedicated to the Almighty God, for his grace is sufficient. I would also like to thank my family for the support given throughout my educational tour. To my sons, Sibusiso and Snalo Chiromba.To my husband, Gervas Chiromba, who has been my pillar of strength.

To my mother, Netsai Zindimba, my siblings, Kudzai Sithole and Tafadzwa Sithole.

ACKNOWLEDGEMENTS

I would like to extend my sincere gratitude to my supervisor, Dr. Mujei, for her support, exceptional guidance, encouragement, and supervision throughout the course of my study. I am greatly indebted to the team CYMMYT and the team Seed Co for sponsoring my studies. Many thanks go to the Product development team for providing resources and a conducive environment for the success of this project.

I appreciate the hard work of extension, farmers, and we worked to provide engagement and insights. Many thanks to Edmore Mwakutuya, Phanuel Senzere, Rabson Musimudziwa, and Larry Shamba. Thank you for the support you gave me.

Above all, I acknowledge the almighty God for his never-ending love. To my mother, Netsai Zindimba, to my father, Isaah Garikai Sithole, my husband, Gervas Chiromba, and my sons, Sbusiso and Snalo Chiromba. My siblings, Kudzai Sithole and Tafadzwa Sithole, thank you for all the emotional support and all the love you gave me, which gave me the strength to keep going.

ABSTRACT

This study articulated the farmers' preferences and the adoption of improved maize varieties in Zimbabwe. The study adopted the mixed method approach to find the quantitative value and thick descriptions of farmers' preferences. To recruit study participants, the study employed two sampling techniques, which are: purposive and simple random sampling. A total of 307 participants were recruited, including the key informants. A survey method, in-depth interviews, and key informant interviews were adopted as data collection procedures. The data was analysed using thematic analysis and descriptive statistics. The study was guided by the 'Structural Empowerment Theory as its theoretical framework. The first research question of the study was to identify the specific qualities and traits that farmers prioritize when selecting maize varieties. The research found that common traits and qualities preferred by farmers include: drought tolerance, large cob size, grain texture, disease tolerance, and early maturity, amongst others. The study also sought to assess the extent to which farmers have adopted improved maize varieties introduced by SeedCo. The results indicated that about 75% of the respondents were utilizing improved maize varieties from SeedCo. The study also intended to examine differences in adoption rates and preferences across the five regions involved in the trials. The results of the study portrayed that, across all 5 regions involved in the trials, Mashonaland Central had the highest adoption rate, followed by Mashonaland West and Mashonaland East, respectively. Masvingo province and Manicaland had the lowest adoption rates of improved maize varieties. Finally, the study sought to investigate the challenges and obstacles farmers face in adopting improved maize varieties. The results of the study postulated that unavailability, high cost of improved seeds, climate change, limited land, and gender discrimination were among the core challenges mentioned by the participants. From the results of the study, it is recommended that the government and NGOs should provide access to credit or financial assistance to help farmers purchase the seeds and inputs needed for new varieties. There is also a need to encourage the development of local markets and trade channels for maize products.

LIST OF ABBREVIATIONS AND ACRONYMS

FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GoZ	Government of Zimbabwe
NAPF	National Agriculture Policy Framework
NGOs	Non-Governmental Organizations
OPV	Open Pollinated Varieties
QPM	Quality Protein Maize
SC	Seed Co
ZIMVAC	Zimbabwe Vulnerability Assessment Committee
AGRITEX	Agricultural extension services

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CHAPTER 1

INTRODUCTION

1.1 Background of the study

Maize is one of the most cherished food crops across the world, and it is considered a staple food crop in Zimbabwe (Chuma, 2019). Nearly all the varieties cultivated in Zimbabwe are normal endosperm maize and, hence, deficient in two essential amino acids, lysine and tryptophan. With the development of quality protein maize (QPM) varieties, there is hope for the provision of an affordable source of balanced protein to millions of inhabitants of the maize-growing regions in the country (Moyo, 2011). However, the adoption of QPM still remains low in Zimbabwe (Chaguta, 2010) despite the recent demonstration of the effectiveness of QPM in improving the nutritional status of all people. There are also more hybrid seeds which have been proven to double the yields regardless of the climate conditions. Large-scale and planned introduction of maize (Zea mays) in southern Africa was accomplished during the last 100 years. Since then, smallholder farmers and breeders have been selecting varieties best adapted to their specific growing conditions (Brown et al, 2012). The environments and farming systems in Zimbabwe, Zambia, and Malawi, where maize is grown, are extremely diverse with production varying considerably between years, and showing a close dependence on rainfall and soil fertility (Cavatasi et al, 2011).

Maize production is the dominant form of agriculture practiced in Zimbabwe. Throughout Zimbabwe, maize production is done by subsistence farmers (smallholder farmers) to feed the largest people living in rural areas (Machida et al, 2010). It is also done at a commercial level to feed the whole nation. Food crops such as maize, millet, sweet potatoes, and wheat are mainly grown in the country, contributing approximately 65% of the agricultural GDP (Government of Zimbabwe, 2019). Maize is the most important staple food for over 90% of the population, and it accounts for over 20% of agricultural GDP (GoZ, 2019). Maize covers about 55% of the total cultivated area, generating about 52% of rural cash income and employment (ZIMVAC, 2022).

Improving maize production is therefore one of the most important strategies for food security in Zimbabwe, especially through the development and improvement of agricultural practices and availability of improved seed varieties (Katengeza et al, 2019). However, improved seed varieties developed by the national and international agricultural research centres very often fail to get

adopted by smallholder farmers (Chimonyo et al, 2019), partly because farmers have different preferences. They require maize seeds of diverse varieties and multiple traits (Moyo, 2011). This depends on crop variety traits or attributes, which are the performance characteristics of plant varieties.

The evidence shows that the farmers' demand for improved seeds is weak despite efforts by research institutions such as SEEDCO to develop various maize varieties, which have vigour characteristics for productivity as well as drought and disease tolerance (GoZ, 2019). The weak demand for improved seeds has been a major constraint for farm input suppliers as they strive to sell improved seeds. Apparently, most farmers lack the knowledge regarding positive traits of improved seed varieties, hence they stick to traditional varieties, which they seemingly prefer, but such seeds are not economically efficient (Chuma, 2019).

1.2 Problem statement

In Zimbabwe, efforts have been made by various institutions towards developing maize seed varieties with higher productivity traits, drought and disease tolerance. Yet, there is still low usage of these improved seed varieties among smallholder farmers (ZIMVAC, 2019). For example, according to agricultural research by agricultural officers in Zimbabwe, only 8.7% of maize farmers in Zimbabwe use improved varieties together with fertilizer. Such improved maize seed varieties may be high-yielding, yet they may not be attractive to farmers unless they possess some crop-specific traits that farmers consider important (Moyo, 2011). It has been observed that the majority of smallholder farmers still rely on unimproved, Pollinated Varieties (OPVs) for planting, partly because such seeds are easy to multiply, cheaper, and readily available (Hampton and Hill, 2020). Farmers have also tended to stick to preferred traditional varieties and OPVs probably due to their perceived aromatic and palatability characteristics (Hussein et al, 2015). Different studies that have been conducted in Zimbabwe revealed the low use of improved maize seeds (GoZ, 2019). About 60% of smallholder farmers continue to use local and recycled maize varieties (Moyo, 2019). However, seed recycling reduces crop yield. There is no balance between the maize produced annually in the country and the population growth; therefore, there is a need to increase maize production through the adoption of hybrid or improved seeds (GoZ, 2019). This study is a tool to capture the farmers preferences and the adoption of improved maize varieties in Zimbabwe.

1.3 Objectives

1.3.1 Main objective

To explore farmer preferences and the adoption of improved maize varieties in Zimbabwe.

1.3.2 Specific objectives

1. To identify the specific qualities and traits that farmers prioritize when selecting maize varieties.
2. To assess the extent to which farmers have adopted improved maize varieties introduced by Seed Co and examine differences in adoption rates and preferences across the five regions involved in the trials.
3. To investigate the challenges and obstacles farmers face in adopting improved maize varieties.

1.4 Research questions

1) What are the specific qualities and traits that farmers prioritize when selecting maize varieties?
2) What is the extent to which farmers have adopted improved maize varieties introduced by Seed Co?
3) What are the differences in adoption rates and preferences across the five regions involved in the trials?
4) What are the challenges and obstacles farmers face in adopting improved maize varieties?

1.5 Justification of the study

In Zimbabwe, the demand for maize has been rising corresponding to the population increase, increased use of maize in animal feed as well increased use for commercial food production like production of corn flakes. In order to feed the increasing population and ensure sustainable food security, high yielding varieties are required. This study informs breeders, seed producers, and extension agents about the key attributes preferred by farmers in order to improve seed quality, consistent with farmers' needs and develop models of distribution channels that supply highly demanded seeds in various parts of the country. The knowledge generated from this study is used

to draw inferences regarding improving seed quality by addressing farmer's needs, which enhances demand and use of improved maize seeds in Zimbabwe. In the next section the study objectives, research questions and study hypotheses are presented.

1.6 Delimitations and scope of the study

The limitations of the study are those characteristics of research design that impact or influence the interpretation of the findings from your research (Maxwell, 2014). The methodological limitations to be faced in this study include the notion of sample size. Krueger (2010) postulated that the number of units of analysis you use in your study is dictated by the type of research problem you are investigating. They stated that if your sample size is too small, it will be difficult to find significant relationships from the data, hence difficult to make generalizations of the findings. This study is difficult to generalize to all farmers in Zimbabwe because the sample is very small.

1.7 Outline of thesis

This study consists of 6 chapters. **Chapter 1** articulates the background of the study, problem statement, objectives, research questions, justification, delimitations, and limitations as well as references. **Chapter 2** of the study focused on the literature review. **Chapter 3** of the study articulated the methodology of the study, which includes; description of study site, research design, sampling procedure, data collection procedures, data analysis procedures, ethical considerations, summary, and references. **Chapter 4** of the study focused on research results for objectives 1 and 2 of the study. **Chapter 5** articulated the results for objectives 3 and 4 of the study. Finally, **Chapter 6** articulated the summary, conclusions, and recommendations of the study.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

2.2 Definition of key concepts

In the context of farming, farmer preferences refer to the things prioritized by farmers, such as reliable markets, access to credits, land access, as well as easy access to inputs (FAO, 2010). This definition will be adopted in this study because it covers a number of issues that the researcher is interested in.

A farmer is someone who engages in agricultural activities, raising living organisms for food or raw materials, whether owning the land or working as a labourer on land owned by others (Moyo, 2011). A farmer is a person involved in farming, which encompasses activities like cultivating crops, raising livestock, and managing orchards or vineyards. Farmers can be categorized based on the scale of their operations, such as small-scale farmers, large-scale farmers, or those specializing in specific crops or livestock (Fisher and Snap, 2014).

Maize varieties refer to the different types or strains of maize that exhibit distinct characteristics and traits, including colour, grain type, and growth habits (Chaguta, 2010). Maize varieties are different forms of the same species (Zea mays) that have been developed through breeding and selection, resulting in variations in traits like grain color, size, and shape, as well as plant height and maturity time (Kassie et al, 2013).

2.3 Background on maize production in Zimbabwe

Maize is still considered one of the special food crops in Africa and other parts of the world. The production of maize in Zimbabwe can be traced from the Iron Age period before colonization. Although maize is often listed as one of the many pre-colonial cereal crops introduced in Africa by the Portuguese, how and when maize was brought to the south-central region of the continent has not yet been established with certainty from an African-centred point of view (Katengeza et al, 2019). However, maize production in Zimbabwe became common and advanced year after year due to the introduction of new varieties of maize. There was also the introduction of the hybrid seeds, which have been proven to double the yields regardless of the climate conditions. From this

trend, maize production became a dominant form of agriculture practiced in Zimbabwe. Throughout Zimbabwe, maize production is mainly done by subsistence farmers to feed the largest population in rural areas (Machida et al, 2010). It is also done at a commercial level to feed the whole nation. Food crops such as maize, millet, sweet potatoes, and wheat are mainly grown in the country, contributing approximately 65% of the agricultural GDP (Government of Zimbabwe, 2019). Maize is the most important staple food for over 90% of the population, and it accounts for over 20% of agricultural GDP (GoZ, 2019). Maize covers about 55% of the total cultivated area, generating about 52% of rural cash income and employment (ZIMVAC, 2022).

2.4 Climate change and food production in Zimbabwe

Southern Africa is recognized as one of the most vulnerable regions in the world to climate change due to widespread poverty and limited coping capacity (Madzwamuse, 2010; UNFCCC, 2007). In Southern Africa, Zimbabwe is particularly vulnerable due to its heavy dependence on rain-fed agriculture and sensitive climate resources (Chaguta, 2010). Climate records demonstrate that Zimbabwe is already experiencing the effects of climate change, notably rainfall variability and extreme events (Brown et al., 2012). The rainfall patterns in Zimbabwe are erratic and mostly characterized by acute mid-season dry spells and droughts, which render maize production unreliable. Climate change probability estimates show that moderate, severe, and extreme droughts are highly likely to occur in January to March at least twice every 10 years (Brown et al., 2012). Smallholder farmers have also reported a change in the weather pattern. Rurinda et al. (2013) reported that more than 90% of farmers in eastern Zimbabwe have perceived that the climate has changed, with increased rainfall variability characterized mainly by the late onset of rainfall and prolonged mid-season dry spells. They observed that the number of rain days per season has decreased with time, whereas the mean total annual rainfall has not changed, thus indicating an increased number of dry spells within the rainy season which calls for adoption of improved varieties.

The effects of these climate changes and variability are being observed in agricultural production and livelihoods mainly of the rural Zimbabwean smallholder farmers. Kindie et al. (2015) predicted that Zimbabwe, like many other countries in SSA, would experience the highest reduction in maize yield due to climate change by 2050. Mano and Nhemachena (2007) showed

that maize production in Zimbabwe's smallholder farming system is significantly constrained by climatic factors (high temperature and low rainfall). Using a Ricardian approach, Mano and Nhemachena show that an increase in temperature of 2.5°C would result in a decrease in net farm revenue of $400 million for all farms in Zimbabwe. Specific to maize production, impacts of climate change have already shown huge negative effects at both the household and national levels. Between 1993 and 2000, average annual maize production stood at 1.64 million tons before dropping to 1.08 million tons between 2001 and 2008 (Brown et al., 2012). Zimbabwean farmers have faced significant economic constraints due to the increasing shortage of foreign currency for imports such as inorganic fertilizers and rising interest rates that have made credit unaffordable (Moyo, 2011). In addition to high temperature and low rainfall, those factors are significantly responsible for the decline in crop production.

An overview of Zimbabwean smallholder farmer's adaptation to changing climate indicates that farmers are already using some adaptation strategies such as dry and early planting, growing drought resistant crops, changing planting dates, and using irrigation (Mano and Nhemachena, 2007). In Chiredzi District, Brown et al. (2012) showed that farmers have been planning and implementing some strategies including improvements in water availability, optimizing crop mix during the rainy season, and planting DT crops. The demand for DT crops such as maize and sorghum is increasing in several countries, including Zimbabwe (Cavatassi, Lipper, and Narloch,et al ; Fisher and Snapp, 2014; Westengen and Brysting, 2014). Fisher et al. (2015) found that the adoption of the DT maize varieties by smallholder farmers in SSA is becoming extensive. The genetic gains of DT maize varieties have proven to be higher than those of non-DT maize in both experimental stations and farmers' field trials. Setimela et al. (2012) reported that the best new DTMA hybrids out-yielded the farmers' varieties by more than 35% and 50% under low- and high-yield conditions, respectively, when compared to the most widely grown commercially hybrid varieties available in southern Africa. However, empirical evidence of the impact of DT maize remains limited.

A review by Fisher et al. (2015) of 19 recent relevant empirical studies, published in scholarly journals, covering 14 SSA countries and over 16,000 farmers, that examined the response of African farmers to extreme weather events and their attempts to adapt to perceived long-term environmental changes addressed two main questions. First, do smallholder farmers in SSA

perceive climate as variable or changing? Second, what adjustments in agricultural practice have African farmers used to adapt to climate variability and change? We add to this literature by assessing the impact of the adjustments/adaptation strategies in maize production. We have singled out the adoption of improved maize varieties as an adaption strategy to climate change. Therefore, this paper will explore the farmer preferences on improved maize varieties across five provinces in Zimbabwe.

2.5 Importance of improved maize varieties for food security and poverty reduction

According to Cho (2013), selecting improving maize varieties is a key resilience strategy for farmers facing changing climatic conditions in different parts of the world. There are two types of seed varieties: traditional varieties and improved varieties. Traditional maize varieties have been selected by Zimbabwean farmers for their special characteristics and due to the fact that they adapt easily to the local conditions. In some respects, these seeds increase the chance of getting a return on investment in stable environments, but are less likely to mitigate GHG emissions (Hussein et al, 2015). Traditional maize crop varieties are usually favored by small scale farmers due to their relatively low cost and availability and can be saved and replanted for further growing seasons. Improved maize varieties are maize seeds that have been scientifically altered to incorporate desired characteristics in specific climatic conditions. Desirable characteristics include higher yields, shorter growing seasons, drought resistance, and salt tolerance to mention but a few. One of the importance of improved maize varieties is the fact that when facing adverse conditions such as extreme temperatures or unreliable, these seeds can still survive and adapt to the conditions. While these seeds offer improvements they are usually commercial products and as a result can be expensive.

Furthermore, improved maize varieties are essential in Zimbabwe to meet the needs of the growing population. ZIMSTAT (2022) postulated that, the population of Zimbabwe has skyrocketed from 12 million to nearly 17 million people which increases the need to improve food production. Cairns et al (2012) highlighted population growth should be accompanied by increased food production to meet the demands of the growing population. Therefore, improved maize varieties is the ideal solution to increase yields in a small piece of land thereby improving food security at large. This study will explore more on farmer preferences and the adoption of improved maize varieties in Zimbabwe.

2.6 Farmer Preferences for Maize Varieties

There are a number of maize varieties grown in Zimbabwe. Some common maize varieties grown on dry land include; SC 727 which is considered highest yielding hybrid maize variety in Afric. It is a late maturing white maize hybrid (155-160 days to reach physiological maturity). It is also considered to an excellent heat and drought tolerance. It is also tolerant to common maize diseases (Fisher and Snap, 2014). It is recommended for natural regions 1, 2, and 3 in Zimbabwe. There is also SC 649, a medium maturing white maize hybrid which takes about 135-145 days to reach maturity. It is considered the highest yielder in Zimbabwe. It also excellent disease tolerance, heat and drought stress tolerance, and wide adaptation. Furthermore, there is also SC 513, which is a popular variety with farmers, an early maturing white-grained maize hybrid. It reaches physiological maturity in 137 days at 1300 metres above sea level. It is considered a Pan-African early maturing hybrid that performs across diverse environments, which is excellent drought tolerance (GoZ, 2019). These are some of the common maize varieties grown and preferred by farmers in Zimbabwe.

Additionally, open-pollinated varieties remain the most preferred among the improved maize varieties. However, most farmers in Zimbabwe have opted for SC 513 and SC 727 for several reasons. They were the most preferred improved maize varieties in regions 1 to 3 for high yield and disease resistance, but in most cases, farmers argue that hybrids are too expensive. In a study by CIMMYT (2022), also indicated that the majority of farmers preferred the hybrid seeds which drought and disease tolerant. However, smallholder farmers have been growing various crops based on certain traits. There is variation in preference from one crop to another. Trait preference tacitly indicates the objectives and priorities of a farming household. The preferences are also dictated by the opportunities and constraints farmers face in selecting their farming enterprise and its management (Kassie et al., 2013). Therefore, this study will explore in detail the farmers preferences on maize varieties grown in Zimbabwe.

Table 1 Ranking of important maize attributes by farmers

Maize trait	Village			
	Njiri	Payarira	Chidawaya	Chiweshe

Yield potential	3	1	4	1
Early maturity	1	-	-	2
Drought tolerance	2	5	2	3
Taste	-	-	7	-
Disease resistance	5	3	2	4
Earliness to maturity	-	-	4	-
Stem borer resistance	-	-	1	-
Weevil resistance	-	6	6	8
Adaptation	-	4	-	-
Medium maturity	-	2	-	-
Seed Price	4	-	-	-
Pest resistance	6	-	-	-
Tolerance to low soil fertility	-	-	-	7
Good husk cover	-	-	-	8
Big kernel size	-	-	-	5
Termites resistance	-	-	-	11
+ Apomictic characteristic	-	-	-	6
Lodging resistance	-	-	-	10

Machida et al (2010)

The above table shows the motives behind farmer preferences in regards to maize varieties grown in Zimbabwe. The data portrays that most farmers prefer maize varieties that are drought resistant and disease-tolerant. However, only a few farmers chose their maize varieties based on time of maturity, in which most farmers prefer early-maturity maize varieties. Therefore, this study will shed more light on farmers preferences for maize varieties in Zimbabwe.

2.7 Adoption of Improved Maize Varieties

Southern Africa region's seed systems are characterized by high reliance on the informal seed sector. This sector is made up of unregulated and uncontrolled seed operations and is largely represented by on-farm seed selection and multiplication efforts by the farmers themselves, seed exchanges among farmers, and use of planting material saved from previous crop harvest (Miller and Tolley, 2019). It is also characterized by the absence of interventions by external organizations that are divorced from research and seed quality control and are confined to seeds that the formal sector largely does not consider profitable to embark on. For decades, the informal seed sector was neglected by national seed programmes in spite of its record of providing nearly 90% of total seed requirements in Southern Africa (Chikobvu, 2014).

In Zimbabwe, research has shown that there's a high adoption rate of improved maize varieties. It shows that a significant portion of the maize area is planted with new genetics, including hybrids. According to CIMMYT (2023), high adoption rates of improved maize varieties are largely attributed to the food security needs of the entire population. The development of improved maize varieties is traced from the 1900s, with a focus on increasing agricultural productivity using agrarian sciences (Fisher and Snap, 2014). An estimated 56% of the total maize area in Zimbabwe is planted with new genetics. According to FAO (2010), 93% of farmers in Zimbabwe grow hybrid maize, while only about 7% grow local maize varieties.

There's a growing emphasis on growing drought-tolerant maize (DTM) varieties among commercial farmers and subsistence farmers, especially in areas facing climate change and variability (Fisher and Snap, 2014). There are several factors that influence the adoption of maize varieties. Miller and Tolley (2019) highlighted that farmers' adoption decisions are influenced by their willingness to pay for different traits, such as drought tolerance, and the availability of improved varieties. In some parts of Zimbabwe, drought is a huge limiting factor in maize production, as well as in most rain-fed agriculture in sub-Saharan Africa. In response to this threat, most African countries have adopted drought-tolerant (DT) maize varieties to ensure food security regardless of the climatic conditions (FAO, 2010). A study has been conducted by Chikobvu et al (2014) to assess the impact of small-scale farmers' adoption of DT maize varieties on total maize production in Zimbabwe. The results indicated that, from a survey of 200 randomly sampled households in two districts of Chiredzi and Chipinge in southeastern

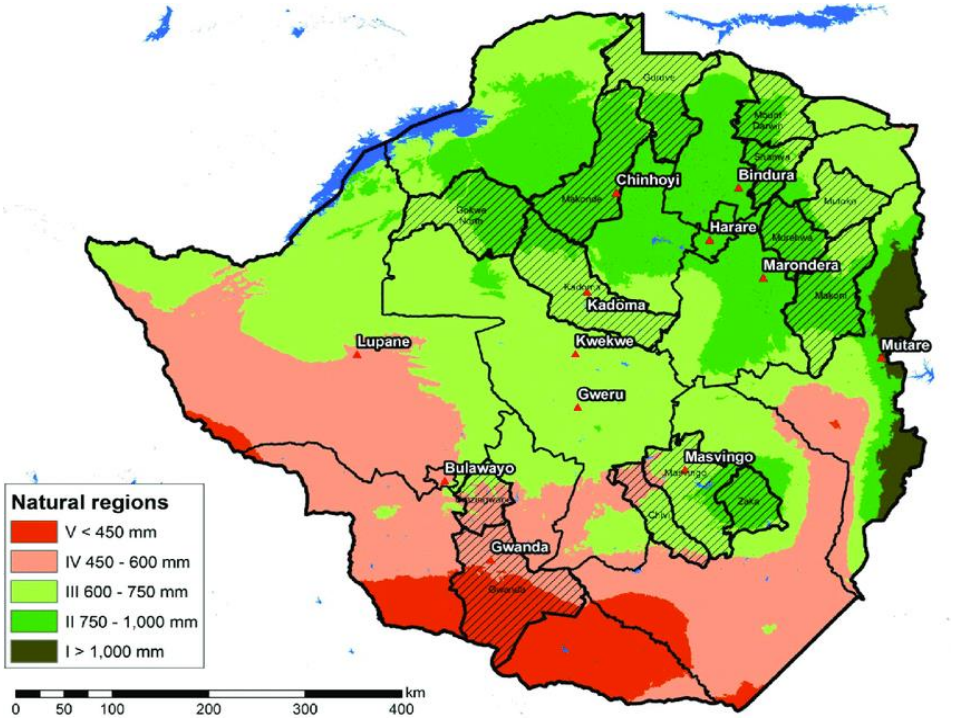
Zimbabwe, 93% of the households were planting improved maize varieties, and 30% of them were growing DT maize varieties. This shows that the majority of farmers in Zimbabwe are adopting improved maize varieties.

A study by Kassie et al (2013) in Tanzania also indicated that 96% of farmers in the country are growing improved maize varieties to increase their yields and to avert the adverse effects of drought. A study by Modi (2014) highlighted that, in Southern Africa, 87% of commercial farmers have adopted improved maize varieties to increase yields. Therefore, the adoption of improved maize varieties is a common phenomenon in the region of Southern Africa and Zimbabwe in particular.

2.8 Regional Variations in Adoption Patterns

Zimbabwe is divided into five agro-ecological regions, also known as natural regions. The division of these regions is based on the rainfall regime, soil quality, and vegetation among other factors. The quality of the land resource declines from Natural Region (NR) I through to NR V (Moyo, 2011). The map below shows the distribution of natural regions in Zimbabwe.

Figure 1 The distribution of natural regions in Zimbabwe



SOURCE: Government of Zimbabwe (2019).

The map above shows region 1 areas are characterized by high rainfall as compared to all other regions. This entails that farmers in these regions tend to adopt maize varieties that can withstand high rainfall and early maturity varieties. Region 2 is also characterized by reliable rainfall, which may sustain maize production of any variety. Rainfall ranges from 750mm to 1000mm per year. In these areas, farmers adopt maize varieties based on yield potential, period to maturity, pest resistance, as well as tolerance to low soil fertility (Nyamai, 2010). Regions 3 and 4 are characterized by relatively low rainfall; therefore, farmers in these areas usually adopt drought tolerance maize varieties. They also consider disease tolerance, pest resistance, kernel size, and taste, to mention but few. This shows that natural regions determine the maize varieties adopted in different areas in Zimbabwe. Last but not least, natural region 5 in Zimbabwe is considered not suitable for any crop production in the country due to extreme temperatures associated with low rainfall, which makes it difficult to support crop production. Therefore, this region is usually used for other agricultural activities such as cattle ranching.

2.9 Challenges and Constraints to Adoption

Research in most African countries have shown several motives behind farmers neglecting improved maize varieties. For instance, in a study by Miller and Tolley (2019), the households that did not grow DT maize varieties were asked for the motives behind their decisions. The participants highlighted a number of factors. In Chiredzi, most of the participants did not grow DT maize varieties due to 'lack of finance' (28.57%) to buy the maize seeds from seed suppliers. Some farmers mentioned 'poorly labelled DT maize packages as a motive (21.43%), and 'unavailability of DT maize at local market' (28.57%) as their three most relevant reasons.

In Chipinge, farmers also reported the same reasons. Similarly, findings have been reported in Ghana by Tambo and Abdoulaye (2012) where farmers mentioned the cost og improved maize varieties and other inputs as constraints to their adoption. Tambo and Abdoulaye (2012) postulated that, major barriers to adoption of DT maize in eastern and southern Africa region include the unavailability of improved seed, poor access to information and resources, high seed costs, as well as farmers' perceptions of variety attributes. They concluded that, these factors require policy intervention to make the improved seed varieties easily accessible.

Additionally, Hampton and Hill (2020) found that between 69% and 82% of sampled farmers who

received an FISP voucher for maize seed redeemed their coupon for a DT maize variety. This may explain why Malawi is performing relatively well in disseminating DT maize to farmers (Fisher et al., Citation2015).

2.10 Theoretical Framework

This study adopted the Sustainable Livelihoods Approach. This approach is a holistic approach that tries to capture, and provide a means of understanding, the fundamental causes and dimensions of poverty without collapsing the focus onto just a few factors. It also explains the decisions people take in different life circumstances. It also tries to sketch out the relationships between the different aspects of poverty, allowing for more effective prioritization of action at an operational level. The SL approach by the DFID aims to help poor people achieve lasting livelihood improvements sustainable livelihoods measured using poverty indicators that they, themselves, define (Brown et al, 2012).

According to Cairns et al (2013), a livelihood comprises the capabilities, assets and activities required for living. The SL approach nevertheless offers both a conceptual and programming framework for sustainable poverty reduction. Unlike more traditional approaches that have sought to tackle poverty by identifying and addressing needs of poor people, the SL approach seeks to improve their lives by building on what they have, their assets (FAO, 2010). As expounded by Kassie et al (2013) an SL approach, captures the prominence of the micro-level institutional context in alleviating the impacts of the macro-level economic and institutional environment on the well-being of particular individuals and social groups. The SL approach can thus be used for: re-assessing existing interventions and activities, informing strategic thinking and discussion, research, identifying, designing and assessing new initiatives/interventions (Cairns et al, 2015).

The establishment of these institutions draws upon existing sources of social capital. In turn, through relations of trust and reciprocity, these institutions help renew or create new forms of social capital. Theory is essential for this study because it explores the key factors that influences farmer preferences and adoption of improved maize varieties.

2.11 Review conclusions

This review has found that, there are several factors that influences farmer preferences and adoption of improved maize varieties. It also highlighted that there is a regional variations in adoption of improved maize varieties. There are implications for policy and program interventions to promote the adoption of improved maize varieties in Zimbabwe. The Ministry of Agriculture in

Zimbabwe has embarked on an inclusive policy development process to harmonize the agricultural sector and sub-sector policies resulting in the Zimbabwe National Agriculture Policy Framework (NAPF2019-2030). This new policy is in line with the Zimbabwe Vision 2030 Agenda, of achieving 'Upper Middle Income Status' by 2030 (ZIMVAC, 2022). Some of the policy objectives stated includes; assuring national and household food and nutrition security in a sustainable and resilient manner. On this objective the government should assist smallholder farmers with improved seed varieties to ensure that food security at national and household level is not jeopardized. There is also need to ensure that the existing agricultural resource base is restored, maintained and improved to achieve sustainable agricultural intensification. This may help farmers to adapt to the new varieties of crops circulating throughout the country.

According to Modi (2014), to promote adoption of improved varieties the government should generate income and decent employment to feasible optimum levels, with a special focus on women and youth. This will enable women and youth to be able to meet the financial needs to purchase the quality seed for maize production without any hindrances. A study by Beyene and Kassie (2015) postulated that, to promote adoption of improved maize varieties the government and NGOs should invest more in farmer education. For instance, in a study by Chaguta (2010) in Zimbabwe, 80% of the farmers interviewed were not even aware of the existence of drought and disease tolerant seeds. Therefore, there is need to ensure that every farmer is aware of the benefits and existence of improved maize varieties in all areas in Zimbabwe.

Gender discrimination in agriculture should be abolished to ensure that men and women have equal access to resources. This will promote the adoption of improved maize varieties because it will allow women to make decisions on themselves and they'll have resources to do all the agricultural activities they desire (Chuma, 2019). The government of Zimbabwe has implemented several development projects to revitalize the economy, but more needs to be done to boost the agriculture sector and provide sustainable livelihoods to vulnerable poor people in rural areas (CIMMYT, 2022). Therefore, policy reform is the key to unlock the improved adoption of maize varieties in Zimbabwe.

2.12 Summary of literature review

This chapter articulated the literature guiding this study. It commences by exploring the definition of key concepts, and background of maize production in Zimbabwe. It also explored the importance of improved maize varieties, farmer preferences of maize varieties, adoption of improved maize varieties, regional variations in adoption patterns, challenges and constraints to adoption and the theoretical framework of the study.

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CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter focuses on the research model, data collection procedures and sample size used. The researcher describes and justifies the data types, data collection procedures and sampling procedures used to answer the objectives and research questions of the study.

This chapter focuses on what is product development and product development trials the research model, data collection procedures and sample size used. The researcher describes and justifies the data types, data collection procedures and sampling procedures used to answer the objectives and research questions of the study.

Product development is the process of creating and launching new products. SeedCo Product Development works together with research on the development of hybrids. It works together with production, marketing and quality assurance. Product development is an essential part of the value chain. It's done in the following stages.

Stage one

- **Market research and idea generation**
- Identify market gaps: Analyse current seed varieties available, farmer needs and emerging trends in the region to pinpoint potential areas for new seed development.
- Target market analysis understands the specific needs of different farmers based on climate, soil type and desired crop characteristics.
- Competitive analysis study competitor seed varieties to SWOT analysis.

Stage 2

- Germ-plasm collection, gather genetic material from diverse sources to broaden the genetic base for breeding
- Research and development, Seed Co has robust research and development program focused on developing seed solutions ideal for different ecological zones in Africa. Seed Co product development works hand in hand with Seed Co research and development team.
- Cross breeding: create new genetic combinations through controlled pollination to develop desired traits high yield, disease and stress tolerance.

- Selection: evaluate progenies from crosses in field trials to select superior lines based on agronomic performance.
- Genetic purity maintenance: Strategies to maintain genetic purity are done through quality assurance.

Stage 3

- Field trials and evaluation

Conduct small-scale trials under different environmental conditions to assess the initial performance of new lines.

- Advanced trials

Conduct large-scale replicated trials across multiple locations to evaluate yield potential and adaptability.

- Compare the new variety to existing commercial varieties.
- Data collection and analysis

Thoroughly analyse yield data, disease incidence, quality parameters, and other relevant traits.

Stage 4

- Seed production and quality assurance

Seed increase

- Produce sufficient seed quantities of the selected variety for commercialization

Seed quality testing

Conduct seed quality tests to ensure germination, purity, moisture content, and other parameters

Nb varieties selected for product development locally or for export pass through quality assurance to ensure farmers get quality seed

Seed treatment

- Apply appropriate seed treatments for disease and improved seedling Vigor

Stage 5

- **Regulatory compliance**: Variety registration, submit necessary registration documentation to the authorities
- **Seed labelling:** Adhere to labelling regulations with a variety of names, genetic purity, germination rate, etc.

Stage 6

- **Market launch and commercialization**

Marketing strategy development: Create a marketing plan to promote new seed varieties to farmers, highlighting key benefits.

- **Distribution network establishment**: Establish a reliable distribution network to reach target farmers and provide technical support to reach target farmers on optimal planting practices for the new variety.

NB Product development as a department dwells much on stage 3 trials and trial evaluation

PD1

Conducting preliminary trials, which are small-scale trials under different environmental conditions to evaluate yield potential and product performance. We have field crops and small grains

PD2

Conducting trials, which are product advancement trials, these are largely replicated trials conducted under different farming conditions to evaluate yield potential and product performance.

Comparative analysis

Comparing existing varieties vs new variety, Product development conduct tricot trials.

Product development objectives

- Ensure products perform consistently across different agricultural ecological regions and conditions
- ensure products that provide competitive advantage through unique traits and attributes
- Ensure products have improved crop yields, quality and productivity
- Support small- and large-scale farmers identity good hybrids and increase their income.
- Expand Seed Co market into new markets with products tailored to their local needs.
- Develop innovative products that differentiate Seed Co from competition.

- Ensure quality hybrids are produced through quality assurance.

How we select farmers as product development

- Farmers are selected with the help of agriculture extension officers.
- Seed Co marketing and agronomy helps us pick some farmers using their existing customer database
- NGOs and other organizations who work with farmers and farmer associations.
- Geographical locations, i.e. identifying diverse agro-climatic conditions to test product performance.
- We select farmers according to varying farm size and type small, medium or large, rain fed or irrigated Peri- urban, communal or commercial.
- Select farmers growing target crops for the new product.
- Select farmers with relevant experience and skills and ensure willingness to participate in product testing and bring feedback.

How **we select trials**

We select on station trials

We select on-farm trials

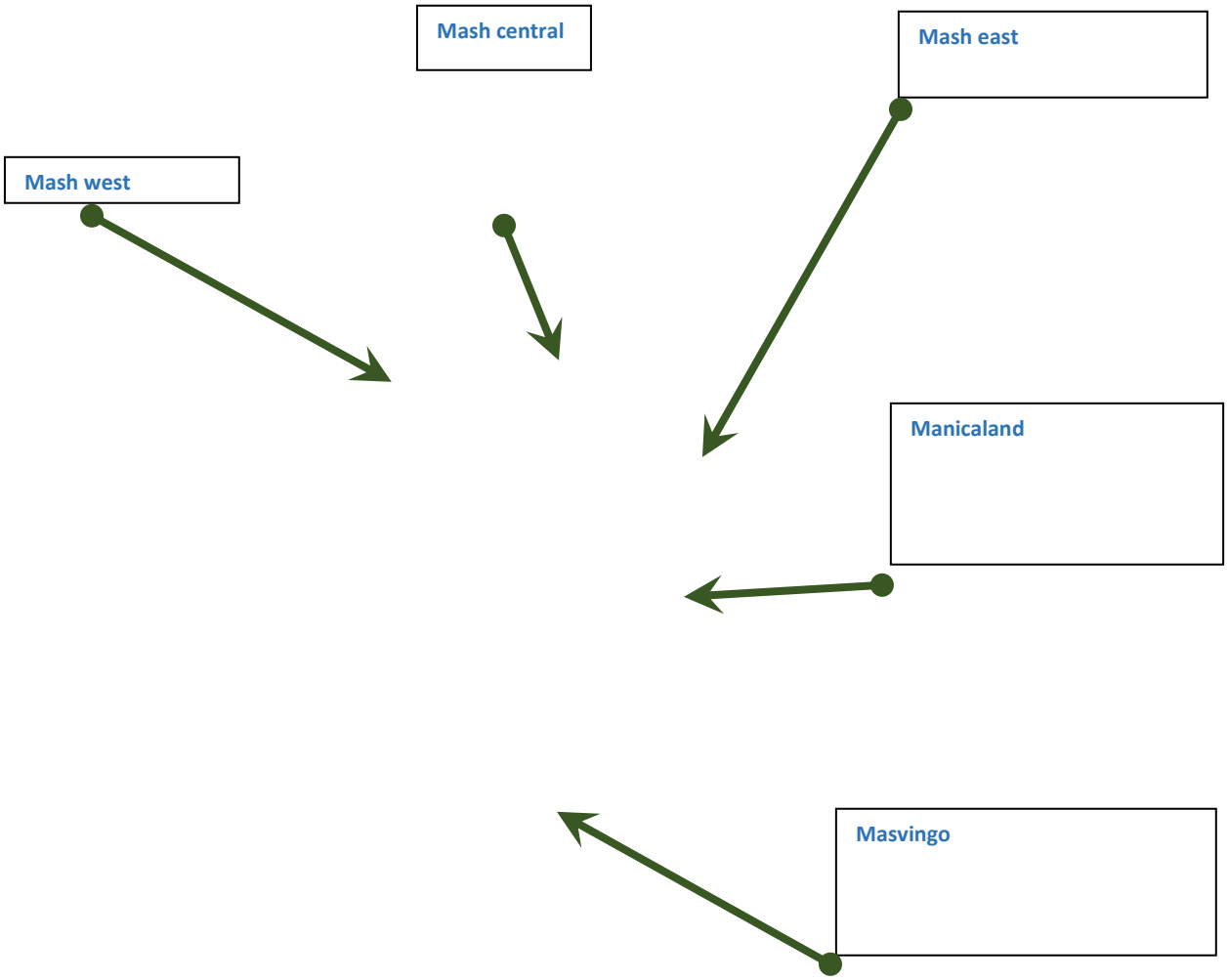
- Based on agro -climatic zones to evaluate trials under different climatic conditions.
- Select locations that are relevant to your target market.
- Select fields that are representative of local conditions and with minimal environmental risks.
- Select a trial design and provide replications.
- Select farms which enable convenience and accessibility during data management and data collection.

Data is collected by the product development team with the help of agriculture extension staff.

3.2 Study area

Trials were done in Zimbabwe, Mashonaland west, Mashonaland east, Mashonaland central, Masvingo, Manicaland .Mashonaland west is in the northern Zimbabwe rainy season stretches from November to march with average temperature of 26 degrees with average rainfall ranging from 600mm to 1000mm.Mashonaland east is in the northern eastern of Zimbabwe rainy season stretches from November to march with temperatures of 28 degrees. Masvingo is in the southern eastern Zimbabwe the rainy season stretches from November to March with hot temperatures ranging from 30 degrees ,average rainfall of 600mm-1000mm.Manicaland is in the eastern of Zimbabwe average temperature ranges from 25 degrees and annual rainfall of 1000mm to 1500mm.These areas were chosen because they have a population which includes both subsistence and commercial farmers. The map below shows the location of these areas in Zimbabwe.

Figure 2: The location for the five provinces under study in Zimbabwe



Province	District	Farmer name
Masvingo	Bikita	Taruwanza
Masvingo	Chivi	Chiunda
Mash west	Zvimba	Mulimba
Mash west	Mutorashanga	Mulota
Mash west	Mutorashanga	Mashinge
Mash west	Zvimba	Gono
Mash East	Uzumba	Sabunu
Mash East	Uzumba	Nyamadzawo
Mash East	Murehwa	Mlambo
Mash East	Mutoko	Gatsi
Mash Central	Uzumba	Marwizi
Mash central	Chiweshe	Chimukoko
Manicaland	Bocha	Rwatiringa
	Nyambeya	Nyambeya

Manicaland	Honde	Matasva
Manicaland	Tsonzo	Ndoro
Manicaland	Watsomba	Muchekamhuru
Manicaland	Nyazura	Rwambiwa
Manicaland	Goto	Madanhire
Manicaland	Dendenyore	Dendenyore

3.3 Research design

This study adopted the mixed method approach. Mixed methods research is a research method that combines and integrates qualitative and quantitative research methods in a single research study (Creswell and Creswell, 2018). It involves collecting and analyzing qualitative and quantitative data to understand a phenomenon better and answer the research questions.

This study adopts convergent design. It is a type of mixed methods research in which the researcher collects quantitative and qualitative data simultaneously and analyzes them separately (Krueger, 2010). After the analysis, it was then combine or compare the results to draw a conclusion. Convergent design is used when there is a need to compare statistical results with qualitative findings to understand the research problem better. Researchers also use these mixed qualitative and quantitative research methods designed to validate and illustrate qualitative findings with quantitative results. In this case both quantitative and qualitative research was used to explore farmer preferences and the adoption of improved maize varieties in Zimbabwe. According to Maxwell (2014), the main benefit of using mixed methods of research is that you get the best of both qualitative and quantitative research methods. Mixed qualitative and quantitative research methods are less tied to established research paradigms, so they are flexible to use. The quantitative survey involved product development tours, farmer days to pick the favorable traits and farmer preferences. Varieties were scored by different individuals which involved farmers, community and Seed Co. Varieties were coded to minimize bias.

According to Wilkinson and Staley (2019), mixed-methods research may not always achieve its goal as mixing quantitative and qualitative methods can produce several threats. Researchers, such as David et al. (2018); Dawadi (2019); and Fauser (2018), have pointed out some practical difficulties associated with mixing qualitative and quantitative. First, data collection and analysis might be a very lengthy process. Therefore, it might be more expensive in terms of cost and time. Furthermore, quantitative and qualitative methods are guided by different epistemological and philosophical frameworks. Therefore, the concerns in integrating them "include whether the assumptions in each paradigm get the same value or attention in the study and whether the data derived from the two methodologies are viewed as incommensurable (Terrel, 2012). Despite the challenges, there has been a movement in favor of promoting 'mixed-methods' that combine qualitative and quantitative approaches (Hammersley, 2014). Bryman (2012) argues that research should avoid epistemological division between quantitative and qualitative methods as, for practical reasons, one type of method will usually be primary, but all research is enriched by the addition of other methods.

3.4 Sampling Procedure

The study adopted two sampling techniques, which include simple random sampling and purposive sampling. The researcher conducted on-farm trials sampling from the groups that carried out trials. I picked up 20 farmers to do a score sheet to assess their taste and preferences in terms of maize hybrids. Only 20 famers were selected to have a deeper investigation on cases in which farmers adopt different maize varieties.A simple random sample is a smaller group of people (a sample) selected at random from a larger group in statistics. Field visits, farmer days were done sampled and evaluated, targeting a farmer field where 15-20 farmers are invited together with some stakeholders to evaluate the selected trials and give insights on good traits and their preferences. Farmers to visit or to conduct a farmer day were randomly selected. There are key informants such as seed Co staff who also did the evaluation and scoring. Varieties were coded to minimize bias.

A simple random sampling was also be used to recruit farmers. A simple random sample is a randomly selected subset of a population. In this sampling method, each member of the population has an exactly equal chance of being selected (Maxwell, 2014). This method is the most straightforward of all the probability sampling methods, since it only involves a single random selection and requires little advance knowledge about the population. Because it uses randomization, any research performed on this sample should have high internal and external

validity, and be at a lower risk for research biases like sampling bias and selection bias (Denscombe, 2014).

The researcher selected farmers who have worked with Seed Co for some time using purposive sampling. They have farming experience which is needed in data collection.

3.5 Methods of data collection

The main instruments used in the mixed method research consist of closed-ended, open-ended questionnaires and interviews. These different ways of gathering data can supplement each other and hence boost the validity and dependability of the data (Denscombe, 2014). This study used in-depth interviews, open end questionnaires to gather data and close ended questionnaires.

3.5. 1 In-depth interviews

In-depth interviews was used to obtain information about the preferences of farmers and the adoption of improved maize varieties in Zimbabwe. It is defined as a qualitative method of data collection, which allows a secure conversation between a respondent and an interviewer (Taylor et al, 2016). One of the advantages of using in-depth interview was that it gives time to the participants in peace, to further develop and give a motive for their experiences and preferences regarding maize varieties. In-depth interviews, gives the researcher greater opportunity to ask follow-up questions, probe for additional information, and go back to key questions later to generate a rich understanding of people's experience of a phenomenon (Cresewell and Creswell, 2018). In addition, in-depth interviews were also chosen because they allow for detailed exploration of individual experiences, perspectives, and motivations. For instance, farmers can express themselves in their own words, providing a depth of understanding that may not be possible with other methods (Lund, 2012). Therefore, this study interviewed farmers. Each interview took at least 20 minutes. Interviews were conducted in areas where farmers felt comfortable, that is their homes and some at their fields. Each interview session lasted for approximately 35 minutes.

3.5.2 Key informant interviews

According to Maxwell (2014) key informants refers to the people whose social positions in a

research situation give them high-quality knowledge about other people's experiences who are therefore particularly valuable sources of information to a researcher. The purpose of key informant interviews is to collect information from a wide range of people. In this study the key informants were the staff members of SEED CO, Agritex officers and lead farmers. A total of 10 key informants were recruited. They were recruited because they have knowledge about farmers' preferences and adoption of improved maize varieties in Zimbabwe.

Table 2: The key informants who participated in the study

Stakeholder	Number of participants
Seed Co staff	3
Agritex Officers	5
Lead farmers	2
Total	**10**

3.5.3 Open ended questionnaires

These are types of interviews where the interviewer asks open ended questions that encourage the respondent to share their thoughts, feelings and experiences in detail. These questions allow the farmer to give a score and then share their thoughts and experiences in their words to share how they feel regarding a hybrid. Then give it a score. Open-ended questionnaires were chosen in this study because it allows respondents to express their thoughts and opinions in their own words, providing richer, more detailed, and context-rich answers compared to closed-ended questions (Gergen, 2013). This allows researchers to gain a deeper understanding of the "why" behind the answers, revealing valuable insights into respondents' motivations, experiences, and perspectives. By not limiting responses to predefined options, open-ended questions can uncover unanticipated ideas, trends, or issues that the researcher may not have considered during survey design (Lincoln et al, 2011). This can lead to valuable discoveries that can inspire product innovation, service improvements, or strategic changes.

3.6 Data analysis procedure

The analysis of data begins in the field with recording, listening, and reflection on the data. This process is called transcription, which is the first stage of data analysis. Creswell (2013) argued that transcription is not simply a matter of writing down what was said, but it is a process of construction. The researcher considers the interpretation of the content during transcription and, through repeated listening, will have a detailed knowledge of the content of the interviews (Willig, 2013). Data collected through in-depth interviews was analysed through transcription and then thematic analysis. Thematic analysis is a strategy used by social researchers to give categories to qualitative data. Taylor et al (2016) portrayed that thematic analysis is a process of encoding qualitative information, thus, the researcher develops "codes", words or phrases that serve as labels for sections of data. He also added that a theme captures something important about the data in relation to the research question and provides a meaning within the data set.

Furthermore, this study used descriptive statistics to analyse data. Descriptive statistics refers to a branch of statistics that involves summarizing, organizing, and presenting data meaningfully and concisely (Yin, 2011). It focuses on describing and analysing a dataset's main features and characteristics without making any generalizations or inferences to a larger population. A key advantage of descriptive analytics is that it requires only basic math skills and allows researchers to present otherwise complex data in an easily digestible format (Denscombe, 2014). Excel was then used to develop graphs that give an overview of performance per site and per variety.

Objective	**How it was analysed**
1. To identify the specific qualities and traits that farmers prioritize when selecting maize varieties	Descriptive statistics Bayesian Estimates of Coefficients
2. To assess the extent to which farmers have adopted improved maize varieties introduced by SeedCo and examine differences in adoption rates and preferences	Descriptive statistics
3. To investigate the challenges and obstacles farmers face in adopting improved maize varieties	Regression analysis

3.7 Ethical Considerations

According to Yin (2011), carrying out research with farmers may raise a lot of legal and ethical issues that must be well taken care of before proceeding with their involvement in studies. A number of studies conducted on farmers in Zimbabwe emphasize the notion of informed consent when researching the behaviour of farmers (Mouton, 2020). It means that the research participants must be fully informed about the procedures and risks involved in the research and must give their consent to participate. In this study, informed consent was obtained through explaining to the key informants and farmer participants the purpose and procedures of the research. After that, the researcher gave them forms to sign if they agreed with the terms and conditions of the research.
Protection of research participants is of great importance in this research. Ethical standards require that researchers should not put participants in a situation where they might be at risk of harm because of their participation (Creswell and Creswell, 2018). Harm can be in the form of physical and psychological. Psychological harm is very common when dealing with the elderly. In this study, protection of the participants was achieved through monitoring the discussion and by selecting a quiet and safe place for in-depth interviews.

Another major ethical concern is the notion of confidentiality. Almost all research guarantees the participants' confidentiality. Confidentiality refers to the treatment of information that an individual has disclosed to the researcher or in a relationship of trust and with the expectation that it will not be divulged to other people without permission (Patton, 2015). In this study, participants were informed of the precautions that would be taken to protect the confidentiality of the information they provided and be informed of the people who may have access. The participants were given the opportunity to ask questions concerning anything in relation to the research, at any time before, during, and after their participation in the study.

3.8 Summary

This chapter articulated the methodology of the study of the study which includes: description of study site, research design, sampling procedure, data collection procedures, data analysis procedures, ethical considerations, summary, and references.

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CHAPTER 4

RESULTS

Farmer preferences and the adoption of improved maize varieties in Zimbabwe

4.1 Introduction

This chapter articulates the findings of the study and analysis on farmer preferences and the adoption of improved maize varieties in Zimbabwe. The information presented in this chapter was obtained from the respondents in Manicaland, Mashonaland central, Mashonaland east, Mashonaland west and Masvingo province. This chapter presents results for objective 1 and 2 of the study. The objectives were to:

- Identify the specific qualities and traits that farmers prioritize when selecting maize varieties.
- Assess the extent to which farmers have adopted improved maize varieties introduced by Seed Co.

The discussion of the findings was supported by the available literature on farmer preferences and the adoption of maize varieties in Zimbabwe and the guiding theoretical framework of the study.

4.2 Materials and Methods

4.2.1 Description of study area

The trials for farmer preferences of improved maize varieties were done across 5 Provinces in Zimbabwe. These Provinces includes; Mashonaland west, Mashonaland east, Mashonaland central, Manicaland and Masvingo Province. These provinces were selected because they have climatic variations which are essential to understand farmer's behaviour and preferences within the country. The 5 provinces was also a complete representation of the agro-ecological regions in Zimbabwe, which was vital to explore farmer preferences of improved maize varieties in Zimbabwe.

4.2.2 Research design

This study adopted the convergent design. It is a type of mixed methods research in which the researcher collects quantitative and qualitative data simultaneously and analyses them separately (Maxwell, 2014). Convergent design was used in this study because it made it easier to compare statistical results with qualitative findings to understand the farmer preferences better.

4.2.3 Sampling procedure

The study adopted two sampling techniques. To begin with, purposive sampling was adopted to select farmers who were into maize production across the 5 provinces. The researcher also utilized a simple random sampling to recruit the respondents for the questionnaires. A total sample of 307 was selected across all 5 provinces.

4.2.4 Data collection procedures

This study adopted two data collection procedures. A survey method was used gather data on farmer preferences of improved maize varieties from the respondents. Open ended questionnaires were distributed to the participants to fill with guidance of the researcher. In-depth interviews were also adopted to get thick descriptions of farmer's preferences. It helped the study by getting adequate motives behind farmer's preferences of specific maize varieties.

4.2.5 Data analysis procedure

The study adopted descriptive statistics as a data analysis procedure for quantitative data. It was adopted because it summarizes, organize and present data in a meaningful way. Qualitative data was using thematic analysis. This was done by giving a theme or a code to specific sections of the data. The objective 4 of the study was analysed thematically.

4.2.6 Challenges encountered during data collection

During data collection, the researcher encountered a number of challenges. These includes; time wasting during in-depth interviews. The participants could spent more time explaining things that were not relevant to the study. I used follow up questions to bring them back to the focus of the

study. Participants were also coming late for interviews. Some respondents also did not fill all the sections of the questionnaire which also affected the validity and reliability of the data.

4.3 Results

Table 3: Specific qualities and traits that farmers prioritize when selecting maize varieties

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Drought tolerance	307	1	4	2.14	.883
Cob Size	307	1	4	2.16	.930
Grain Texture	307	1	4	2.39	.683
Disease tolerance.	307	1	4	1.75	.841
Valid N (listwise)	307				

Bayesian Regression

ANOVA[a,b]

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	1018.077	18	56.560	4.130	.000
Residual	3944.536	288	13.696		
Total	4962.612	306			

a. Dependent Variable: Plot

b. Model: (Intercept), Drought tolerance, Standability, Grain Texture..,
Cob Size, Pest Damage, Disease tolerance.

Bayesian Estimates of Coefficients a[b,c]

	Posterior			95% Credible Interval	
Parameter	Mode	Mean	Variance	Lower Bound	Upper Bound
(Intercept)	8.718	8.718	8.837	2.887	14.548
Drought tolerance = 1	-2.359	-2.359	1.868	-5.040	.321
Drought tolerance = 2	-2.449	-2.449	1.672	-4.985	.087
Drought tolerance = 3	-2.861	-2.861	1.511	-5.272	-.451
Drought tolerance = 4	.[d]	.[d]	.[d]	.[d]	.[d]
Standability = 1	-2.152	-2.152	6.359	-7.098	2.795
Standability = 2	-.709	-.709	5.879	-5.465	4.047
Standability = 3	1.064	1.064	5.872	-3.689	5.817
Standability = 4	.[d]	.[d]	.[d]	.[d]	.[d]
Grain Texeture.. = 1	1.382	1.382	1.884	-1.310	4.075
Grain Texeture.. = 2	.164	.164	1.184	-1.970	2.298

Grain Texeture.. = 3	.537	.537	1.157	-1.573	2.647
Grain Texeture.. = 4	.[d]	.[d]	.[d]	.[d]	.[d]
Cob Size = 1	.427	.427	1.059	-1.591	2.445
Cob Size = 2	-.893	-.893	.998	-2.852	1.066
Cob Size = 3	.007	.007	.891	-1.844	1.858
Cob Size = 4	.[d]	.[d]	.[d]	.[d]	.[d]
Pest Damage.. = 1	1.944	1.944	2.764	-1.317	5.205
Pest Damage.. = 2	.137	.137	2.584	-3.015	3.290
Pest Damage.. = 3	-.293	-.293	2.184	-3.192	2.606
Pest Damage.. = 4	.[d]	.[d]	.[d]	.[d]	.[d]
Disease tolerance. = 1	-.447	-.447	3.445	-4.088	3.193
Disease tolerance. = 2	2.533	2.533	3.503	-1.138	6.204
Disease tolerance. = 3	2.462	2.462	2.925	-.892	5.817
Disease tolerance. = 4	.[d]	.[d]	.[d]	.[d]	.[d]

a. Dependent Variable: Plot

b. Model: (Intercept), Drought tolerance, Standability, Grain Texeture.., Cob Size, Pest Damage.., Disease tolerance.

c. Assume standard reference priors.

d. This parameter is redundant. Posterior statistics are not calculated.

Bayesian Estimates of Error Variance[a]

	Posterior			95% Credible Interval	
Parameter	Mode	Mean	Variance	Lower Bound	Upper Bound
Error variance	13.602	13.792	1.340	11.708	16.240

a. Assume standard reference priors.

The information shown above shows the specific traits that farmers prioritize when selecting maize varieties. As shown on the table the mean on disease tolerance was 1.75 which is the lowest on the table indicating the lowest score on average. This means only a small number of farmers selected a maize variety based on its disease tolerance. However, the standard deviation on disease tolerance was higher than that of drought tolerance and grain texture indicating a high consistent scores for diseases tolerance. Grain texture and cob size traits have the means on the table of 2.39 and 2.16 respectively indicating the highest scores on average. This entails that the majority of farmers who participated in the study prioritized the texture and cob size of the maize variety. On the same note the standard deviation on grain texture was the lowest that is 683 showing low consistence on scores as compared to other traits shown on the table. Cob size and drought tolerance had the highest standard deviation indicating high scores consistence scores. This shows that farmers who prioritized drought tolerance and cob size were consistent. In a nutshell, the table indicates that the four traits presented were the most prioritized traits when selecting a maize variety.

During in-depth interviews with the participants they also highlighted some of the traits they prioritized. They revealed that there are several qualities and traits considered by farmers in different provinces in Zimbabwe. Some of the traits mentioned includes; high yield, pest resistance, early maturity, and adaptability to their specific growing conditions amongst others.

The findings above correspond to a study by GoZ (2019) who found that over 45% of the farmers in Manicaland Province prioritized the cob size and drought tolerance trait of the seed at the expense of other traits. Food and Agriculture Organization (2022) postulated that the cob size trait of the seed is very fundamental when selecting the maize varieties. This is because the main agenda of agriculture is to meet the food security needs of the nations, therefore, farmers tend to prefer varieties that can give them high yields as compared to those characterized with low yields. In contrary to this study, Chimonyo et al (2019) in South Africa found that grain quality and marketability was the main trait considered by commercial farmers when selecting maize varieties. This is because most of their maize they produce is exported to other countries hence the need to improve the quality.

In a study by Frischen et al (2020) three varieties reflected a higher level of preference in all agro-ecological zones, they includes SC 627, SC 713, and PAN 6549. These same varieties are also recommended by TOSCI (2009) for low and higher altitudes ranging from 500 – 1500m above sea level. Similarly, Ransom et al. (2003) and Kaliba et al. (2000) found that there is a positive relationship between altitude and adoption of improved maize varieties, for example farmers in lowland areas use improved maize varieties more than farmers in highland areas; On the contrary Cavane and Suvedi (2009) reported that farmers on the highlands of Mozambique were readily adopting improved maize seed varieties that had traits for drought tolerance and high quality maize meal, which are found in SC513. It can therefore be said that preference to improved maize seed variety depends on variety traits and its adaptability to a particular zone. Moreover, findings from this study indicate that there is variation in the use of improved maize seed varieties across the seven agro-ecological zones in Tanzania, which is in line with the hypothesis that there is variation in farmers' preference of improved maize seed varieties between farmers in agro-ecological zones in Tanzania.

From these lenses, the Structural empowerment theory also postulated that different nations have different structures which leads to different perceptions towards traits to consider when selecting maize varieties. Therefore, the study concludes that farmers should be empowered to freely select maize varieties by considering more than one trait. By allowing farmers to choose maize varieties based on multiple traits it may create a room to increase maize production in Zimbabwe.

Table 4: The extent at which farmers adopted varieties from Seed Co

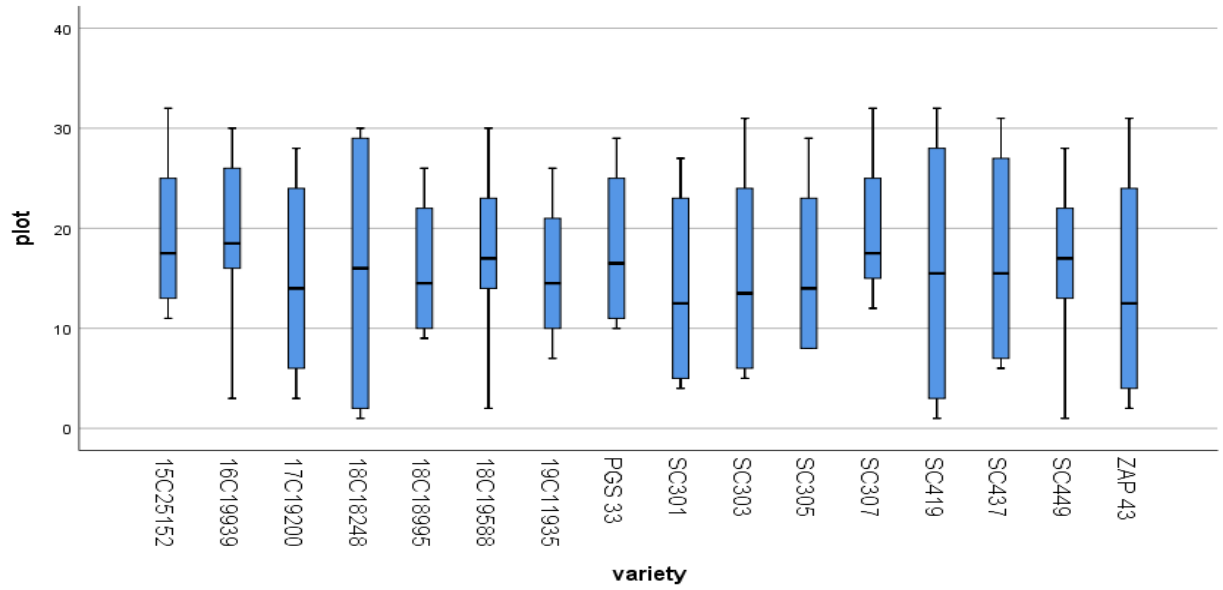
Variety

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		127	28.3	28.3	28.3
	14C5981	23	5.1	5.1	33.5
	16C35138	22	4.9	4.9	38.4
	20C27094	46	10.3	10.3	48.7
	P3812W	23	5.1	5.1	53.8
	PAN7M81	23	5.1	5.1	58.9
	PHB30G19	23	5.1	5.1	64.1
	SC 657	23	5.1	5.1	69.2
	SC 659	23	5.1	5.1	74.3
	SC 665	23	5.1	5.1	79.5
	SC555	23	5.1	5.1	84.6
	SC661	23	5.1	5.1	89.7
	SC719	23	5.1	5.1	94.9
	SC727	23	5.1	5.1	100.0
	Total	448	100.0	100.0	

The table above shows the frequencies at which farmers adopted the improved maize varieties introduced by Seed Co. The responses from the study participants indicate that about 76% of the farmers have adopted improved varieties introduced by Seed Co. However, the table above shows different frequencies of adoption for different varieties. The cumulative percentages indicates that farmers adopted more varieties that are drought tolerant, early maturity and high yielding. During in-depth interviews with the participants, they argued that, they all buy seed from Seed Co because that's the only seed company they know and trust from childhood. Some highlighted that they use varieties from Seed Co not only because it is available but because they produce quality hybrid seeds that increases their yield year after year. The diagram below portrays the rate at which each

variety is adopted.

Figure 3: The rate at which each variety is adopted by farmers



These findings correspond to a study by Cho (2013) who found that over 75% of the respondents were utilizing maize varieties from Seed Co. This was due to the increased need to maximize agricultural productivity since most improved maize varieties have a high yielding characteristics. Studies by Frischen et al (2020) and Chivasa et al (2022) indicated that Seed Co now faces completion from large international seed companies, which invest more resources in maize breeding than the government and CIMMYT combined, but it remains the most important seed provider in the country. Chuma (2019) postulated that farmers usually consider to grow seeds that mature early with high yields to alleviate hunger in the world where population growth is skyrocketing year after year. Therefore, in Zimbabwe, Seed Co is main known seed company that produces different varieties based on farmer's preferences. FAO (2022) argued that, the farmers who are not adopting improved maize varieties always have low agricultural productivity as compared to those utilizing improved varieties. Structural Empowerment theory argued that empowering farmers means that they should have more choices to fulfill their economic needs. However, it seems as if there are no other seed companies in Zimbabwe that can compete with Seed Co resultantly all farmers end up adopting varieties introduced by Seed Co.

4.4 Recommendations

Seed companies should develop more early-maturing varieties, as farmers value this trait, especially in regions with limited rainfall. There is need to conduct training programs and workshops on the benefits of new varieties, proper planting techniques, and fertilizer usage. Farmers should plant a mix of varieties for instance, planting a familiar variety alongside earlier and later maturing hybrids which can help manage risk and optimize yield.

4.5 Conclusions

This chapter articulated the results on the specific qualities and traits farmers prefer as well as the rate of adoption of improved seeds from Seed Co across the five provinces. From the findings of the study, a number of the respondents mentioned drought tolerance, disease tolerance, early maturity, and large cob size as the most preferred qualities and traits of maize varieties by farmers across the 5 regions. The responses from the study participants indicate that about 76% of the farmers have adopted improved varieties introduced by Seed Co.

4.6 References

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CHAPTER 5

RESULTS

Farmer preferences and the adoption of improved maize varieties in Zimbabwe

5.1 Introduction

This chapter portrays the findings of the study and analysis on farmer preferences and the adoption of improved maize varieties in Zimbabwe. This chapter focuses on results for objectives 3 and 4 of the study. These objectives were to:

- Examine differences in adoption rates and preferences across the five regions involved in the trials.
- Investigate the challenges and obstacles farmers face in adopting improved maize varieties.

The discussion of the findings was supported by the available literature on farmer preferences and the adoption of maize varieties in Zimbabwe and the guiding theoretical framework of the study.

5.2 Materials and Methods

5.2.1 Description of study area

The study was conducted to find out the farmer preferences of improved maize varieties across 5 Provinces in Zimbabwe. Mashonaland west, Mashonaland east, Mashonaland Central, Manicaland and Masvingo Province were selected for this study due to climatic variations which may influence farmer's behaviour and preferences of certain maize varieties.

5.2.2 Research design

Convergent design was adopted for this study. It is a type of mixed methods research in which the researcher collects quantitative and qualitative data simultaneously and analyses them separately (Maxwell, 2014). Convergent design was necessary for this study because it can help offset the weaknesses of each data type. For instance, quantitative data may provide a broader overview, while qualitative data can offer richer contextual details (Yin, 2011).

5.2.3 Sampling procedure

The study adopted purposive sampling and simple random sampling to recruit the study participants. Purposive sampling was adopted to select farmers who were into maize production across the 5 provinces. Purposive sampling was also used to select the key informants of the study. A simple random sampling was carried out to recruit the respondents for the questionnaires. A total sample of 307 was selected across all 5 provinces.

5.2.4 Data collection procedures

This study adopted two data collection procedures. A survey method was used to gather data on farmer preferences of improved maize varieties from the respondents. Open ended questionnaires were distributed to the participants to fill with guidance of the researcher. In-depth interviews were also adopted to get thick descriptions of farmer's preferences. It helped the study by getting adequate motives behind farmer's preferences of specific maize varieties.

5.2.5 Data analysis procedure

The study adopted descriptive statistics as a data analysis procedure for quantitative data. It was adopted because it summarizes, organize and present data in a meaningful way. Qualitative data was using thematic analysis. This was done by giving a theme or a code to specific sections of the data. The objective 4 of the study was analysed thematically.

5.2.6 Challenges encountered during data collection

During data collection, the researcher encountered a number of challenges. These includes; time wasting during in-depth interviews. The participants could spent more time explaining things that were not relevant to the study. I used follow up questions to bring them back to the focus of the study. Participants were also coming late for interviews. Some respondents also did not fill all the sections of the questionnaire which also affected the validity and reliability of the data.

5.3 Results

Table 5; Differences in adoption rate across the five regions involved in the trials

Province

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Manicaland	22	7.2	7.2	7.2
	mash central	110	35.8	35.8	43.0
	mash east	56	18.2	18.2	61.2
	mash west	98	31.9	31.9	93.2
	Masvingo	21	6.8	6.8	100.0
	Total	307	100.0	100.0	

The frequency table above shows that across all Provinces, Mashonaland has the highest adoption rate as indicated by the highest frequency 110. This was attributed to awareness programs conducted each year about improved varieties. During an interview one farmer mentioned that they usually conduct periodic farmer workshops to educate each other about the new equipment and varieties. This explains why Mashonaland central have the highest adoption rate. Mashonaland Central has also showed a high frequency on adoption rate which 98. The high adoption in Mashonaland West was attributed to farming events they organize with extension officers as well as poultry and pig projects they do to get income. These projects have helped them to get income to purchase improved varieties that are considered expensive by other farmers. Mashonaland East has a relatively high frequency of 56. The participants revealed that most farmers have abandoned crop production to livestock production thereby reducing the number of farmers adopting the improved maize varieties. Manicaland and Masvingo Province have relatively low adoption rate as indicated by the frequency of 22 and 21 respectively. This was attributed to changing climatic conditions which are no longer favourable for maize production. Another motive for low adoption rate in these areas is the fact that the majority of farmers have resorted to traditional crops such as millet and sorghum. This shows that there are remarkable differences in adoption rate across 5 provinces.

Table 6: Regression Analysis

Notes

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Pest Damage.., Grain Texeture.., Drought tolerance, Cob Size, Disease tolerance.[b]	.	Enter

a. Dependent Variable: Plot

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.294[a]	.086	.071	3.881

a. Predictors: (Constant), Pest Damage.., Grain Texture..,
Drought tolerance, Cob Size, Disease tolerance.

b. Dependent Variable: Plot

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	429.050	5	85.810	5.697	.000[b]
	Residual	4533.562	301	15.062		
	Total	4962.612	306			

a. Dependent Variable: Plot

b. Predictors: (Constant), Pest Damage.., Grain Texture.., Drought tolerance, Cob Size, Disease tolerance.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	6.694	.962		6.955	.000
	Drought tolerance	.089	.324	.017	.273	.785
	Grain Texeture..	.077	.371	.013	.207	.837
	Disease tolerance.	1.843	.354	.385	5.201	.000

	Cob Size	-.218	.275	-.050	-.795	.427
	Pest Damage..	-1.192	.398	-.231	-2.995	.003

a. Dependent Variable: Plot

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	4.58	10.79	7.48	1.184	307
Residual	-9.186	8.096	.000	3.849	307
Std. Predicted Value	-2.446	2.799	.000	1.000	307
Std. Residual	-2.367	2.086	.000	.992	307

a. Dependent Variable: Plot

The mean yield of all varieties in the same environment has been used as the environmental index in a number of studies, and the available literature have shown that the yield of a variety can be expressed as a linear function of the environmental index . So, in the present study, for each variety, we first regressed the variety yield against the on-trial environment index using the following model: (Eq. 1) $yj=a+bxj+ej$, yj is the yield of a variety in the jth environment (test site) (j=1,2,…,29),xj is the on-trial environment index obtained as the mean yield of all varieties in the environment, a and b are the regression coefficients, and ej is the error term representing the deviation from regression in the j environment, which is assumed to have a mean value of zero, a

constant variance of σ2, and to be uncorrelated with itself across observations.

Discussion

The findings above are similar to a study by Zimbabwe Vulnerability Assessment Committee (ZIMVAC) (2022), which found the highest adoption rates of improved maize varieties in Mashonaland Central and Mashonaland West respectively and less adoption rates in Masvingo and Manicaland Provinces. According to Ziwange (2019) most areas in Masvingo and Manicaland province fall under agro-ecological region 3 and 4 which makes it difficult for maize production. However, the famers that engage themselves into crop production tend to adopt varieties that are drought tolerant to maximize the productivity. On the other hand, most areas in Mashonaland central and west are found in agro-ecological region 1 and 2 with reliable rainfall and temperatures which is favorable for maize production. Nyamai (2010), postulated that, climatic factors are the main force that influences farmers' decision on which varieties to grow. Therefore, the adoption rates of improved varieties is mostly controlled by climate change rather than other factors. Structural Empowerment theory is of the view that different structures and boundaries that are set by the government and local authorities may have direct or indirect impact on decision making (Frischen et al, 2020). This entails that there is need for structural changes in Zimbabwe increase the adoption rate of improved varieties in Zimbabwe.

Furthermore, the regression analysis in this study was used to identify factors influencing farmers' preferences for different maize varieties across the 5 regions. This analysis may help breeders and extension workers understand what traits are most important to farmers, allowing them to develop and recommend varieties that better meet farmers' needs (Challinor et al, 2016). It also elaborated the differences in adoption rate of maize varieties. FAO (2024) also found that access to credit is a major factor which influence farmers' decisions to adopt improved varieties, particularly when combined with other factors like access to seed and information. Kebede et al (2020) found that farmers who have access to improved varieties and information are more likely to adopt improved varieties. In this study it was evident that, there were differences in adoption rate of improved varieties due to differences in climate, soil type, and access to information as well as government policies amongst others. This corresponds to a study by Chivasa et al (2022) who found that climate change and soil type was the leading motives behind differences in adoption rate of improved maize varieties.

5.4 The challenges and obstacles farmers face in adopting improved maize varieties.

During in-depth interviews with the participants, they mentioned a number of challenges and obstacles faced by farmers when adopting improved varieties which including limited access to improved seeds, inadequate resources, high input costs, and the impact of climate change. Socioeconomic factors were also mentioned, for example, land ownership and limited access to credit also play a significant role. Furthermore, the availability of quality seeds and the ability to manage pests and diseases are crucial for successful adoption.

5.4.1 Unavailability and high cost of improved seeds

Farmers in 5 provinces that were selected indicated that the availability and affordability of improved seed varieties is a major challenge, especially for smallholder farmers. This is due to lack of finances to purchase the seeds. In Mashonaland East, all farmers highlighted that unavailability and expensive prices of the new maize varieties was the main hindrance to adoption. One of the participants stated that,

"Most of us here we are smallholder farmers and we do not afford to purchase quality seeds from Seed Co because we do not have resources and capital to get it. Therefore, we use our traditional grains most of the times because that's what we can afford."

From the above quotation it is showing that smallholder farmers have interests in adopting new maize varieties but unavailability and expensiveness of the seed is a major hindrance.

Similarly, a study by Tambo and Abdoulaye (2012) in Nigeria, also found that the majority of small scale farmers struggled to purchase the new maize varieties due financial constraints. Structural empowerment theory also highlighted that, the financial structures of a country or region may cause different access to resources and inputs among farmers. For instance, in Zimbabwe smallholder farmers have limited chances of getting a loan from the banks as compared commercial farmers (Moyo, 2019). This makes it easier for commercial farmers to manage the seed costs of the new maize varieties. This portrays that availability and affordability of the seed is a major issue of concern to improve the adoption of improved maize varieties in Zimbabwe.

5.4.2 Climate Change

During interviews with some of the participants in this study they highlighted that climatic changes was a major setback to the adoption of improved maize varieties. For instance, they stated that, changes in rainfall patterns and extreme weather events negatively impact maize production and make it difficult to adopt varieties with the right traits. In Manicaland one of the farmers stated that,

"For us here it is difficult to purchase improved varieties which are expensive because year after year our crops are destroyed by extreme weather conditions such as tropical cyclones or extreme temperatures, therefore, we choose varieties which are cheap."

In Mashonaland central and Masvingo province, they also highlighted that the changes in rainfall patterns and temperature variations has affected their desire for improved maize varieties.

These findings correspond to a study by Chimonyo et al, (2019) in South Africa, who found that most farmers were no longer purchasing improved maize varieties due to climatic conditions. He illustrated that, in most rural areas in South Africa flash floods destroys the crops year after year which is a tremendous setback to most farmers towards adopting improved maize varieties.

5.4.3 Limited land

The participants of this study also revealed that limited land resources is a major hindrance to adoption of improved maize varieties on a larger scale. Most farmers in Mashonaland central highlighted that they do not have adequate land to adopt hybrid seeds for. They indicated that, due to natural population increase there is increased pressure on land which leave most farmers with small tracts of land.

This is similar to the findings of GoZ (2012) in Masvingo province, who found that limited land was a major setback to the adoption of improved maize varieties. Moyo (2019) postulated that, some farmers who did not receive farms during the land reform program in Zimbabwe have limited land for agricultural activities, resultantly they neglect other practices due to limited space. Therefore, one can argue that limited land is a major hindrance to the adoption of improved maize varieties.

5.4.4 Gender discrimination

The participants of the study also mentioned gender discrimination as an obstacle to the adoption of improved maize varieties. In Manicaland, female farmers indicated that there is gender discrimination in resource allocation and seed distribution by government officials. They also revealed that they face specific challenges in adopting new technologies due to limited access to resources, land ownership, and extension services. One of the participants stated that,

"All women in this province are disadvantaged when it comes to accessing the resources to improve our crop production due to prevailing patriarchal beliefs, which give the first priority to men, leaving women stranded with nothing."

This indicates that gender discrimination still exists across all farming regions in Zimbabwe.

Similarly, a study by Hussein et al (2015) also postulated that gender discrimination in the agricultural sector affects the ability of women to adopt new technologies and agricultural practices. Katengeza et al (2019) in South Africa also found that 79% of their female participants were advocating for women's empowerment in the agricultural sector to be able to improve their agricultural productivity. The structural empowerment theory also postulated that the empowerment of women is the first step to sustainable development. Therefore, gender discrimination is a major challenge to the adoption of improved maize varieties in Zimbabwe.

5.5 Recommendations

The extension officers organize farmer-to-farmer exchange programs to allow farmers to learn from each other's experiences with new varieties. The government and NGOs should provide access to credit or financial assistance to help farmers purchase the seeds and inputs needed for new varieties. There is also a need to encourage the development of local markets and trade channels for maize products. The government should also consider offering incentives for farmers who adopt new varieties, such as subsidies or recognition programs.

5.6 Conclusion

The chapter articulated farmers preferences of improved maize varieties in Zimbabwe. It emerged from the findings that Masvingo and Manicaland have the least adoption rate across all 5 Provinces, and Mashonaland Central had the highest. Major challenges highlighted by farmers in adopting improved maize varieties includes: climate change, unavailability of the seeds, high seed costs, limited land, and gender discrimination, amongst others.

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CHAPTER 6

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

6.1 Introduction

This chapter articulates the summary, conclusions, and recommendations of the study. The specific objectives of the study were to; identify the specific qualities and traits that farmers prioritize when selecting maize varieties; to assess the extent to which farmers have adopted improved maize varieties introduced by Seed Co. the study also sought to examine differences in adoption rates and preferences across the five regions involved in the trials as well as to investigate the challenges and obstacles farmers face in adopting improved maize varieties.

6.2 Research summary

The main objective of the study was to explore the farmers' preferences and the adoption of improved maize varieties in Zimbabwe. The study adopted the mixed method approach to find the quantitative value and in-depth descriptions of farmers' preferences. To recruit study participants, the study employed two sampling techniques, which are: purposive and simple random sampling. A total of 307 participants were recruited, including the key informants. A survey method, in-depth interviews, and key informant interviews were adopted as data collection procedures. The data was analysed using thematic analysis and descriptive statistics. The study was guided by the 'Structural Empowerment Theory as its theoretical framework.

The first research question of the study was to identify the specific qualities and traits that farmers prioritize when selecting maize varieties. The research found that common traits and qualities preferred by farmers include: drought tolerance, large cob size, grain texture, disease tolerance, and early maturity, amongst others. The study also sought to assess the extent to which farmers have adopted improved maize varieties introduced by Seed Co. The results indicated that about 75% of the respondents were utilizing improved maize varieties from Seed Co. The study also intended to examine differences in adoption rates and preferences across the five regions involved in the trials. The results of the study portrayed that, across all 5 regions involved in the trials, Mashonaland Central had the highest adoption rate, followed by Mashonaland West and Mashonaland East, respectively. Masvingo province and Manicaland had the lowest adoption rates

of improved maize varieties. Finally, the study sought to investigate the challenges and obstacles farmers face in adopting improved maize varieties. The results of the study postulated that unavailability, high cost of improved seeds, climate change, limited land, and gender discrimination were among the core challenges mentioned by the participants. From the results of the study, it is recommended that the government and NGOs should provide access to credit or financial assistance to help farmers purchase the seeds and inputs needed for new varieties. There is also a need to encourage the development of local markets and trade channels for maize products.

6.3 Conclusions

The study sought to explore farmers' preferences for improved maize varieties in Zimbabwe. From the findings of the study, a number of conclusions can be made. To begin with, it may be concluded that drought tolerance, disease tolerance, and large cob size are the most preferred qualities and traits of maize varieties by farmers across the 5 regions; therefore, Seed Co should prioritize these traits as they make improved maize varieties. The extent to which farmers have adopted improved varieties is limited due to several obstacles. Therefore, the government and NGOs should help farmers to get all the necessary inputs without any difficulties. There is a need to engage farmers in training campaigns, especially in areas such as Masvingo and Manicaland, where the adoption rate of improved varieties is low. It can be concluded that the adoption of improved varieties is still lagging behind in some provinces due to a combination of environmental, political, economic, and demographic factors at play in these areas.

6.4 Policy implications and recommendations

- Seed companies should develop more early-maturing varieties, as farmers value this trait, especially in regions with limited rainfall.
- There is a need to conduct training programs and workshops on the benefits of new varieties, proper planting techniques, and fertilizer usage.
- The extension officers organize farmer-to-farmer exchange programs to allow farmers to learn from each other's experiences with new varieties.
- The government and NGOs should provide access to credit or financial assistance to help farmers purchase the seeds and inputs needed for new varieties.
- There is also a need to encourage the development of local markets and trade channels for

maize products.

- The government should also consider offering incentives for farmers who adopt new varieties, such as subsidies or recognition programs.

6.5 Areas for further research

Further research on farmer preferences for improved maize varieties should focus on understanding the interplay between socioeconomic factors, production constraints, and the specific traits valued by farmers. This includes exploring how these factors influence the adoption of both improved varieties and local varieties, as well as the willingness to pay for specific traits. Additionally, research should delve into the heterogeneity of farmer preferences, recognizing that not all farmers have the same priorities.

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6.7 APPENDICES

Appendix A: In-depth interview guide

Appendix A: Key informant interview

For Farmers:

1. What are your top priorities when selecting seed varieties for your farm?
2. How do you currently evaluate the quality and performance of SeedCo varieties since 1994?
3. What are the most significant challenges you face in terms of crop yields, disease resistance, and pest management?
4. How important is sustainability and environmental stewardship in your farming practices?
5. What types of support or resources would you like to see from a seed house like ours?

Extension Agents

1. What are the most common issues you see farmers facing in terms of crop health and productivity?
2. How do you recommend farmers select the best seed varieties for their specific needs?
3. What role do you see seed houses playing in supporting sustainable agriculture practices?
4. What are some emerging trends or challenges in agriculture that seed houses should be aware of?
5. How can seed houses like ours better support your work with farmers?

For Industry Experts:(Breeders and marketers)

1. What are the biggest opportunities and challenges facing the seed industry in the next 5-10 years?
2. How do you see the role of seed houses evolving in terms of product development and innovation?
3. What are some key factors driving demand for specific types of seed varieties?
4. How can seed houses like ours stay ahead of the curve in terms of market trends and regulatory changes?
5. What types of partnerships or collaborations do you see as critical for seed houses to succeed?

6. How has seed production and development evolved from 1994 to date?

Appendix B: Questionnaire

Thank you for agreeing to participate in this study. Iam Sandra an MSC student from BUSE

doing a research project for my MSC thesis "**Exploring the evolution, performance, and adoption of SeedCo maize hybrid varieties in Zimbabwe.**" The information generated in this study will be kept in a secure place and will be used only for the purposes of this research. Answers will be kept confidential, and analysis will not involve individual names. There is no way anyone will be able to identify with you. Thank you for your willingness to participate in this study. You have the right to terminate this interview at any time, and you have the right to refuse to answer any question you might not want to respond to. Your expertise as a breeder, marketing officer, and extension officer will provide valuable insight into this topic.

Section 1: Demographics

Interview Date……. Interviewer: Tariro Sandra Sithole

Province……. Respondent initials (Name/surname)

1. Household size: ___

2. Age of household head: ___

3. Highest Education level of household head 0=no formal education 1=primary 2=secondary 3=high school 4=College or university

4. What is your marital status? 1= married 2= unmarried (widowed, separated, divorced) 3=Single (never married)

5 Household Average Annual Income level US$: ___

6 Number of household members contributing to household income:

6. Household Main Source of Income:

1=Formal employment (private sector) 2=Formal employment (public sector/government)

3= Informal employment (self-employed, e.g., vendor, taxi driver) 4. Small business owner/entrepreneur 99= Other (specify)

Section 2: Specific qualities and traits preferred when selecting improved maize varieties

What are the specific qualities and traits you prefer when selecting maize varieties?

Please indicate your answer by ticking:

Early maturity ☐

Drought tolerance ☐

Taste ☐

Disease resistance ☐

Earliness to maturity ☐

Stem borer resistance ☐

Weevil resistance ☐

Adaptation ☐

Medium maturity☐

Seed Price ☐

Pest resistance ☐

Tolerance to low soil fertility ☐

Good husk cover ☐

Big kernel size ☐

Termites resistance ☐

+ Apomictic characteristic☐

Lodging resistance ☐

Maize Variety Preferences

Specific Traits:

Yield: How important is high yield? (e.g., very important, important, neutral, etc.).

Drought Tolerance: How important is drought tolerance? (e.g., very important, important, neutral, etc.).

Disease Resistance: How important is resistance to specific diseases (e.g., rust, blight)? (e.g., very important, important, neutral, etc.).

Grain Quality: (e.g., grain size, color, taste, processing quality).

Maturity: How important is early maturity? (e.g., very important, important, neutral, etc.).

Other Traits: (e.g., pest resistance, striga resistance, cob size, seed availability).

Ranking

1. Rank the importance of different maize traits (e.g., yield, drought tolerance, etc.).
2. List preferred traits for specific purposes (e.g., home consumption, sale, etc.).

Open-ended questions

1. What are the most important traits for your maize varieties?
2. What are the biggest challenges in maize production for you?
3. What are your preferred maize varieties and why?

Perceptions of Varieties

Current Varieties:

1. How do you rate your current maize varieties based on yield, drought tolerance, etc.?
2. What are the strengths and weaknesses of your current maize varieties?

New Varieties:

1. Would you be willing to try new maize varieties?
2. What factors would make you more or less likely to adopt new varieties?

Additional Information

Access to Information:

What are your main sources of information about maize varieties (e.g., extension services, other farmers, seed companies)?

Seed Access:

How easy is it to access improved maize seeds?

Market Conditions:

What are the current market prices for maize?

Section 3: Differences in adoption rate across 5 regions and the rate of adoption in each Province

Are you aware of SeedCo maize hybrid varieties? Yes /No?

1. Province: Mashonaland Central ☐

   Mashonaland West☐

   Mashonaland East☐

   Manicaland ☐

   Masvingo☐

1. How many improved varieties have you adopted from Seed Co?

1 ☐ 2☐ 3☐

4☐ 5☐ Above 5☐

None ☐

Performance

1. How would you rate the performance of SeedCo maize hybrid varieties in terms of

Yield Potential (Excellent, Good, Average, Poor, Very Poor)

Drought tolerance (Excellent, Good, Average, Poor, Very Poor)

Disease tolerance (Excellent, Good, Average, Poor, Very Poor)

Pest tolerance (Excellent, Good, Average, Poor, Very Poor)

Vigor (Excellent, Good, Average, Poor, Very Poor)

Shelf life (Excellent, Good, Average, Poor, Very Poor)

Market Value (Excellent, Good, Average, Poor, Very Poor)

Overall appeal (Excellent, Good, Average, Poor, Very Poor**)**

2. **Have you experienced difficulties with SeedCo varieties? (yes /no) What are they?**

   Evolution

   1. How have SeedCo maize hybrid varieties evolved over the past 30 years in terms of

   Yield Potential

   Drought tolerance

   Pest tolerance

   Disease tolerance

3. **What new traits or characteristics would you see in the future SeedCo maize varieties?**
4. **plans**

   Do you plan to continue using SeedCo maize hybrids?

Section 4: The challenges and Obstacles farmers face in adopting improved maize varieties

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Appendices 6.8

2024-25 PRODUCT DEVELOPMENT PAT TRIALS HARVEST DATA COLLECTION SHEET						
Farmer name:					Gender:	
Data of planting:					farming experience	:
District:					Date of harvest:	
Area under maize					Farm name:	
Score: 1= Excellent ,2=Good ,3=Average ,4=poor , 5=Very poor						
	Evaluation during the vegetative stage				Evaluation during the harvest stage	
Variety	Vigor score	Diseases tolerance	Drought tolerance	Pest tolerance	Overall appeal	Market value
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

11						
12						
13						
14						
Name of the local variety usually grown by the farmer						
Compare the traditional variety with SeedCo variety						
Which seed are you buying this season						