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Faculty of Tropical AgriSciences

Agricultural Programs Affecting Food Security and Sustainability in Zimbabwe

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DECLARATION

I do hereby declare that all text in this bachelor's thesis entitled **"Agricultural Programs Affecting Food Security and Sustainability in Zimbabwe"** is original, and independently written. All sources have been cited and acknowledged using complete references, thus, according to the Citation Rules of the Faculty of Tropical AgriSciences.

In Prague, 15th April 2022

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Safiyya Cavatina Kassim

DEDICATION

This research is dedicated to my loving family – my parents (Mr. and Mrs. Kassim), my brothers (Carlisle & Zacariah), sisters (Naseema, Maria & Chernice, and two beautiful, precious, loving, and energy-filled daughters (Alaine & Anaya – my role models): you have all been a spring of inspiration and a never-ending source of strength to me. Thank you for believing in me more than I believed in myself, and for pushing me forward when I felt too weary to go on… Thank you for keeping my drive alive.

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ABSTRACT

The agricultural sector accounts for about 15% of the Gross Domestic Product (GDP) in Zimbabwe. Over the years, agricultural production has substantially reduced due to the negative impacts of several socio-economic, institutional, and policy-related issues, thus threatening the already critically declining food security in the country. Climate change on the other hand has had the most devastating effect(s) on the predominantly rainfed farming systems. This research is focused on the influence of the Special Maize for Import Substitution Scheme, and the Zimbabwe Livelihood and Food Security Program (LFSP) Pfumvudza on agricultural productivity. Very little is known about Pfumvudza in particular, as there is limited scientific knowledge published about the program. The overall objective is to investigate the effects of specific Government Input Support Programs (GISP) on food security and Climate Smart Agriculture practices (CSA) in Zimbabwe. 109 respondents were interview using face-to-face interviews. Further analysis was done using the Statistical Package for Social Sciences (SPSS) software 27.0. The key findings of the research showed that the majority of the farmers benefited from better agricultural knowledge; 53% of the respondents belonged to the acceptable food security category, and institutional factors such as cooperatives were associated to adoption os CSA. In addition, radio was found to be the major source of information. As a recommendation, policymakers should be recommended to promote combinations of different CSA methods and GISP focused on increasing agricultural yields, which will in turn enhance household food security.

Keywords: Climate-smart, food security, Pfumvudza, Special Maize for Input Substitution (SMPIS), sustainability.

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ABBREVIATIONS

AEZ(s)	Agro-Ecological Zone(s)
CA	Conservation Agriculture
CSA	Climate-Smart Agriculture
F2F	Farmer to Farmer
FCS	Food Consumption Score
FFE	Farmer to Farmer Extension
FFS	Farmer Field Schools
FISP	Farmer Input Support Program
FTLRP	Fast Track Land Reform Programme
GDP	Gross Domestic Product
GISP(s)	Government Input Support Program(s)
ISP(s)	Input Support Program(s)
LFG(s)	Local Farmer Group(s)
LFSP	Livelihoods and Food Security Programme
LSCF	Large-Scale Commercial Farmers
NGO(s)	Non-Governmental Organizations
rCSI	Reduced Coping Strategy Index
SAP(s)	Sustainable Agricultural Practice(s)
SCF	Small-Scale Farmers
SMPIS	Special Maize Programme for Import Substitution
VFT(s)	Volunteer Farmer Trainers

1. INTRODUCTION

The economy of Zimbabwe relies largely on agriculture. Agriculture contributes at least 15% to the country's GDP, employs about 70% of the national workforce, and is also a major source of livelihood for the majority of the rural population (FAO 2015a; ITA 2021). However, the country is plagued with severe food insecurity and had a global hunger index of 28.8 in 2016, ranking 99th globally (IFPRI 2017; UNDP 2017). Smallholder farmers – the main producers of staple crops – are dependent on rainfed agriculture (FAO 2015a; Nkomoki et al. 2018). The dominant livelihood activities in Zimbabwe are small-scale or subsistence farming, with maize being the most cultivated crop, as in the case of Zambia (Nkomoki et al. 2018). They are often unable to afford irrigation systems and lack access to credit/loans to purchase inputs necessary for agricultural production. Thus, climate variability (erratic rainfall, drought, unpredictable weather conditions, floods, prolonged droughts) is another critical problem that must be tackled globally, which often culminates in food insecurity.

To address the issue of climate variability, smallholder farmers are provided with extension services in the form of education and/or practical training, hence, encouraging the adoption of Climate Smart Agricultural Practices (CSA). In Sub-Saharan Africa, the adoption of CSA practices has been proven to increase agricultural productivity, enhance food and nutrition security (Nkomoki et al. 2018) and boost ecosystem multifunctionality (Birchall & Bonnett 2021). Nevertheless, limited access to extension services and credit, poor/declining soil fertility, and lack of labor have further contributed to insufficient food production, rising food insecurity levels, cropping calendar changes, and failure to adopt CSA (Nkomoki et al. 2018; IPC 2021; Musafiri et al. 2021).

Notably, lack of land tenure security often has the most significant impact on the adoption of CSA, as farmers lack the motivation to invest more for fear of not reaping the benefits (Nkomoki et al. 2018). Thus, influencing farmers' climate adaptation uptake (Murken & Gornott 2022). Deininger & Ali (2008) highlighted the importance of land-attached investment and how it ensures sustainable natural resource management, rural poverty reduction, and more importantly, economic growth. Farmers often lack the freedom to invest, and Fenske (2011) pointed out that on certain tenure leases, innovation is forbidden. Similar studies were done in Zimbabwe, Zambia, Uganda, China, Burkina Faso, and other countries, suggesting that with better land tenure security, farmers will be willing to adopt more Sustainable Agricultural Practices (SAP), hence, innovate and invest in more lucrative farming systems.

Thus, contributing to enhancing agricultural yield, soil fertility, and food and nutrition security (Chimhowu & Woodhouse 2008; Deininger & Ali 2008; Korsaga 2018; Tatsvarei et al. 2018).

Government Input Support Programs (GISP) such as the Livelihoods and Food Security Programme (LFSP), Pfumvudza (referred to henceforth as 'Pfumvudza') and the Special Maize Programme for Import Substitution (SMPIS) provide smallholder farmers with agricultural input subsidies, as well as extension services. Farmers are trained under Pfumvudza on planting basin usage; this is a minimum tillage method that promotes water conservation, as Goromonzi is prone to drought. Over 2 million smallholder farmers have been trained to date – across Zimbabwe – on planting basins effectively (Mapira 2020; ZimVAC 2021). SMPIS, on the other hand, provides smallholder farmers with input subsidies to enhance maize production and, in turn, agricultural yield.

It is, therefore, essential for policymakers to understand the effects of specific Government Input Support Programs (GISP) on food security and Climate Smart Agriculture practices (CSA) in Zimbabwe. Many farmers did not benefit positively from some GISP programs, such as command and target command agriculture, implemented after the Fast Track Land Reform Programme (FTLRP) of 2000-2006. There is empirical evidence revealing the shortcomings of the FTLRP, which lead to several complications, including the reduction in maize yields (Marongwe 2011). This was due to the program's short roll-out period, lack of effective monitoring systems, political interference, lack of finances and/or extension services, and more (Pazvakavanbwa & Hungwe 2009; Marongwe 2011; Ngarava 2020). Moreover, political influence and/or interference also affect access to land, credit, land tenure security, and extension services, thus, resulting in reduced agricultural yield.

On the contrary, very little is known about Pfumvudza, as there is limited scientific knowledge published about the program. Therefore, investigations on how the GISP impacts household food security and the adoption of SAP – mainly focusing on CSA – would also help close this knowledge gap. Furthermore, this research could assist district offices in Goromonzi evaluate the performance and benefit of the different GISPs rolled out in the study area. This could also be a starting point for future research aimed toward better implementation of GISP for the benefit of farmers – with a focus on smallholder farmers. In addition, this study can assist policymakers in understanding factors affecting the adoption of CSA practices and how best to address such matters when they arise, hence formulating policies to address these issues.

2. LITERATURE REVIEW

2.1. Food security

For decades, food insecurity has afflicted the rural inhabitants of many developing countries. Food security is a quantifiable measure that can be looked at from several angles (Mallick & Rafi 2010). Food security is the availability, accessibility, utilization, and stability of nutritious and safe food, at all times (FAO 2006; Peng & Berry 2018). It emphasizes the entitlement to a healthy and active life, hence, the need to meet people's preferences and dietary requirements, whilst ensuring the right to food at an individual, household, and national level (FAO 2006, 2010). Jones et al. (2013) highlighted the access to safe, sufficient, and nutritious food.

According to Mallick & Rafi (2010), food security can be defined as, *the peoples' security against risks of not having access to required food"*. National food security is when a country can meet its dietary needs through sufficient food access. Food security and insecurity can be temporary, severe/chronic, break-even/adequate, and surplus (in excess) (FAO 2008; Mallick & Rafi 2010). In cases where severe food security is experienced, households sell income-generating assets or borrow money with coping with food insecurity (Mallick & Rafi 2010). As a result, this causes a further reduction in productivity, and most cases result in chronic food insecurity (Mallick & Rafi 2010) – with households after that being forced to rely on irregular income streams as a means of survival. Acheampong et al. (2022) revealed that access to credit influences the household food security status.

In 2006, FAO (2006) revealed that 850 million people were undernourished worldwide in 2016 (an increase from 777 million in 2015), with 98% being accounted for in developing countries (FAO 2010). Nkomoki et al. (2019) pointed out that smallholder farmers are most affected by the global challenge of food insecurity. Jung et al. (2016) and Abdullah et al. (2019) stated that women-headed households are more prone to feed insecurity. However, Mallick & Rafi (2010) disagree, pointing out an insignificant difference between male – and female-headed households' food insecurity levels.

The FAO (2011) highlighted that agricultural yield and output could increase by 20-30% and 2.5-4% by giving women the same resources as men. This would, in turn, enhance household food security levels. Therefore, closing this gender gap could help to reduce worldwide hunger by 12-17% (FAO 2011, 2018).

2.2. Food Security in Zimbabwe

Paired with economic uncertainty and political instability, the rural population needs assistance, which goes far beyond donor aid, exaggerated propaganda, and global criticism.

In Zimbabwe, an estimated 5.5 million rural people were said to be food insecure during the 2019/2020 lean season – as a result of the 2018/2019 drought that led to a large-scale crop failure – according to USAID. The same source indicated that an additional 3.8 million needed food assistance – most of which are women. Women lack the resources necessary to be more productive in the agriculture sector.

Climate change is an overarching challenge faced by farmers, as it majorly affects agricultural production (Westengen et al. 2019). Climate change and variability are major determinants of the food insecurity situation in Zimbabwe, hence, triggering all droughts, and floods (UNDP 2017). FEWS Net (2022) revealed that although Zimbabwe's acute food security situation is improving, vulnerable households still face high food insecurity levels. This is attributed mainly to the rising food prices and the decreasing household income. UNDP (2017) pointed out that climate change and inelastic food production sector, volatility in food prices, and the interaction of the progressive poor or low investment into the agriculture sector intensify food poverty and insecurity levels. Poverty was also found to be a major driving force behind food insecurity (Ozioko et al. 2020).

The major determinants of household food security are 1) Household head characteristics; 2) Household characteristics, 3) Farm characteristics, and 4) Institutional characteristics. Such characteristics include but are not limited to 1) Age, gender, marital status, level of education, and farming experience; 2) Household size, income, employment type, and livestock ownership; 3) Farm size and land ownership; and 4) Farmer group membership, access to credit and extension services, respectively (Nkomoki et al. 2018, 2019; Abdullah et al. 2019; Acheampong et al. 2022). Notably, these are the same/similar factors to those affecting the adoption of CSA practices.

2.3. Agriculture in Zimbabwe

Agriculture is of paramount importance in the world we live in today. According to the World Bank (2020), agriculture accounted for more than 4% of global Gross Domestic Product (GDP) and up to 66% in developing countries, in 2018. It is a major source of income in developing countries, provides employment for about 80% of the labor force, and is a means of survival for an additional 850 million rural people. Murray et al. (2006) pointed out that over 2.5 billion people globally, are dependent on agricultural production systems.

In Zimbabwe, agriculture is highly diversified and responsible for at least 40% of the total export value. The country relies significantly on agriculture, which directly and indirectly provides livelihoods for about 60-70% of the national labor force, accounting for 23% of formal employment (FAO 2015a; ZAGP 2015; FAO 2017. 33.3 million hectares of land are reserved for agricultural production; commercial and subsistence farming is practiced in Zimbabwe (Maiyaki 2010). According to FAO (2017), 3 573 893 people are employed in agriculture, fisheries, and forestry. However, communal households in Zimbabwe rely on subsistence farming, which poses a threat to the household food security situation (McAllister & Wright 2019). Agriculture in Zimbabwe is also prone to climate variability: erratic rainfall, drought, and unpredictable weather conditions/climate change (Asfaw et al. 2018), which all contribute to the dwindling food production and food security levels in Zimbabwe. Therefore, any shock felt in the agricultural sector negatively affects other sectors and the economy as a whole (Simpson 2021). According to the African Development Bank (2021), the agriculture sector suffered such a shock in 2020. This caused a 10% decline in Zimbabwe's GDP due to reduced agricultural production, thus, resulting in a further escalation of inflation rates and high food prices (Simbarashe et al. 2021). Furthermore, poverty levels and the resilience of rural livelihoods are often dependent on the performance of agriculture.

Another challenge faced by the agricultural sector is the lack of willingness or capacity of farmers to adopt innovative technologies due to lack of technical know-how, financial, and human resources, and also willingness to adopt (Yigezu et al. 2018). This further elicits the reliance on monocropping, which in itself, brings about a series of complications that include poor soil and nutrition fertility, loss of biodiversity, reduced agricultural yield, and more (McAllister 2018).

Therefore, agricultural production is considered a prerequisite for economic growth and industrialization, in Zimbabwe (Mapfumo 2013).

2.3.1. Crop Production

The main agricultural season in Zimbabwe usually stretches from November until April (Mazvimavi 2010; FEWS Net 2022). However, the central plateau – where Zimbabwe's prime agricultural land is found – receives winter rains from June to October. Inversely, the southern, eastern, south-eastern, and lowland areas receive little to no rain during the same period (ZimVAC 2010). **Figure 1** illustrates the typical crop calendar in Zimbabwe (FAO 2021; FEWS Net 2022). It also shows the lean season which lasts from November to March or May in some areas. Unskilled labor demand is usually required during early harvest (March till June).

Maize (Zea mays L.) is the staple crop in Zimbabwe (Chikobvu et al. 2010; Odunze & Uwizeyimana 2019; Santpoort 2020), thus, making it the most important cereal crop in the country. Maize is also the most important and most cultivated crop in the Southern African region (FEWS Net 2022). Other major crops grown in Zimbabwe are tobacco (*Nicotiana tabacum*) – the country's main foreign currency earner, wheat (*Triticum L.*), sorghum (*Sorghum bicolor (L.)* Moench), cotton (*Gossypium*), groundnuts (*Arachis hypogaea L.*), soyabean (*Glycine max*), potatoes (*Solanum tuberosum*), and sweet potatoes (*Ipomoea batatas*) (**Figure 2**) (Nyathi et al. 2020). Tobacco is Zimbabwe's main export crop (Simbarashe et al. 2021).

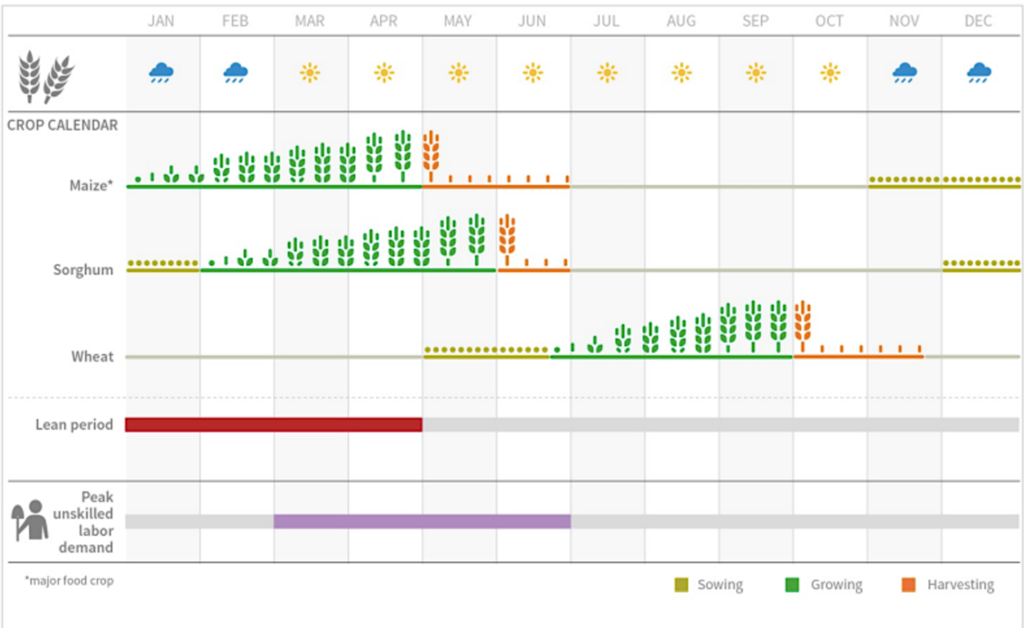


Figure 1. *Zimbabwe Crop Calendar.* (FEWS Net 2021; FAO 2022)

Types of farming practiced in Zimbabwe are crop rotation, inter-cropping, shifting cultivation, intensive, semi-intensive, and extensive farming (Table 2). In Zimbabwe, the major farming systems practiced are sole-livestock, crop, and mixed farming. The major cropping system used is monocropping. But this triggers various problems, such as reduced agricultural yield, increased use of chemical fertilizers, and pesticides, and outbreaks of weeds, pests, and plant diseases.

There are six farmer groups in Zimbabwe, namely: 1) A1 farmers; 2) A2 commercial farmers; 3) A2 communal farmers; 4) Old resettlement farmers; 5) Small-scale commercial farmers and 6) Peri-urban commercial farmers. Most of the agricultural growth in Zimbabwe is reliant on Large-Scale Commercial Farmers (LSCF) who occupy the more fertile land in Zimbabwe. However, 89% of Small-Scale Farmers (SSF) – who rely on rainfed agriculture – occupy land where rainfall is unreliable, and soils are less fertile (Sepo Marongwe et al. 2012; UNDP 2017; Simbarashe et al. 2021). Nevertheless, since the 1970s, crop production has been immensely affected by erratic rainfall, causing a drawback that continues to plague the agricultural sector. Nyathi et al. (2020) added that frequent dry spells, poor soil fertility, and lack of soil fertility amendments, i.e., fertilizer and manure, threaten crop production in Zimbabwe.

Over the years, there has been a massive decline in the cultivation of cereal crops, as farmers are either unable to afford new seed varieties and other innovations or are unwilling to adopt improved seed varieties. **Figure 2** shows a decrease in groundnut production. There is also an enhanced soyabean production, which could be a result of the SMPIS, as the government extended the scheme to the soyabean and livestock sector in 2017.

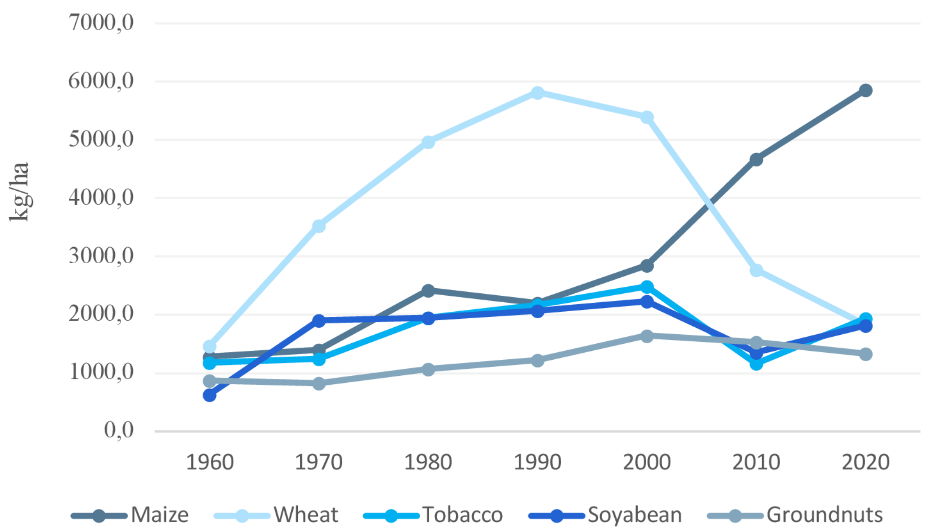


Figure 2. *Crop Production in Zimbabwe: 1960 – 2020.* (FAOSTAT 2022)

2.3.2. Livestock Production

Livestock is a valuable part of agriculture in developing countries. It is also a key asset in rural areas. Hence, a significant component of both agricultural production and food security (UNDP 2017). In Zimbabwe, livestock is an important source of resistance to shock. Furthermore, it symbolizes wealth accumulation. The same is true for other developing countries. Livestock and livestock products contribute a significant share to Zimbabwe's economy. The main livestock products include skins, hides, eggs, and milk (Simbarashe et al. 2021). According to Dizyee et al. (2017), at least 60-75% of rural households own cattle, which account for 35-38% of the GDP. The entire cattle herd in Zimbabwe is estimated at 5.5 million heads (Bennet et al. 2019). Cattle have several uses in Zimbabwe, which include meat, draught, power, manure, skins, and hides.

It is common for women to own smaller livestock such as goats, sheep, pigs, donkeys, and poultry. However, have limited access to large livestock i.e., cattle, credit, land, extension services available to men, and education related to livestock rearing (Sanginga & Njuki 2013; Ndiritu et al. 2014; Bennet et al. 2019). In the beef value chain, men own more livestock than women, whilst women are often the main caregivers, hence, have several responsibilities, i.e., taking to the feeding pen, cleaning pens, selling livestock products, and so on (Ayoade et al. 2019; Bennet et al. 2019). Such inequalities are significantly present in countries such as India, Nigeria, Nicaragua, Pakistan, Bangladesh, Ghana, Indonesia, and others (FAO 2011). This often varies from culture to culture (Matondi & Dekker 2011; Bennet et al. 2019).

Studies by Maiyaki (2010) revealed that 70-90% of rural households and/or smallholder farmers own goats, with at least 80% owning chickens. This can be seen in **Figure 3**. Small ruminants and poultry are easily disposable and in times of cash crisis in Zimbabwe, they serve as a safety net against climate-change-induced shocks (Musara et al. 2021). The figure below shows the Tropical Livestock Units (TLU) of cattle, goats, chickens, asses, and pigs. It also illustrates a reduction in chicken production from 2005. This was a result of the import bans placed on poultry during this period which caused a spike in the prices of day-old chicks being imported mainly from Zambia and South Africa. Additionally, a disease outbreak in South Africa exerted pressure on the poultry industry. In 2019, import bans were lifted as the government identified a strain on food availability within the country (Zengeni 2014). On the other hand, there is an increase in goat production, suggesting that consumers resorted to goat rearing and consumption. Additionally, a slight increase was seen in ass and pig production.

According to Runganga (2021), *"Zimbabwe's smallholder system has the potential to grow and become the mainstream of the livestock sector's performance indicator."*

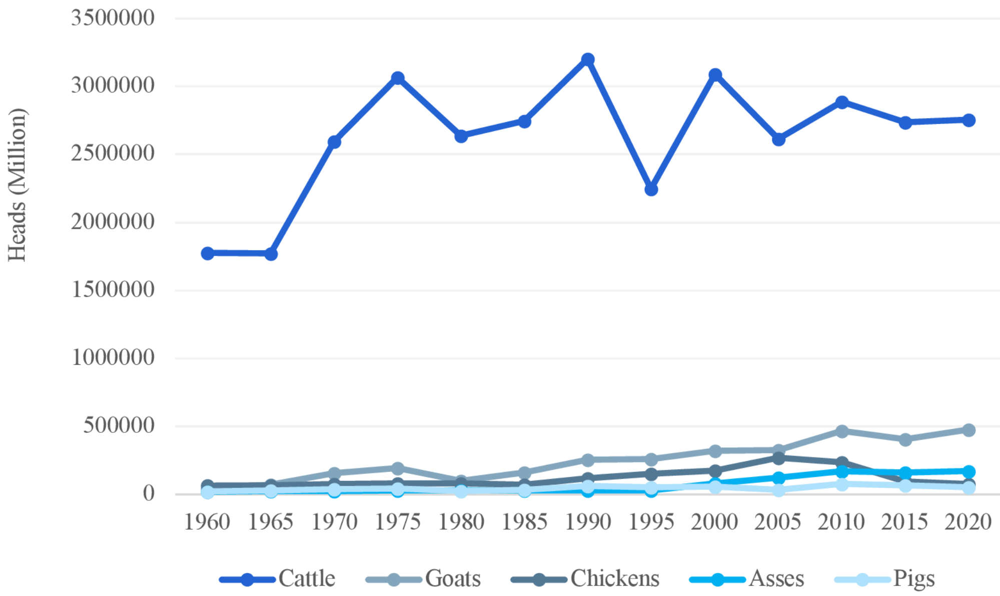


Figure 3*. Livestock Production in Zimbabwe (TLU): 1960 – 2020.* (FAOSTAT 2022)

2.4. Climate-Smart Agricultural Practices

Climate-Smart Agriculture is the transformation and re-orientation of agri-food systems concerning green and climate-resilient practices to support food security, hence, tackling areas relating to 1) enhancing agricultural productivity and income; 2) the reduction of greenhouse gas emissions, and 3) building resilience and adapting to climate change (Lipper et al. 2014). Over the years, agriculture has been the main source of food for the rapidly growing population. However, production, as well as food security have been threatened by farmers' inability to adopt Sustainable Agricultural Practices (SAP), as they often prefer to rely on old, traditional (tried-and-tested) methods of farming (Oyewole & Sennuga 2020). Sub-Saharan Africa (SSA) is faced with high levels of food and nutrition insecurity, which require the adoption of SAP and more investment, as a means of combating this (Oyewole & Sennuga 2020). On the contrary, the adoption of CSA practices has been proven to increase agricultural productivity, and household income, as well as enhance both food and nutrition security, in SSA (Nkomoki et al. 2018; Oyewole & Sennuga 2020). Moreover, sustainable agriculture serves as a substitute for the preferred, primitive methods of farming (Oyewole & Sennuga 2020). Furthermore, these methods are highly beneficial to the environment, as they help to maintain both biodiversity and the ecological undercurrents of agro-ecosystems.

Conversely, adopting SAPs, reduce environmental vulnerability and ecological problems, in areas such as soil erosion, land degradation, unsustainable usage of water, and more (Zira et al. 2013; Oyewole & Sennuga 2020). Mujere (2021) highlighted other benefits of the adoption of CSA, i.e., mitigation and adaptation to climate change, restoration of natural ecosystems, and improving the resilience of farming systems (Syed et al. 2022). Findings by Nkomoki et al. (2019) suggest that the adoption of CSA contributes to the food security status. Likewise, Ogada et al. (2020), pointed out that the adoption of CSA can cause a substantial increase in household income, and in turn, asset accumulation. Soil organic cover, crop rotation, and minimum tillage (planting basins) are the most preferred and promoted methods of CSA practices in Zimbabwe (Jones et al. 2005; Sepo Marongwe et al. 2012). Mazvimavi & Twomlow (2009), added that farmers in Zimbabwe are more likely to adopt CSA in areas with higher rainfall, whereas those in Zambia tend to in areas with low rainfall. Nevertheless, CSA adoption in Africa is lower, in comparison to the rest of the world; in 2015/2016, Zambia and Zimbabwe were leaders in CA adoption with about 316 000 and 100 000 hectares, respectively (Nyathi et al. 2020). However, several factors hinder the adoption of CSA practices, namely: 1) Household characteristics, 2) Farm characteristics, and 3) Institutional characteristics (Nkomoki et al. 2018).

Table 1. *Factors Influencing the Adoption of CSA.*

Influencing Factors	Reference
Age	Nwakor et al. 2011; Mutambara et al. 2012; Oyewole & Sennuga 2020
Gender	Sanginga & Njuki 2013; Esabu & Ngwenya 2019; Assefa et al. 2022
Land Size	Nkomoki et al. 2019; Nyaga et al. 2015
Education	Mutambara et al. 2012; Nwakor 2011; Otekunrin 2022
Soil fertility	IPC 2021; Rusinamhodzi 2013; Mbanyele et al. 2021; Musafari 2021
Access to labor	IPC 2021; Assefa et al. 2022; Ayoade et al. 2019; Bennet et al, 2019
Access to credit	Pazvakavanbwa & Hungwe 2009; Marongwe 2011;
Access to training	Adesida et al. 2021; Kiyani et al. 2017
Freedom to invest	Fenske 2011; Kassie et al. (2017; Murken & Gornott 2022
Rainfall variability	Mazvimavi 2009; Thiefelder et al. (2013); UNDP 2017
Farming experience	Nkomoki et al. 2018, 2019; Thiefelder 2015; Nwigbo 2021
Land tenure security	Nkomoki et al. 2018; Makuwerere Dube 2020
Resource ownership	Rusinamhodzi 2015; Nkomoki et al. 2018, 2019
Livestock ownership	Nkomoki et al. 2019; Rusinamhodzi 2015; Musafari 2021
Access to knowledge	Abura et al. 2013; Kiyani et al. 2017; Musafari 2021
Adoption of innovations	Kalyanapu 2015; Nwakor 2011; Mazvimavi & Twomlow 2009
Access to input subsidies	Phillan Zamchiya 2013; Zira et al. 2013; Koppmair et al. 2017
Access to extension services	Nkomoki et al. 2018; Pazvakavanbwa & Hungwe 2009; Kiyani et al. 2017
Cooperative/FG membership	Adesida et al. 2021; Nkomoki et al. 2019; Nwigbo 2021
Climate change and variability	Runganga 2021; Chikodzi 2016; Thiefelder et al. (2013)

2.4.1. Planting Basins

According to (Triplett & Dick 2008), the use of planting basin/no-till is highly sustainable. The widespread uptake of planting basins in Zimbabwe is incentivized by seed and fertilizer inputs that farmers receive from different NGOs or as a part of an agricultural or government input support program/scheme (Rusinamhodzi 2015a). Planting basins are holes dug using hand hoes, thus, prepared in the dry season. Minimum soil disturbance is done when using this CSA practice (Rusinamhodzi 2015a). They are on average 15-20cm deep, 30cm long, and 15cm wide, however, spaces between the holes may differ according to the Natural Region in which the practice is to be adopted. In AEZ II, III, IV, and V, holes with a diameter of 15 x 15 x 15cm are dug. However, the spacing in regions II and III is 75 x 60cm, whilst in Natural Regions IV and V, it is 90 x 60cm (Twomlow et al. 2008). The basins are prepared in the dry season and planting is done after the first effective rains (Mazvimavi & Twomlow 2009). They are predominantly adopted on small plots of land or farms. When the planting process is carried out, inputs are placed inside the holes, closest to the plant, hence encouraging active efficient uptake and nutrient use. Such inputs include seed, fertilizer, manure, lime, and compost. According to Rusinamhodzi (2015a), the same planting basins can be repeatedly used each planting season. Rusinamhodzi (2015a) discovered that when rainfall was poorly distributed, planting basins did not improve water conservation. However, this contradicts other studies which proved that planting basins enhance both soil and water conservation, and yields (Twomlow et al. 2008; Nkomoki et al. 2018; Marumbi et al. 2020; Yigezu & El-Shater 2021). Early preparation of planting basins has a positive influence on agricultural yield (Ngoma et al. 2015; Githongo et al. 2021). Furthermore, the use of planting basins substantially increased sorghum yields (Marumbi et al. 2020). Nyamangara et al. (2014) added that clay soils enhance the benefits of CSA.

2.4.2. Improved Seed Varieties

Improved seed and drought-tolerant varieties are widely used throughout Africa, for example in Ethiopia, Tanzania, Malawi, Zimbabwe, and other developing countries as a means of countering the radical effects of climate change (Mugwe et al. 2019; Westengen et al. 2019). Hence, maize varieties are the most common seed used. Improved seed varieties have many benefits, that include but are not limited to drought tolerance, pest and disease resistance, early maturity, increased yield, less seed use, and more (cite). However, in southern Africa, crop productivity is affected due to smallholder farmers' inaccessibility to improved seed varieties, soil infertility, and other factors (Sanginga & Woomer 2009; Wall et al. 2013; Mugwe et al. 2019).

In Tanzania, (Kalema et al. 2022) found improved seed varieties to be inexpensive, compared to other seeds. Nonetheless, findings from Ahmed (2022) contradict this. Lack of adoption was attributed to two factors, which were, namely: 1) farmers' lack of knowledge regarding the benefits of usage, with a belief that local varieties are better, and 2) the expensiveness of the seeds. Encouragingly, improved seed varieties were found to increase agricultural production and enhance household food security (Shiferaw et al. 2014; Thierfelder et al. 2015a; Acheampong et al. 2022). When adopted in combination with fertilizer and/or other nutrient inputs, improved seed varieties were found to have a much higher yield than when used alone (Ahmed 2022). However, Teklewold et al. (2013) disclosed the major trade-offs that can occur as a result of this, i.e., agrochemicals can cause stress on the environment, in a bid to increase agricultural productivity.

2.4.3. Crop Rotation

Crop rotation is the planting of different crops in succession. The most common combinations are cereal and leguminous crops, such as maize and soyabean; this is also the most frequently used rotation in Zimbabwe and the USA (Arriaga et al. 2017). However, farmers choose crops to be used in the rotation based on their commodity-market prices (Asseng et al. 2014). The rhizobacteria help to fix atmospheric nitrogen (which is highly beneficial to both the plant and soil) when cereals are planted after legumes (Asseng et al. 2014). The benefits of crop rotation are numerous. Such benefits include but are not limited to: it provides a diverse range of crops that act as a price buffer in fluctuating market prices, helps to avoid an accumulation of pathogens, diseases, and weeds, due to the sequential use of pesticides, avoids plow-pan or compaction layer build-up, decreases labor requirements and equipment costs, and more (Francis 2005; Mazvimavi & Twomlow 2009; Al-Kaisi & Lal 2017). Other benefits include the reduction of greenhouse gas emissions (because of reduced nitrogen (N) levels from fertilizer), enhancement of soil aggregation and water holding capacity (highly beneficial in arid and semi-arid regions), and replenishing soil carbon and N levels (Asseng et al. 2014). In situ crop harvest residue, sufficient crop nutrition, and crop rotation are proven to increase both agricultural yield and promote sustainable CSA (Rusinamhodzi 2015b; Alhameid et al. 2017). Thus, making it an essential component of CSA.

2.4.4. Agroforestry

Agroforestry is a dynamic, ecologically-based natural resource management system involving the integration of woody perennials, and/or trees in animal or crop production fields, farms, and agricultural landscapes. There are three types of agroforestry practices, namely: Silvo-pastoral system, Agri-silvicultural system, and Agri-silvopastoral system. These three systems comprise a mixture of forestry and livestock; forestry and agriculture; and forestry, livestock, and agriculture, respectively (Bhattarai et al. 2017).

Agroforestry is an important tool used by farmers in their fight against poverty and hunger, at a household, and community level, thus, combating issues such as food insecurity and gender inequality, thus, improving the lives of rural women (Leakey et al. 2005; Sobola & Amadi 2015; Raj & Chandrawanshi 2016; Uisso & Masao 2016; Leakey 2017; Plieninger et al. 2020; Miller et al. 2021). Agroforestry has also been proven to address the unsustainable use of natural resources, whilst promoting their sustainable use, in line with some of the UN-Sustainable Development Goals (Kiyani et al. 2017; Tschora & Cherubini 2020; Plieninger et al. 2020). Uisso & Masao (2016) supported this, by pointing out that agroforestry has the potential to advocate for enhanced natural resource management.

In Zimbabwe, traditional agroforestry methods are practiced. Agroforestry home gardens are used by many farmers and farming households and are also one of the most practiced methods of Agroforestry in Zimbabwe (Maroyi 2009; Galhena et al. 2013).

Agroforestry has multiple benefits which include, but are not limited to fighting against climate change, enhancing biodiversity, improving ecosystem services, carbon sequestration, creating of micro-climate, reduction of pests and diseases, provision of wind and fire breaks, providing a diverse source of income from agroforestry tree products, and more (Raj & Chandrawanshi 2016; Uisso & Masao 2016; Kiyani et al. 2017; Tschora & Cherubini 2020). In addition, agroforestry encourages the reduction of deforestation, thus, promoting increased environmental stability, soil fertility, and soil and water conservation (Kiyani et al. 2017).

The benefits of agroforestry by far, outweigh the disadvantages. However, it is necessary to point out that agroforestry implementation is very costly and time-consuming, and farmers often lack the required know-how and subsidies that allow them to adopt the practice (Miller et al. 2021). Additionally, its benefits are not well known, and there are few or no policies to support it (Jagger & (Marty) Luckert 2008). Furthermore, the land is seldom allocated specifically for agroforestry use.

Nkomoki et al. (2019)added that farmers with secure land tenure rights are more likely to adopt a higher diversity of agroforestry practices, in comparison to those without.

2.5. Factors Influencing the Adoption of CSA Practices

2.5.1. Household Characteristics

2.5.1.1. Age

According to Nwakor et al. (2011), age influences the adoption of farming innovations and/or technologies. When focusing on CSA adoption, Defrancesco et al. (2008) suggest that younger farmers should be targeted due to the labor intensity of some of the practices. Mazvimavi & Twomlow (2009) add that young farmers are more open to innovation, hence, are more willing to take necessary risks. However, old farmers are more reliant on traditional methods and often unwilling to change (Oyewole & Sennuga 2020). Studies by Nkomoki et al. (2018) revealed that farmers are 0.5% less likely to adopt crop diversification, with a one-year increase in age. Mutambara et al. (2012) added that agroforestry adoption was also significantly influenced by age in Goromonzi, Zimbabwe.

Furthermore, as farmers increased in age, they were found to be less likely to adopt CSA due to the fear of risk involved in taking up new technologies. Mazhar et al. (2021) added that yound farmers below the age of 30 are more willing to adopt CSA than older ones. Notably, as people age, they tend to opt for less physically and/or mentally-taxing activities (Mutambara et al. 2012).

2.5.1.2. Gender

Esabu & Ngwenya (2019) pointed out that males are more likely to adopt CSA than females. However, Assefa et al. (2022), found that women-managed farms had higher crop diversification in comparison to their male counterparts. On the contrary, women have limited access to credit, and land, extension services, thus, hindering their ability to adopt CSA practices (Sanginga & Njuki 2013; Ndiritu et al. 2014). However, women are in most cases constrained from conducting the same practices as men, due to several cultural and social restrictions. This may also be due to women’s economic dependency on men (Assefa et al. 2022). The simultaneous adoption of multiple SAPs was found to increase women’s workload thus suggesting that strengthening technological interventions may not be gender-neutral (Teklewold et al. 2013).

2.5.1.3. Household Size

Some CSA practices are labor-intensive; smallholder farmers are often unable to afford paid labor to assist with tillage, fertilizer application, and even harvesting. Therefore, bigger households are at an advantage, as household members can perform necessary CSA-related duties. Adesida et al. (2021) noted that planting basins were positively influenced by an increase in household size.

2.5.1.4. Level of Education

Access to formal education influences CSA adoption (Zira et al. 2013). Mutambara et al. (2012) established that agroforestry is adopted more by farmers with a higher level of education, thus, implying that educated household heads have a greater probability of adopting CSA. Adoption of improved varieties was also found to be influenced by the level of education (Nwigbo 2021). Research by D'Emden et al. (2008) proved that when decision-makers had tertiary education, the no-till adoption rates were favorable. In addition, female education could improve the chances of CSA adoption of improved seed varieties and conservation tillage, as revealed by (Teklewold et al. 2013).

2.5.2. Farm Characteristics

2.5.2.1. Farm Size

Farmers with larger land-holding sizes have the freedom to adopt more CSA practices (Mutambara et al. 2012). Inversely, those with smaller farms focus on subsistent farming and/or opt for the cultivation of cash crops, using traditional farming methods such as monocropping. Labor-intensity of CSA practices could be another reason why farmers with larger pieces of land chose not to adopt certain practices (Teklewold et al. 2013). Jayne & Rashid (2013) pointed out that farmers from Malawi, Zambia, and Kenya with larger landholding size received more subsidy support than those with smaller landholding size.

2.5.2.2. *Land Ownership*

Farmers lacking land tenure security are in most cases unwilling to invest much in innovations and/or CSA, which in turn affects agricultural productivity. Fear of losing their investments and/or agricultural yield are the main driving forces behind this (Nkomoki et al. 2018). In Zimbabwe, land tenure security is a major challenge, as resettled farmers (mostly in communal areas) lack title deeds (Matondi & Dekker 2011); freehold, communal, and state-owned land are found in the Goromonzi district.

Moreover, farmers lack the motivation to invest in farm infrastructure, which further cripples the ability to increase production (Zikhali 2008). Land ownership was found to have a positive influence on the adoption of certain CSA practices, i.e., mulching; this was not the case with non-landowners (Adesida et al. 2021).

2.5.2.3. *Farming Experience*

Farmers take pride in the experience they gain over the years. However, often than not, they are willing to adopt new technologies with the belief that their way of farming is superlative. Adesida et al. (2021) demonstrated that advanced farming experience negatively influenced the adoption of CSA. D'Emden et al. (2008) disclosed that farmers' personal experience affects their perception of certain CSA practices, influencing their desire to adopt them. Research by Thierfelder et al. (2015) discovered that an increase in years of experience causes a significant rise in agricultural yield. On the contrary, some studies show that farming experience positively influences the adoption of CSA (Nwakor et al. 2011).

2.5.2.4. *Labor*

As pointed out by Zira et al. (2013), labor and draught power availability significantly influence the adoption of CSA. Women provide a huge source of labor, and their contribution is pivotal to both agricultural activities and production (Ayoade et al. 2019; Bennet et al. 2019; Assefa et al. 2022). However, they are restricted from performing certain activities, in comparison to men. Nevertheless, the same is not true in every community, as some women are permitted to participate freely in the labor force, whilst others are restricted to do so (Mallick & Rafi 2010). Men, on the other hand, adopt more labor-intensive practices than women e.g., agroforestry and planting basins. However, insufficient labor when using planting basins may lead to a reduction in agricultural yield, late planting, and underutilization of land (Muoni et al. 2013).

2.5.3. Institutional Characteristics

2.5.3.1. Access to Credit

Results from Mutambara et al. (2012) demonstrate that access to credit does not influence the adoption of CSA practices such as agroforestry in Goromonzi, Zimbabwe. An increase in age was also found to enhance the adoption of CSA. However, several other studies contradict this notion, hence, pointing out that access to credit has a noteworthy influence on the adoption of CSA (Pazvakavanbwa & Hungwe 2009; Marongwe 2011; Sepo Marongwe et al. 2012; Yigezu et al. 2018). Smallholder farmers – many of which rely on ISPs – are unable to afford the escalating prices of fertilizers, seed, and other agricultural inputs, therefore, stressing the importance of access to credit. In addition, women's access to credit is restricted (even in Zimbabwe), forcing them to use their husbands as surety, as they often lack collateral (due to limited assets, i.e., livestock, land, etc.) to enable them to apply for loans (Masiyandima et al. 2011; Sanginga & Njuki 2013; Ndiritu et al. 2014; Bennet et al. 2019). In many instances, microfinance companies have high interest/repayment rates which drag defaulting farmers into a poverty trap when they fail to repay the loans (Masiyandima et al. 2011).

2.5.3.2. Access to Extension

Extension services provide a wide range of assistance, which include but are not limited to agricultural training and capacity building, technical knowledge-share, and aid with the application for input subsidy assistance. In Zimbabwe, the major providers of extension services are 1) the Ministry of Agriculture, Department of Research and Specialist Services (DRSS) (government); 2) the Department of Agricultural, Technical and Extension Services (AGRITEX) (government), and 3) SEEDCO (private seed-producing and plant-breeding organization) (World Bank Group 2017; SEEDCO 2021). The SMPIS selected 96% of A1 and 100% of A2 farmers who were eligible to benefit from the skill, through an extension officer, thus, highlighting the importance of extension services (Matenga 2017). (Adesida et al. 2021) determined that access to extension encouraged farmers to adopt various CSA practices such as fertilizer trees and animal manure. The same is true for the implementation of other CSA practices. These findings are supported by (Musafiri et al. 2021). Surprisingly, Adesida et al. (2021) discovered that it was less probable for farmers with more frequent contact with extensions officers to adopt mulching and crop diversification. Farmer's trust in extension officers and their expectations of swift government intervention during crop failure was seen to influence SAP adoption (Teklewold et al. 2013).

2.5.3.3. Cooperative Membership

Cooperatives in Japan are founded upon the following principles, namely: 1) expansion of agricultural production, 2) increasing farmer's income, and 3) revitalizing regional societies. Local Farmer Groups (LFG) associated with the ruling party have easier access to subsidies than those who do not (Murisa 2011). (Nwigbo 2021) posited that the adoption of improved varieties was influenced by cooperative membership. In Zimbabwe, cooperatives or farmer groups are the body through which farmers apply for input subsidies (Muchetu 2019). These findings are supported by (Murisa 2011; Zira et al. 2013; Nkomoki et al. 2019). (Muchetu 2019) added that agricultural cooperatives in Zimbabwe adopt single-purpose models, hence, are focused solely on input provision and output marketing. However, in Kenya, at least 80% of the population was found to receive income from cooperative activities (Wanyama 2009). Adesida et al. (2021) discovered that farmers who were not members of farmer groups were less likely to adopt fertilizer trees and cover crops in comparison to members.

2.5.3.4. Farmer Field School (FFS)

Farmer Field Schools are a platform through which farmers can acquire technical knowledge and capacity-building skills. The study by (Adesida et al. 2021) found heightened adoption of cover crops and crop diversification. Studies from Tomlinson & Rhiney (2018) highlight the various benefits farmers can yield from attending FFS. These benefits include: empowerment to plan for and cope with the effects of climate change, capacity building, improved awareness on the adoption of CSA practices, and more. Tomlinson & Rhiney (2018) further adds that those attending FFS had better adaptation than those who did not.

2.6. Communication Channels

Empirical evidence revealed that amongst the main sources of information used for agricultural information dissemination are Farmer to Farmer (F2F), cooperatives, extension services, radio, television, newspapers (including online), mobile phones more. However, farmers in developing countries in most cases have low disposable income and consider televisions and radios to be luxuries (Tantisantisom 2011). They opt instead to use their revenue on agricultural supplies and food (Tantisantisom 2011).

Maggio & Sitko (2019) added that poor radio network coverage, ad other personal restraints caused were other barriers faced by smallholder farmers in Zambia. However, Maggio & Sitko (2019) argues, stating that radio in Zimbabwe has significant coverage of agriculture-related content, as well as a wider range of listeners, thus, is an inexpensive medium.
Although, a lack of content specialists, language barriers are some of the constraints faced when broadcasting to minority groups (Venda, Kalanga, and others).

Studies by Kutyauripo et al. (2021) showed that newspapers in Zimbabwe (the Herald, the Standard, the Sunday Mail, and Newsday) covered a wide scope of issues, mainly categorized under climate change and food security-related topics. Some specific topics surveyed included climate change awareness, crop and livestock production, water harvesting, value addition, marketing, and more. However, farmers – due to various reasons do not – do not purchase newspapers, hence, prefer to use other mediums, i.e., radio, and others.

F2F or Farmer to Farmer Extension (FFE) approaches are widely adopted in various developing countries (Hellin & Dixon 2008; Islam et al. 2010; Ssemakula & Mutimba 2011). In Kenya, Volunteer Farmer Trainers (VFTs) employ a F2F or FFE approach. This approach promotes Agriculture Market Information and Services (AMIS) from farmers to farmers. F2F extension promotes sustainability and continuity through capacity building and knowledge-pass-down (Kiptot & Franzel 2015). In addition, VFTs share various information relating to cropping, livestock feed technologies, market and credit access, climate-related information, and more (Christoplos 2010; Sulaiman & Davis 2012). One of the advantages of the F2F approach is that farmers have expert knowledge of the local conditions, can gain the trust of other farmers (as they are known by them), and are also aware of the cultural aspect. There are several other benefits of FFE are that it is 1) low cost; 2) effective; 3) inclusive, and 4) a wide-ranging substitute, thus, promoting its wide usage (Kiptot & Franzel 2015). CSA information is easily disseminated via this channel by farmers with hands-on knowledge. The Kasisi Agricultural Training Center, in conjunction with the Republic of Zambia Ministry of Agriculture and other entities, employs this method through the Farmer Input Support Program (FISP). Research by Kiptot & Franzel (2015) revealed that VFTs use a participatory approach when addressing farmers, selecting topics to discuss, planning training meetings, and so on. In turn, farmers develop a sense of ownership, and this further strengthens the trust and/or relationship between farmers and VFTs. However, VFTs face several challenges, which involve lack of training material, limited technical knowledge, resistance from farmers, highly expectant trainees, local politics (often inciting non-participation), lack of transport, inadequate incentives, and family feuds (amongst trainees).

2.7. Agricultural Support Programs

The sole purpose of agricultural support programs is to assist farmers in need of farming and agricultural inputs, extension services, access to credit facilities, and more. Subsidy programs throughout Africa give governments the chance to demonstrate their ability to tangibly assist farmers, thus, adrdressing the aforementioned aspects (Jayne & Rashid 2013). Jayne & Rashid (2013) pointed out that between 2008 and 2011, over US$1 billion was spent on funding fertilizer subsidy and agricultural expenditures in Zambia, Tanzania, Senegal, Nigeria, Mali, Malawi, Kenya, Ghana, Ethiopia and Burkina Faso. However, whether or not the ISPs are achieving the national policy objectives remains elusive Jayne & Rashid (2013). Jayne & Rashid (2013) further highlighted that the political nature of ISPs prolong their lifeline, irrespective to whether they are effective or not. ISPs often take up funds that could be chanelled into other critical aspects (Jayne & Rashid 2013). Therfore their benefits, relative to the capital injection remains questionable. ISPs have also been seen to influence farmers behavior regarding farming practices, the choice of seed varieties used (saline – heat – and drought-tolerant), small-scale irrigation system investment, and so on (Jayne et al. 2018). ISPs have been proven to tackle recuring agricultural-challenges (Jayne et al. 2018). On the contrary, increased GHG emissions as a result of excessive use of fertilizer received through ISPs, may be counter-productive in fighting against climate change (Jayne et al. 2018).

2.8. The Fast Track Land Reform Programme (FTLRP)

The Land Acquisition Act of 2002, saw the birth of the 3 phase, 4-year FTLRP which was established based on the reallocation of estates, state-owned, and formerly white farmer-owned land to local farmers. This came after the Land Reform and Resettlement Program Phase II (LRRP II) which took off in June 1998 (Centre for Public Impact 2017). The early land redistribution program, however, dates back to 1980, and this consisted of land being sold on the market, backed by government support (Pazvakavanbwa & Hungwe 2009). The second phase – which was much slower than the first – focused on the distribution of this purchased land, and finally the third and final phase (FTLRP), which amid speculations of reform failure, took place with strong political influence and interference. This Fast Track phase of the program was initiated in the year 2000 as a means of speeding up this redistribution process (Ngarava 2020). However, the government was faced with the dilemma of allocating land which had been over-purchased on paper and did not tally with actually available land, on the ground (Hentze et al. 2017).

The FTLRP was initially targeted at 150 000 farmers who were to receive land, varying in size (small and large scale farms – the latter of which were further divided into medium-scale commercial farms), as a result of this program (Scoones et al. 2011; Marongwe 2011; Mkodzongi & Lawrence 2019; Ngarava 2020). The program was targeted at farmers lacking land for agricultural production. Under the two farming models were small-scale farms – allocated for subsistence use, and the medium to large-scale indigenized farms for commercial use (Hentze et al. 2017; Marongwe 2011).

Studies by Marongwe (2011) – in comparison to the pre-FTLRP with regards to tobacco production – revealed that the crop received increased export value since the commencement of the program. However, the number of tobacco growers declined (Ngarava 2020). Moreover, there was a decline in maize production during this same period, thus, affecting household food security levels, as maize is the staple crop and most consumed crop in Zimbabwe.
Pazvakavanbwa & Hungwe (2009) suggest that this decline in productivity may be attributed to a lack of access to farming equipment and or input subsidies, lack of finance, and agricultural services including extension services. Ngarava (2020) further suggested that lack of adequate knowledge and know-how could have been the main driving factor, as many farmers had access to land post the FTLRP but lacked necessary farming competencies (Pazvakavanbwa & Hungwe 2009). (Marongwe 2011) ruled out that the FTLRP had adverse effects on commercial agriculture in the Goromonzi district.

2.9. Rapid Decline in Maize Production

Although maize plays a major role in attaining food security throughout Africa, it is highly sensitive to erratic rainfall patterns which result in moisture or water stress (Kassie et al. 2017). As pointed out by Rukuni et al. (2006), at least 64% of maize produced in Zimbabwe is used for human consumption, whilst 22 and 14% are used for livestock and poultry feed, and other industrial uses, respectively. After independence, Zimbabwe's maize production was sufficient to sustain the population, and excess was stored in grain reserves. However, this took a drastic turnaround in 1991/92; Zimbabwe experienced the worst drought in more than a century (Kalyanapu 2005).

A country once having surplus grain reserves, had to resort to relying on imports and food aid, as production dropped by a warping 80%, and was unable to sustain the growing population's needs. Additionally, nearly 37% of the population experienced malnourishment and/or suffering from starvation (Kalyanapu 2005).

Both lack of purchasing power due to reduced production and reduced agricultural production are attributed to malnourishment. Furthermore, households in areas experiencing low rainfall often suffer more from malnutrition and a series of other health-related complications (Kalyanapu 2005).

In 2001, the already slow-paced economic growth took another plunge as production was affected this time by a regional drought. A substantial shortfall (70%) of farm-level production resulted in a deficit at the national level; annual food requirement needs were unable to be met. Studies from Rukuni et al. (2006) revealed that total maize output experienced an erratic reduction, falling from 1.4 million tonnes in the 2000/01 season to 498 000 tonnes in the 2001/02 season, whilst staple maize production fell to less than 25% of consumption (Kalyanapu 2005). Kalyanapu (2005) pointed out that this was because of the farm-level production shortfall, coupled with the Government of Zimbabwe-sanctioned farm invasions. These fluctuations in output have led to a dependency on food aid, although, there have been reports of its unsystematic distribution. The food shortages deteriorated even further, resulting in a humanitarian disaster and famine (ZimVAC 2002; Kalyanapu 2005).

2.10. Government Input Support Programs (GISP)

2.10.1. Special Maize Programme for Import Substitution

Zimbabwe's maize production continued to plummet from 2009, following the decline in agricultural production since the FTLRP implementation from 2000 to 2006 (Zikhali 2008; Chilunjika & Uwizeyimana 2015). Surprisingly, between 2000 and 2005, the area under cultivation augmented, whilst the maize yields continued to diminish. This coincides with the tenure of the FTLRP when smallholder farmers received farmland but lacked both agricultural know-how and inputs. This sharp regression reached critical levels in 2015 after a devastating drought stuck (**Figure 4**), hence, resulting in only a quarter of the country's consumption needs being met (Odunze & Uwizeyimana 2019). Mapfumo (2013) added that droughts and irregular rainfall cause low yields and soil erosion across the country.

According to UN Comtrade (2019), only 511 816 tonnes were produced in the 2015/2016 season – a significant drop from the previous planting season. This spurred an increase in national food insecurity levels from 12% to 42% in 2011 and 2016, respectively (Odunze & Uwizeyimana 2019), thus, leaving at least four million people in dire need of food aid, as revealed by (ZimVAC 2015).

In 2015 imports of maize – Zimbabwe's staple crop – rose drastically, as locally produced maize was insufficient to feed the population (Odunze & Uwizeyimana 2019).

Amid the drought of 2015, Special Maize Programme for Import Substitution (SMPIS) was formulated and rolled out the following year (October 2016). This was after the inception of command agriculture in 2014 (Uledi 2019). It was a policy under the target command agriculture scheme, hence, necessitated by the distorted access to credit, increased vulnerability to droughts, and intensified land tenure insecurity (Makuwerere Dube 2020). It was a temporary solution aimed at addressing, and consequently, reducing the amassed import expenditure bill, the fast-increasing national food insecurity levels, curbing poverty, and the uncontrollably dwindling maize yields (Uledi 2019; Odunze & Uwizeyimana 2019). In addition, the SMPIS served as a tool to reduce foreign currency loss, because of excessive imports.

Sakunda Holdings, an international commodity firm, and the Government of Zimbabwe funded the scheme through a public-private partnership with an initial budget of US$500 million (Mazwi et al. 2019). However, concerns were raised about the nature of this partnership, especially regarding the high-interest rates being charged by the private company (Mazwi et al. 2019).

The SMPIS was complemented by the Presidential Input Scheme (PIM) which had similar objectives as the SMPIS (to spruce up national grain reserves). The SMPIS targeted A2 commercial farmers, whilst PIM aimed at providing support for about 1.4 million farmers (A1 farmers producing maize, cotton, tobacco, and other small grains), and A2 communal farmers – most of which were found in regions I and II (Mazwi et al. 2019). Ministry of Agriculture's Department of Extension Service – AGRITEX – was used to mobilize farmers (96% and 100% A1 and A2 farmers, respectively). The focus was mainly on farmers with sufficient farming and irrigation equipment, and those not solely reliant on rainfed agriculture – located near water bodies (Shonhe & Scoones 2022). Farmers were given subsidies amounting to $250 000. These included seed, fertilizers, chemicals, irrigation equipment, electricity and water charges, and tillage services. However, subsidy distribution was not carried out fairly (Mutami 2015). The Periscope Report (2017) stated that farmers were expected to commit 5 tonnes per hectare as repayment for this loan, throughout the scheme.

The graph below shows an increase in maize yields after the implementation of the SMPIS, between 2015 and 2020. This suggests that the program's objectives were/are being met. However, Matenga (2017) arguably pointed out that "the scheme fell short of its expected outcomes".

Uledi (2019) supported this by bringing to light that government spending continued to increase, whilst maize yields took a plunge, before the rolling out of the SMPIS. Uledi (2019) further divulges that the SMPIS interfered with the production of other crops (soya bean and others), thus, resulting in a further increased import bill. Furthermore, it failed to achieve its mandate of job creation and enhancing income and food security Uledi (2019).

Matenga (2017) and FEWS Net (2021) highlighted that maize grain levels on the open market were critically low, resulting in restricting private maize sale, as it is a controlled crop. This caused maize levels of both deficit – and surplus-producing regions to be significantly low. Moreso, commercial land was underutilized, and the scheme's overall performance failed dismally, to meet its initial targets (especially in 2016/2017). Surprisingly, more capital was injected into the SMPIS amidst all the failures recorded, further widening Zimbabwe's budget deficit. The PIM proved to be more successful than the SMPIS (Matenga 2017).

A meager total of 168 666 tonnes of maize were produced under the SMPIS; hence, the area harvest was ed reduced compared to previous planting seasons. Although only $30 million was invested into the PIM, it yielded 770 682 tonnes.

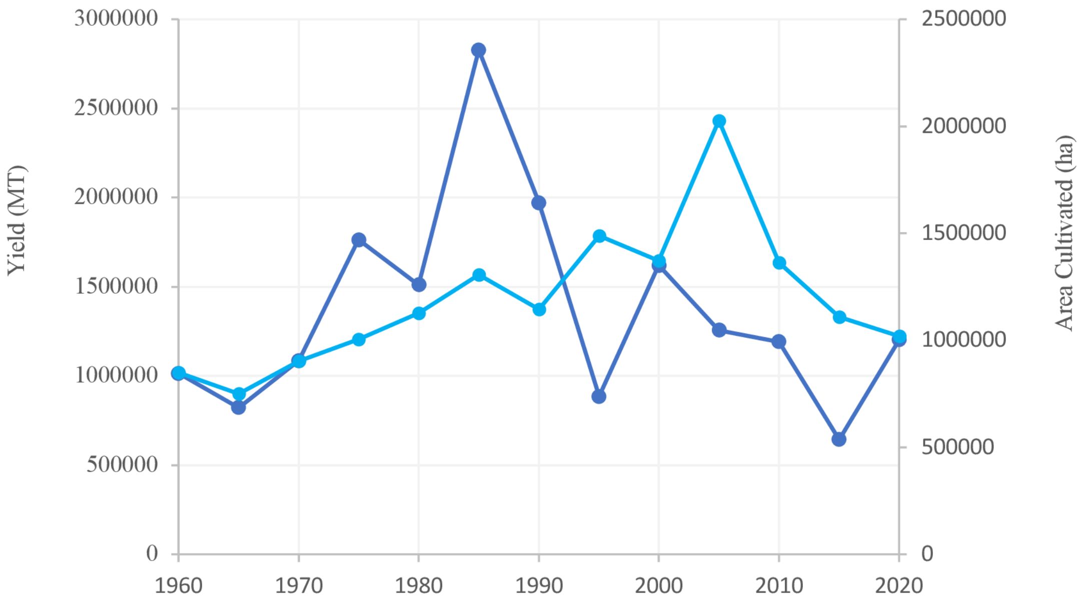


Figure 4*. Maize Yield (MT) and Area Cultivated (ha): 1960 – 2020.* (FAOSTAT 2022)

2.10.2. Livelihoods for Food Security Programme Pfumvudza

To tackle challenges such as reliance on unpredictable, rainfed agriculture, lack of credit, weak extension delivery services, poor soil fertility, reduced agricultural productivity, lack of draught power, and more, the United Kingdom's Department for International Development (DFID) funded the Livelihoods for Food Security Programme. It was a USD$ 72 million four-year program aimed at reducing rural poverty and enhancing food and nutrition security. It was also set to address constraints faced by women, including access to markets, climate variability and the HIV Aids prevalence further compound the situation (FAO 2015b). The Pfumvudza program was formulated by the, which had similar objectives was formulated by Foundation of farming. The program was centered around the promotion of planting basins. Farmers were given maize and fertilizer subsidies, as well as a plot of land measuring 0.6ha on which to cultivate. Over 2 million farmers have been trained under the Pfumvudza scheme (Mapira 2020; Mujere 2021).

A Pfumvudza plot has 1 456 planting plots/holes and 3 maize seeds are placed in each of these. Each hole has a 15 x 15 x 15cm dimension. Each portion of land or Pfumvudza plot yields on average 56 rows of maize, which is translated into a 20kg bucket of maize, with the capacity of feeding a family for at least six weeks (Mujere 2021).

250 000 tonnes of cereals and a corresponding 45 000 tonnes of oil seed, were set aside towards the implementation of Pfumvudza, according to (AgriNews 2020). They further revealed that total of 3 255 378 farmers, comprising of 1 772 183 females and 1 483 195 males and have been trained so far by the extension workers as at 4 September.

Farmers are aware of the program and optimistic thatit will be able to address both their climate-related challenges and rural hunger.

2.11. Conceptual Framework

Figure 5 illustrates the conceptual framework.

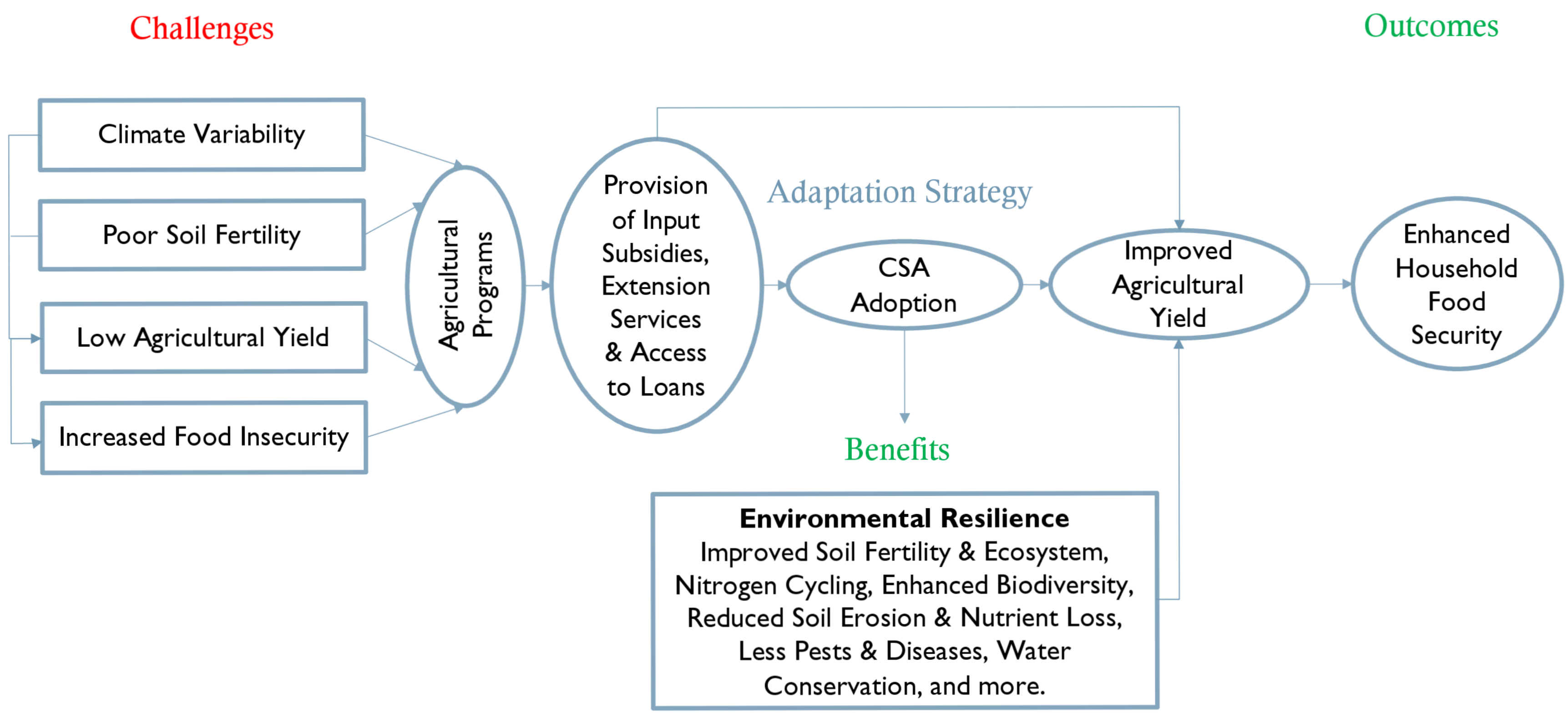


Figure 5. *Conceptual Framework.*

3. AIMS OF THE THESIS

The overall objective is to investigate the effects of specific Government Input Support Programs (GISP) on food security and Climate Smart Agriculture practices (CSA) in Zimbabwe.

3.1. Specific objectives

1. To determine the perception of smallholder farmers on GISP.
2. To assess the prevalence of household food security in Goromonzi.
3. To examine the association of institutional factors on the adoption of CSA.
4. To examine the influence of institutional factors on GISP.

3.2. Research questions

i. Are farmers benefiting from the GISP?
ii. What is the household food security situation in Goromonzi?
iii. Do institutional factors influence the adoption of CSA?
iv. Do institutional factors affect the success of GISP?

4. METHODOLOGY

4.1. Agro-Ecological Zones

Table 2. *Agro-Ecological Zones (AEZ) in Zimbabwe.* (Manatsa et al. 2020)

Region	Area (km^2)	Area %	Annual Rainfall (mm)	Farming Systems	Maize Variety
I	6008.8	1.5	Annual rainfall >1000mm but possible to get amounts <1000 (rainfall: 110 – 120 days). The maximum temperature is 21 – 25°C.	**Intensive:** Livestock production and forestry plantations; banana apples, macadamia nuts, coffee, and tea. **Crops:** Maize Irish potato, field peas, and soya beans.	>130 days to maturity.
IIA	22085.4	5.7	Annual rainfall is between 750 and 1000mm (rainfall: 105 – 120 days). The maximum temperature is 23 – 27°C.	**Intensive:** Livestock production. **Crops:** Flue-cured tobacco, groundnuts, Irish potato, cotton, and soybean. Barley and wheat are grown under irrigation in the winter and drier months.	120 – 130 days to maturity.
IIB	26304.7	9.3	Annual rainfall is between 750 and 1000mm (rainfall: 115 – 120 days). The maximum temperature is 25 – 28°C.	**Intensive:** Livestock production. **Crops:** Cotton, Irish potato, barley, flue-cured tobacco, groundnuts, sorghum, sugar beans, coffee, and horticultural crops can be successfully grown. Winter wheat is also grown under irrigation.	115 – 120 days to maturity.
III	63215.2	16.2	Annual rainfall is between 650 and 800mm; some places may receive amounts >800mm (rainfall: 110 – 120 days). The maximum temperature is 25 – 28°C.	**Semi-intensive:** Livestock production; beef, dairy, and small stock (e.g., goats and poultry). **Crops:** Soybean, groundnuts, cotton, and sunflower are also suitable for this region. Irrigation is critical.	110 – 120 days to maturity.

Table Continued...

Region	Area (km^2)	Country (%)	Annual Rainfall/mm	Farming Systems	Maize Varieties
IV	113595	29.1	Annual rainfall is between 650 and 800mm; some places may receive amounts >800mm (rainfall: 110 – 120 days). The maximum temperature is 25 – 28°C.	**Extensive:** Cattle ranching, rearing of small stock (e.g., goats and poultry), and wildlife are ideal farming systems for this region. **Crops:** Drought-tolerant crops such as sorghum (finger millet, pearl millet, watermelons, and cowpeas.	105 – 120 days to maturity.
VA	115041	29.4	Annual rainfall is less than 650mm (rainfall: 100 – 120 days). The maximum temperature is 28 – 30°C.	**Extensive:** Game-ranching, cattle ranching, goat production and tourism. Tree plantations: mainly oranges, lemons, and lime are also recommended where irrigation is available. **Crops:** Drought-tolerant crops such as sorghum, finger millet, pearl millet, and cowpeas. Sugarcane is an ideal crop under irrigation.	
VB	344999	8.8	Annual rainfall below 600mm, (rainfall: >110 days). The maximum temperature is 28 – 32°C.	**Extensive:** Cattle ranching, goats, and wildlife tourism. Tree plantations: mainly oranges, lemons, and lime are recommended where irrigation is available.	
TOTAL	**390750**				

Zimbabwe is divided into 7 distinct Agro-Ecological Zones (AEZ), as shown in the table above. These are also known as National Regions and have exclusive homogenous combinations of agricultural activities, ecology, soil units, and agroclimatic conditions (Manatsa et al. 2020). The AEZ further determines the ability to support rainfed agriculture with climate as the prime influence-exerting factor.

4.2. Study Area

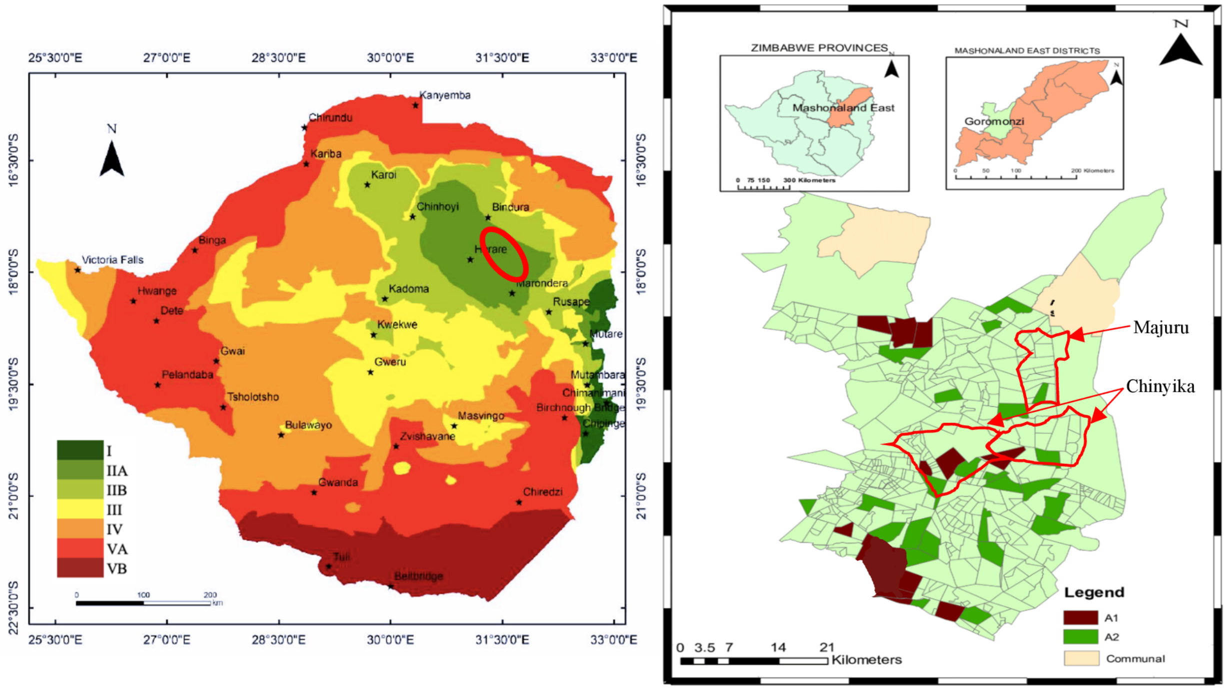


Figure 6. *Zimbabwe Agro-Ecological Zones (Left) & Map of Goromonzi: Majuru and Chinyika Study Sites (Right). Study Area Represented by* . (Muchetu 2019;Manatsa et al. 2020)

Goromonzi is a rural district located in the Mashonaland East province of Zimbabwe, approximately 1100m above sea level. It is about 50km from Harare – the country's capital city (Mutandwa 2006). The district is home to an estimated 173 067 people (ZIMSTAT 2020) and lies within the AEZ IIA (**Table 2**), covering a land area of 3500km2 (Permin 2002). The four major land use categories found in the Goromonzi district are 1) Large Scale Commercial Farming Areas (LSCFA) – encompassing residential areas; 2) Small Scale Commercial Farming Areas; 3) Communal Areas (CA) and 4) Urban areas. Goromonzi has a subtropical climate and receives an average rainfall of between 750-1000mm, with temperatures ranging from 23 to 27°C (Mugandani et al. 2012; Manatsa et al. 2020). The two distinct dry and wet seasons – dry and wet – last from May till October and November to April, respectively (Mugandani et al. 2012). During the dry season, temperatures can drop below the freezing point at night and reach a high of 25°C during the day (Permin et al. 2002).

However, the area is prone to drought and reduced rainfall which in turn result in food insecurity; at least 70% of the district's population experiences some form of food insecurity (FEWS Net 2022). (FAO 2021) added that farmers in the province were found to be experiencing difficulties in accessing seed and other farming inputs (FAO 2021).

The average landholding size in Goromonzi is 0.5ha (Mugweni 2014). Clay and sandy loams are dominant soil types (Mutandwa 2006). The main farming practice in the area is mixed crop-livestock farming (het Lam 2014). The soils in these particular study sites are rich and well suited for farming activities. These are best suited for flue-cured tobacco, maize varieties requiring 120-130 days to maturity, soybean, groundnuts cotton, and Irish potato. Wheat and barley are also grown under irrigation during the drier and winter months, and intensive livestock production is also best suited to this region (het Lam 2014; Manatsa et al. 2020). The major source of livelihood in the district is smallholder crop production and livestock rearing; rainfed, mixed-farming systems are used. Goromonzi is comprised of A1, A2, and Small-scale communal farm types (Muchetu 2019). The main crops grown in Goromonzi are maize, soybean, groundnuts, and sweet potatoes (Mutambara et al. 2012; Mutenje et al. 2020). Cattle, goats, and poultry are the preferred livestock species (Mutambara et al. 2012; Zengeni 2014; Gwiriri et al. 2016; Mutenje et al. 2020). In addition, cattle – which symbolize wealth throughout the country – are mainly kept for milk, draught, and beef. Cattle in Goromonzi are fed mostly on crop residue and poor quality, communal rangeland feed (Gwiriri et al. 2016; Mutenje et al. 2020).

4.3. Survey Sampling Process

Some studies revealed that numerous agricultural and input subsidy programs have been rolled out in Goromonzi (Mudavanhu & Mandizvidza 2013). Zamchiya (2013) suggested that the reason for this is due to the strong ruling-party influence in the Goromonzi district. Multi-stage random sampling was used because of the extensive nature of the area. Firstly, the Goromonzi district was purposively selected due to the highly publicized rolling out of agricultural Input Support Programs (ISPs) within the district; enumerators had expert knowledge of the area, thanks to their affiliation with the Ministry of Agriculture. In the second stage, the two study sites – Majuru and Chinyika – were also purposively selected to compare the farming activities and input support received by both smallholder communal/subsistence and small-scale commercial farmers. Furthermore, the input support programs rolled out here specifically targeted the area due to the farm sizes/types (communal farms are an average of 0.5-1 hectare in size). Finally, the farms were conveniently selected depending on their proximity to each other. However, in a few instances, snowballing was done; farmers' referrals also proved to be vital at this stage.

4.4. Data Collection Procedure

Smallholder farmers' perceptions, thoughts, and experiences can be understood through qualitative research (Denzin & Lincoln 2005). Qualitative data was collected by conducting one-on-one interviews with household heads or with persons representing the household head, in his or her absence (second-in-charge). Intensive data collection was conducted over a 3-day-period (from 17th to 20th January 2022) by three trained enumerators from AgroElite Pvt. Ltd. (a small agriculture organization based in Bulawayo, Zimbabwe). A semi-structured questionnaire was administered to 120 respondents. The questionnaire had a total of 26 questions and was divided into 4 major sections. These sections covered broad aspects/areas, which included household demography, farm size, land ownership, food security indicators used to measure food security at a household level, as well as institutional factors affecting the adoption of Climate Smart Agricultural practices (CSA), and more. Farming knowledge, CSA training information, and the perceived benefit of the ISPs were also elicited. Printed copies of the questionnaire were utilized and were later inputted into Google Forms – online – over a 2-week-period (from the 24th of January to the 7th of February 2022). The questions were translated into Shona (the main local language spoken in Goromonzi) where necessary.

4.5. Data Analysis

After data cleaning, 109 responses were used; 11 were outliers. A Microsoft Excel workbook was generated from Google Forms (https://docs.google.com/forms/). It was used to sort, code, and process data. Descriptive statistics were calculated in Microsoft Excel (percentages, frequencies, standard deviation, and mean). Further analysis was done using the Statistical Package for Social Sciences (SPSS) software 27.0. Furthermore, a Chi-Square test was used to analyze the influence of certain demographic factors on household food security. Finally, FCS and rCSI were used to calculate the prevalence of household food security.

4.6. Food Consumption Score (FCS)

Table 3. *Food Consumption Score Guideline.* (WFP VAM 2008, 2014; People in Need 2017a)

Item	Food Item Examples	Food Groups (Definitive)	Weight (Definitive)
1	Rice, Maize, Barley, and Tubers: Potatoes, Sweet Potatoes	Main Staples	2
2	Beans, Lentils, Peas, Groundnuts	Pulses	3
3	Vegetables, Leafy Greens	Vegetables	1
4	Fruits	Fruit	1
5	Beef, Pork, Poultry, Goat, Sheep, Eggs, Fish	Meat & Fish	4
6	Milk, Yogurt, Cheese, Other Dairy Products	Milk	4
7	Sugar, Honey, Other Sugar Products	Sugar	0.5
8	Oil, Fat, and Butter	Oil	0.5
FCS = (starches*2) + (pulses*3) + vegetables + fruit + (meat*4) + (dairy*4) + (fats * 0.5) + (sugar * 0.5).			

The Food Consumption Score (FSC) is an indicator used to measure dietary diversity, relative nutritional importance, and food frequency. The FCS was first developed in Southern Africa in 1996 and was tested in several countries including Zimbabwe, Zambia, Laos, Guatemala, Colombia, Armenia, Afghanistan, and others (WFP VAM 2008; Deitchler et al. 2011; Jones et al. 2013). Information for the FCS indicator is collected from a representative sample of target households. One-on-one interviews are conducted with household heads/members. The eight food groups stated in **Table 3**, are used as a guide from which respondents are asked to highlight the food the household has consumed within a 7-day-recall-period. The question asked in the questionnaire was, *"List below the food/s you have eaten in the past 7 days (if 'Sadza' is eaten 4 days per week, record '4' as the "Number of times eaten/used")"*. Items from the eight food groups are then gradually named, as the respondent answers. The consumption frequencies of each group are then summed up and any total above 10 is re-coded as 7. In the next stage, the sum of each frequency is multiplied by the definitive weight, i.e., '1' for fruits, and so on; FCS = a1x1+a2x2+.+a8x8, where 1.8 = food group, a = frequency (7-d recall), x= weight (*see also equation above*) (Jones2013). By summing up all the weighed food group scores, the 'Food Consumption Score' is obtained. The thresholds for the FCS are: Low 0-21; Borderline 21.5-35; Acceptable >35.5. However, it is possible to modify these thresholds based on the study area (e.g., from 21/35 to 28/42), as they do not apply to all contexts. A 14 FCS interval should always be kept between the thresholds.

The percentage of households with low, borderline, and acceptable FCS is calculated by dividing the FCS by the total number of households and multiplying by 100. However, the FCS has some limitations: 1) The FCS is prone to seasonal variations and is more accurate when data is collected pre – and post-harvest; 2) It is not sensitive to extreme food insecurity cases; 3) Data collection during fasting periods could affect the results; 4) Other more complex indicators such as the Household Hunger Score can/should be used together with the FCS in acute food insecurity contexts, and 5) In different contexts, the thresholds may not carry the same meaning (WFP VAM 2008; WFP 2015).

4.7. Reduced Coping Strategy Index (rCSI)

Table 4*. Reduced Coping Strategy Index Guideline.* (People in Need 2017b)

Coping Strategy	**Frequency** (0 - 7: Number of Days per Week)	**Severity Weight**	**Weighted Score** (Frequency x Weight)
"In the previous 7 days have there been times when you did not have enough food or money to buy food, how often has your household had to…			
Q1. …rely on less preferred and less expensive foods?"		1	
Q2. …borrow food or rely on help from friends or relatives?"		2	
Q3. …limit portion size at mealtime?"		1	
Q4. …restrict consumption by adults in order for small children to eat?"		3	
Q5. …reduce number of meals eaten in a day?"		1	
rCSI = Q1 frequency + (Q2 frequency * 2) + Q3 frequency + (Q4 frequency * 3) + Q5 frequency.			**Total Household Score**

The Coping Strategy Index (CSI) is a household food security indicator that correlates easily with other complex measures/indicators. The Reduced Coping Strategy Index (rCSI) is a simplified version of the CSI. It is used to compare food security situations in different crises or geographical contexts. Qualitative data can be attained using the rCSI; it can also be used for quantitative data collection. After selecting a representative sample, 5 standard questions are highlighted in **Table 4**, which are administered/asked to determine the rCSI. They are a standard set of individual coping behaviors that can be applied to any household. The rCSI is calculated as shown in the table (*see the equation above*).

However, the rCSI is not a stand-alone tool and should be used together with another indicator and its scale has no designated cut-off point. For instance, if household (A) has a lower score of 36, in comparison to household (B) with a score of 63 – household (A) is said to be more food secure (i.e., less food insecure) than household (B). This can be concluded when the households being compared are from the same community. The rCSI has several uses/applications: 1) For the verification of other indicators (to get a more clear-cut overall analysis of household food insecurity); 2) A cross-sectional analysis tool to determine which households are better off than others; 3) To compliment nutritional surveys. Furthermore, it can be utilized as an early-warning system to ascertain household food insecurity. Although the rCSI is capable of yielding similar results as the CSI, it has some limitations: 1) It may not reveal the most vulnerable or insecure households; 2) The rCSI is sensitive to short-term changes such as the effects of shocks and changes in seasonality (Maxwell et al. 2008).

5. RESULTS AND DISCUSSION

5.1. Descriptive Analysis

Table 5. *Descriptive Statistics of Categorical Variables (n = 109).*

Variable	Description	Frequency	%
Government Input Support Programs			
Special Maize Programme for Import Substitution	Household benefited from SMPIS (Yes = 1)	36	33.0
Livelihoods Food Security Programme Pfumvudza	Household benefited from Pfumvudza (Yes = 1)	50	45.9
Climate Smart Agricultural Practices			
Improved Seed Varieties	(Yes = 1)	105	96.3
Planting Basins	(Yes = 1)	100	91.7
Crop Rotation	(Yes = 1)	82	75.2
Agroforestry	(Yes = 1)	40	36.7
Household Head Characteristics			
Gender	Gender of HH (Male = 1)	58	53.2
	Female = 2	51	46.8
Marital Status	Single = 1	13	11.9
	Married = 2	66	60.6
	Divorced = 3	6	5.5
	Widowed = 4	24	22.0
Level of Education	Illiterate = 0	4	3.7
	Primary = 1	25	22.9
	Secondary = 2	64	58.7
	College/University Degree = 3	16	14.7
Institutional Characteristics			
Credit/Financial Support	Had Financial Support (Yes = 1)	38	34.9
Farmer Field School	Attended Field School (Yes = 1)	46	42.2
Extension Services	Access to Ext.Services (Yes = 1)	77	70.6
Cooperative	Cooperative Member (Yes = 1)	43	39.4
Farm Characteristics			
Farming System	Crop Production	34	31.2
	Mixed Production	75	68.8
Land Ownership	Private (= 1)	53	48.6
	Communal (= 2)	30	27.5
	Leased/Rented (= 3)	26	23.9
HH = Household Head	**Mixed Production = Crop & Livestock**		

Table 5. Continued...

Variable	Description	Frequency	%
Information Sources			
Radio		92	84.4
Farmer to Farmer (F2F)		83	76.1
Extension	Government Ext. Officers	77	70.6
Cooperative		43	39.4
Television		22	20.2

Note: *A categorical variable consists of a set of categories that can either be nominal or ordinal, hence, having a measurement scale* (Sinharay 2010).

Table 5 shows the classification of categorical variables. The study group was made up of 109 individuals in total, 53.2% males and 46.8% females – the majority of whom were married (60.6%). The greatest proportion of education attained was secondary education – 58.7%, followed by primary education with 22.9%. 14.7% had acquired a college/university degree, and only 3.7% had no form of formal education (illiterate). Only 34.9% of respondents had access to credit and 39.4% belonged to a cooperative. The majority of the respondents (70.6%) benefited from extension service, whilst 42.2% attended a FFS. The results obtained show that mixed farming is the predominant farming system in the Majuru and Chinyika areas, with 68.8% of the 109 respondents implementing it, whilst only 31.2% implemented crop farming. Furthermore, the analysis shows that radio, F2F, and extension were the predominant sources of information used by farmers (**Figure 13**).

Table 6. *Descriptive Statistics of Continuous Variables (n = 109).*

Variable	Description	Mean	SD	Min	Max
Farmer's Characteristics					
Age	Years	45.3	14.2	19.0	79.0
Education	Years of Schooling	9.9	4.2	0.0	19.0
Household size	Individuals in House	5.1	2.4	1.0	23.0
Farming experience	Years of Farming	18.4	11.9	2.0	50.0
Farming Characteristics					
Land Size	Hectares	2.6	2.9	0.2	10.0
Land Under Cultivation	Hectares	1.4	1.4	0.2	6.0

Note: *Continuous variables which include things like distance and time can have an infinite number of values between the lowest and the highest measurement points* (McCue 2007).

The classification of continuous variables is highlighted in **Table 6**. The average age of farmers was 45.3 years (the youngest farmer being 19 and the oldest 79). The average years of schooling amongst the respondents was 9.9 years and the maximum 19 years. The average household sizes in Majuru and Chinyika is 5.1 individuaks. The largest household comprised of 23 people. The farmer with the most farming experience had 50 years-years-worth of experience. The average farming experience was 18.4 years. The average land size was 2.6ha, 1.4ha as the average land area under cultivation. The largest farm and the largest area under cultivation were 10.0ha and 6.0ha, respectively.

5.2. Specific Objective 1: Are Farmers Benefiting from the GISP?

5.3. SMPIS

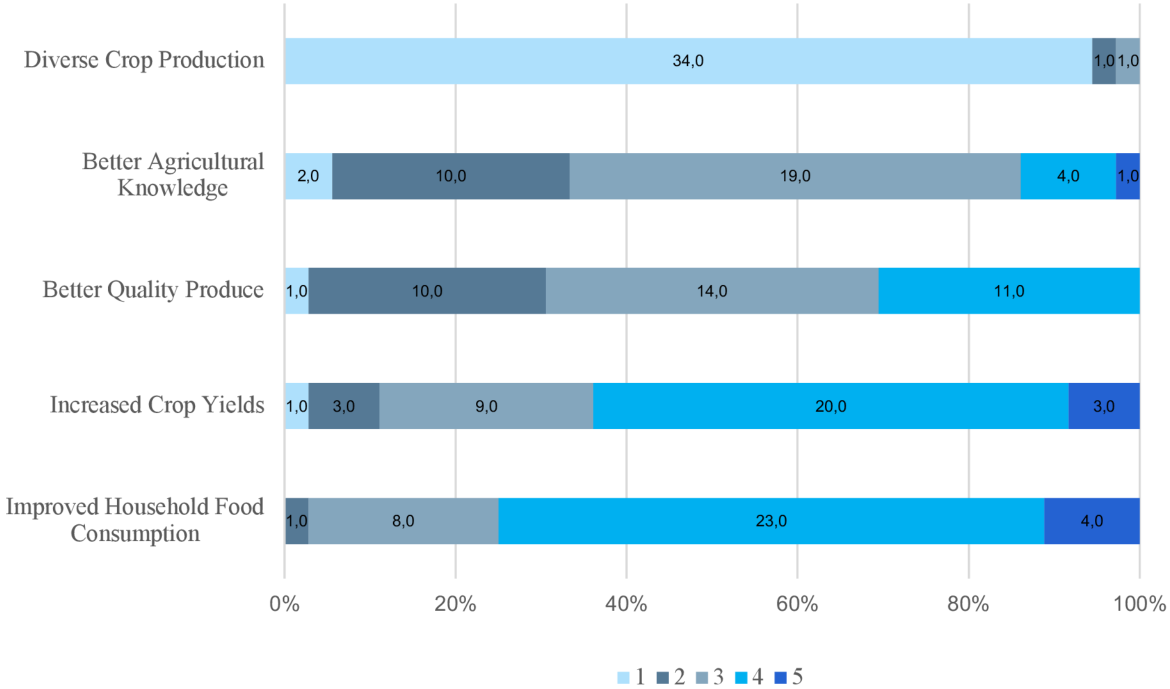


Figure 7. *Benefits of SMPIS.*

The study revealed that 67% of the 109 respondents did not benefit from the SMPIS in any way. However, 31.2% benefited minimally from diverse crop production. This may be because the SMPIS is mainly focused on maize production. It was also discovered that a below-average benefit was reported by 9.2% of the respondents, who experienced both better quality produce and gained better agricultural knowledge from the program. 8.3%, 12.8%, 17.4%, 0.9%, and 0.9%% of the respondents benefited averagely from increased crop yields, better quality produce, better agricultural knowledge, diverse crop production, and improved household food consumption, respectively. In the criteria of improved household food consumption, increased crop yields, and better quality produce, there was an above-average benefit of 21.1%, 18.3%, and 10.1% respective experienced. Maximum benefit was recorded from an insignificant number of respondents, with 3.7% having improved household food consumption, 2.8% reporting increased crop yields, and a mere 0.9% acquiring better agricultural knowledge. A Likert Scale of 1 – 5 was used. *1 = minimum benefit; 2 = below average benefit; 3 = average benefit; 4 = above-average benefit; 5 = maximum benefit.*

5.4. Pfumvudza

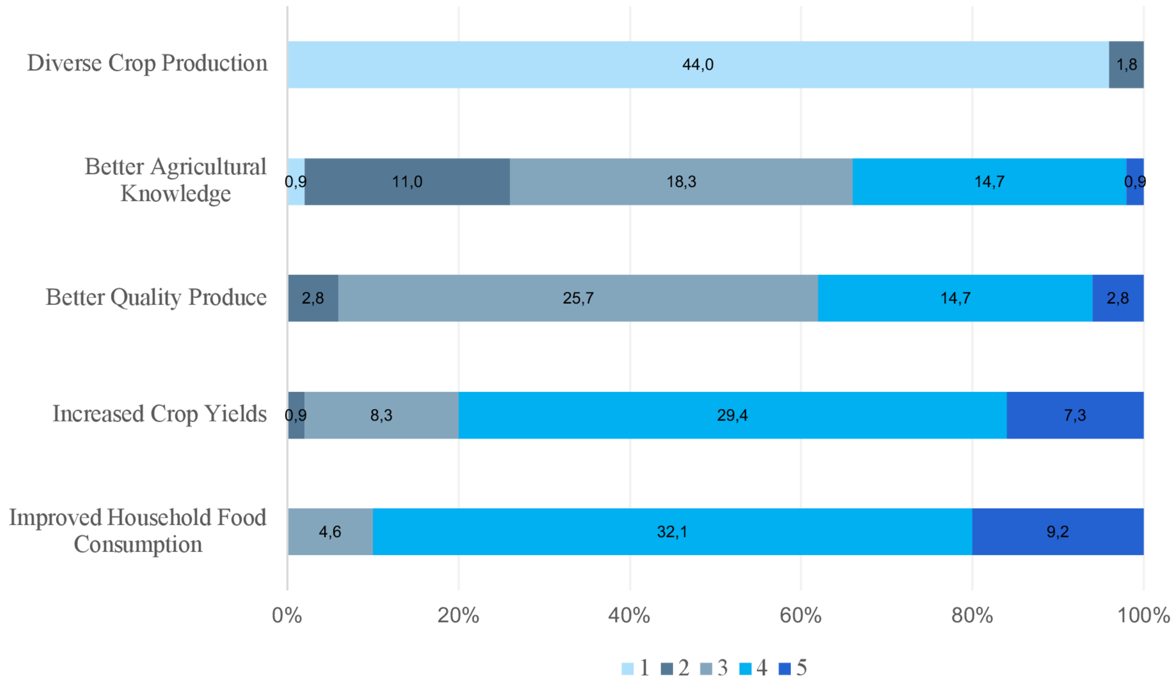


Figure 8. *Benefits from Pfumvudza.*

A Likert Scale of 1 – 5 was used for the analysis. 1 = minimum benefit; 2 = below average benefit; 3 = average benefit; 4 = above-average benefit; 5 = maximum benefit. Of the 109 respondents, 54% saw no benefit whatsoever from Pfumvudza. 44% benefited minimally from diverse crop production, whilst a mere 0.9% obtained better agricultural knowledge. There was an 11% below average benefit experienced in the area of better agricultural knowledge. On average, 25.7% of the respondents had better quality produce, whilst 18.3% attained better agricultural knowledge, 8.3% reported better crop yields, and only 4.6% had improved household food consumption. There was a 14.7% average benefit seen by farmers in both better quality produce and better agricultural knowledge. Increased crop yields and improved household food production, on the other hand, saw an average benefit of 29.4% and 32.1%, respectively. The maximum benefit was seen by 9.2% of the respondents, who obtained improved household food consumption. Finally, increased crop yields and better quality produce were experienced by 7.3% and 2.8% respectively, although only 0.9% had an increased knowledge gain.

5.5. Specific Objective 2: What is the Household Food Security Situation in Goromonzi?

5.5.1. Food Consumption Score (FCS)

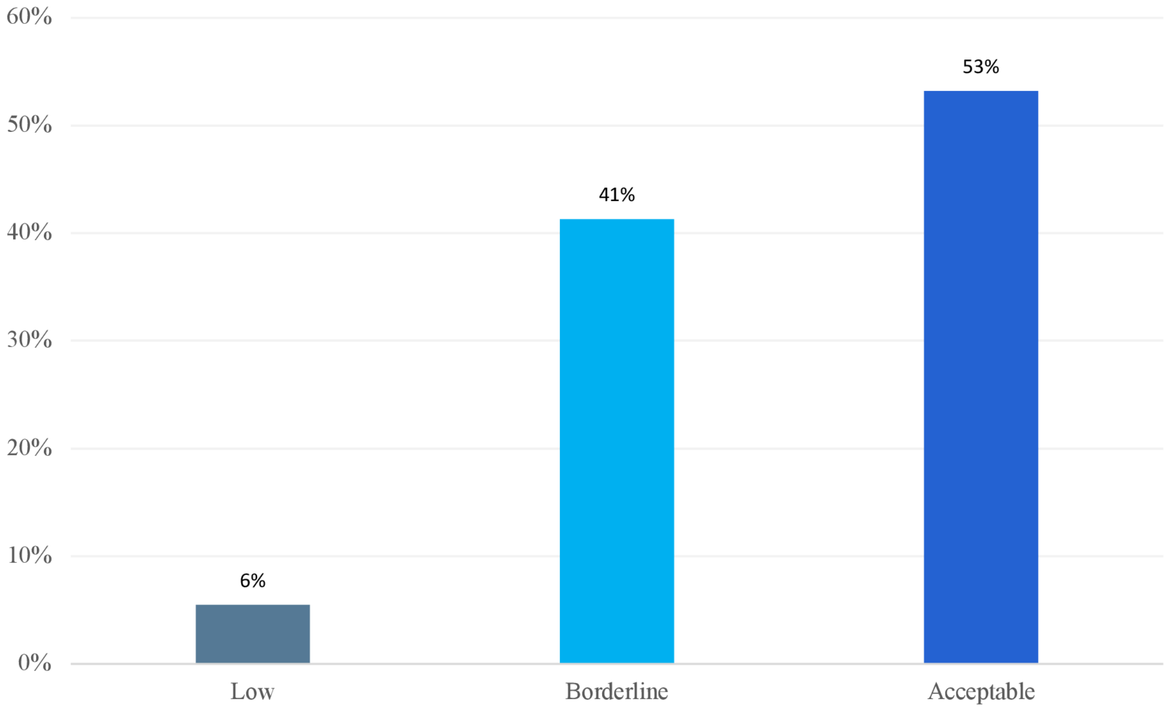


Figure 9*. Food Consumption Score Results.*

In order to measure food security, consumption can be an appropriate method of analysis (Mallick & Rafi 2010). **Figure 9** shows that the majority of respondents belong to the acceptable food security category (53%), whilst 41% and 6% belong to the borderline and low food security categories, respectively. These results correspond with findings from (Acheampong et al. 2022) where data was collected from 2 603 households. Pre – and post-harvest data collection would be ideal to get more accurate results. However, this would have been costly to carry out research of this magnitude, hence, posing a limitation to the study.

5.5.2. Reduced Coping Strategy Index (rCSI)

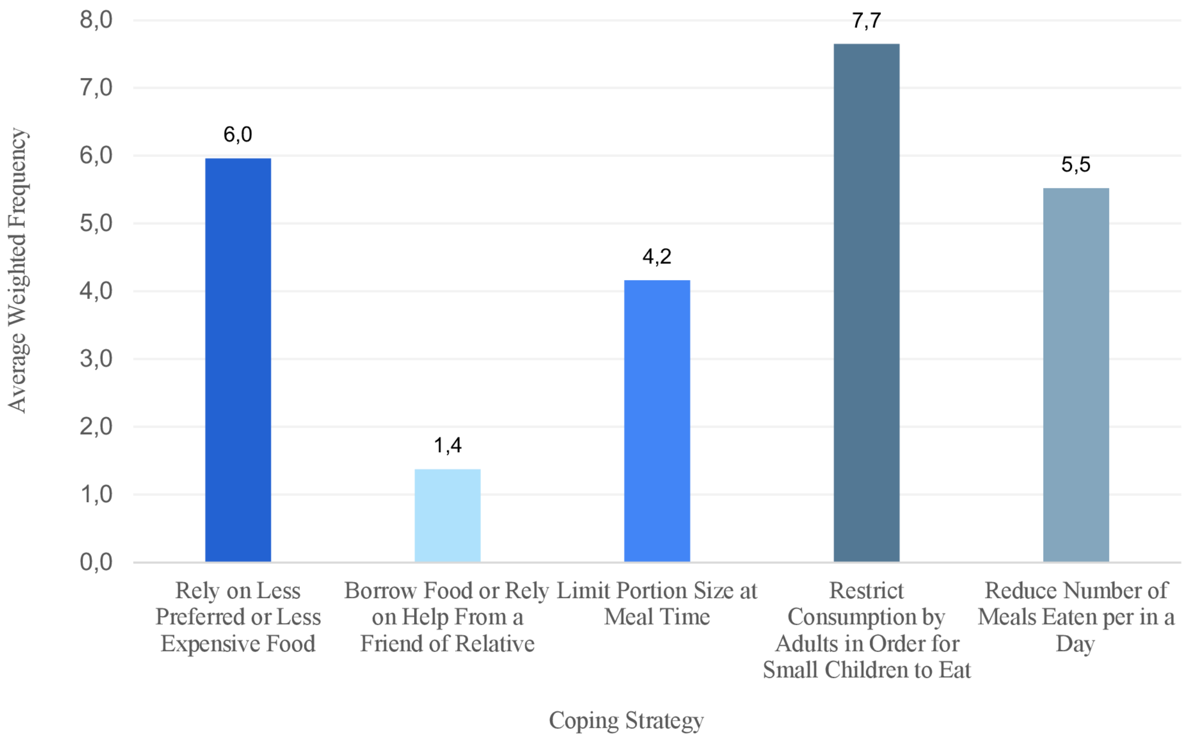


Figure 10. *Reduced Coping Strategy Score Results.*

The study revealed that most of the respondents resorted to restricting consumption by adults in order for small children to eat, as the most preferred coping strategy (**Figure 10**). This was followed by reliance on less preferred or expensive food and a reduction in the number of meals eaten in a day. Findings from the 2002 – Zimbabwe Vulnerability Assessment Committee (ZimVAC) Report also pointed out that the majority of respondents opted for less expensive food and reduced the number of meals consumed in a day (ZimVAC 2002). It is common in Zimbabwe for households to eat soya chunks, as a substitution for meat which is more expensive. Other alternatives include soya or kidney beans, lentils (nyemba), small, dried fish (kapenta), mopane worms (madora), flying ants (ishwa), and termites (majuru), blackjack or pumpkin leaves (muboora), and more.

Households that resort to reducing the number of meals consumed, prioritize breakfast – where mealie meal porridge (bota) is consumed, and/or dinner, as they are unable to afford 3-meals-per-day. In several instances, small/young, and school-going children are fed before adults. Other mitigation strategies include taking children out of school, sending them away to a relative or friend, being forced to migrate to find food or work, or considering permanent migration (ZimVAC 2002)

5.5.3. Chi-Square Test: Factors Influencing GISP/CSA

Table 7. *Factors influencing GISP and CSA.*

Independent Variable	Dependant Variable	P-Value
Farmer Group		
	SMPIS	0,005
	Pfumvudza	0,014
	Usage of Improved Seed Varieties	0,089
Farmer Field School		
	Pfumvudza	0,080
	Adoption of Crop Rotation	0,048
	Adoption of Agroforestry	0,073
	Usage of Crop Rotation	0,069
	Usage of Agroforestry	0,073
Extension (Info Source)		
	SMPIS	0,041
	Adoption of Improved Seed Varieties	0,041
Cooperative (Info Source)		
	SMPIS	0,005
	Pfumvudza	0,014
	Usage of Crop Rotation	0,088

The institutional related variables were tested to asses the association with GISP and CSA. **Table 7** shows the variable that were statistically significant

5.6. Specific Objective 3: Do Institutional Factors Influence the Adoption of CSA?

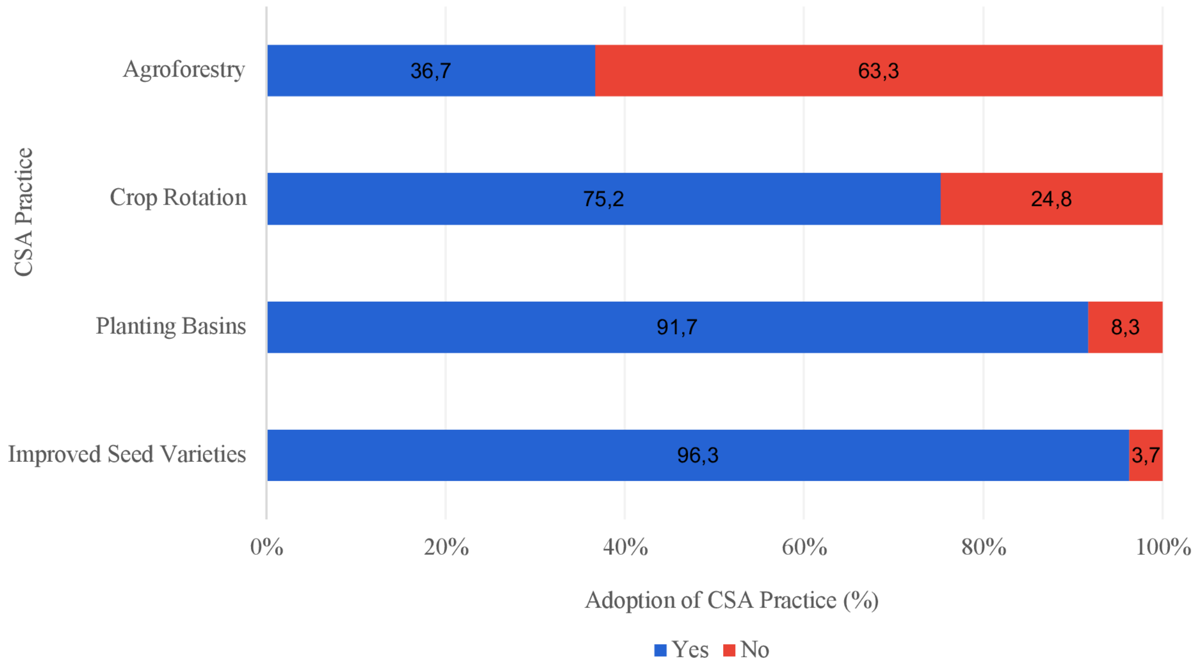


Figure 11. *Adoption of CSA Practice.*

Studies by Nyathi et al. (2020) noted that the adoption of plating basins was positively influenced by local by-laws. However, the opposite was true for crop rotation. **Figure 11** shows that improved seed varieties were the most used CSA practice, with 96.3% adoption. This was followed by planting basins (91.7%), and crop rotation (75.2%). Agroforestry, however, had the lowest adoption rate of only 36.7%. **Figure 12** illustrates the frequency of utilization of the four practices. The findings coincide with general usage: 63.3%, 24.8%, 7.3%, and 3.7% of the respondents never used agroforestry, crop rotation, planting basins, and improved seed varieties, respectively. Improved seed varieties had 74.3% frequent utilization and 22.0% only using the practice sometimes. Similarly, planting basins were frequently used by the majority of respondents (59.6%), and 33.0% only used the practice sometimes. Both crop rotation and agroforestry had less usage with only 67.0% and 35.8% using the practices sometimes, respectively. Research from Adesida et al. (2021) revealed that farmers with increased income were less likely to adopt planting basin use.

Oyewole & Sennuga (2020) pointed out that irrespective of the older farmer's experience, very few are willing to adopt agroforestry, as tree planting is a process that takes a long time. However, knowledge and experience have a positive impact on the adoption of other

SAPs. Furthermore, farmers who were part of a farmer group were found to be more likely to adopt these practices, as compared to those who lacked such exposure. In addition, older farmers, with more access to information on soil fertility are highly likely to adopt new technologies, concerning the same.

Conventional tillage was found to be more profitable than planting basins, as it was less labor-intensive, thus, needed only 6 man-days ha^{-1} for land preparation, in comparison to the 51.5 – 76.5 man-days ha^{-1} required for planting basin land preparation. (Rusinamhodzi 2015a) discovered that planting basins had fewer benefits regarding water conservation, soil organic carbon, and increased crop production. Similar findings by (Githongo et al. 2021) supported this, stating that planting basins had an insignificant influence on soil organic carbon and maize yields. In addition, planting basins appeared to be a major impediment for farmers who did not own livestock (to use as draught), and weeding was found to need 40% more labor in contrast to conventional tillage. Findings by Thierfelder et al. (2015a) contradict this, stating that planting basins had an 80% better yield response than the conventional control plot used in the research. However, the use of both conventional tillage and planting basins in combination with the application of 60kg ha^{-1} and 3 t ha^{-1} of manure saw high maize yields of 5.6 t ha^{-1} and 4.6 t ha^{-1}, respectively. (Nyamangara et al. 2013) agrees with this combination of planting basins with mulching, fertilizer application, and or crop rotation use. However, maize yields were significantly suppressed in the absence of these combinations. (Wall et al. 2013) discovered that the performance of planting basins was also dependent on soil types and performed better in areas with climate variability. (Yigezu et al. 2018) add that access to credit has a significant influence on the adoption of CSA. Nonetheless, Nyaki 2020 highlighted that planting basins were the most used and one of the most preferred CSA methods.

Due to the improved agricultural yield, farmers are willing to invest in improved seed varieties – as revealed by Kassie et al. (2017) and Koppmair et al. (2017). Research by Arriaga et al. (2017) points out that optimal soil health and sustainability are not realized in conventional methods. The findings of this research suggest that improved seed varieties were the preferred practice due to the climate variability, i.e., the prevalence of droughts experienced in the study area.

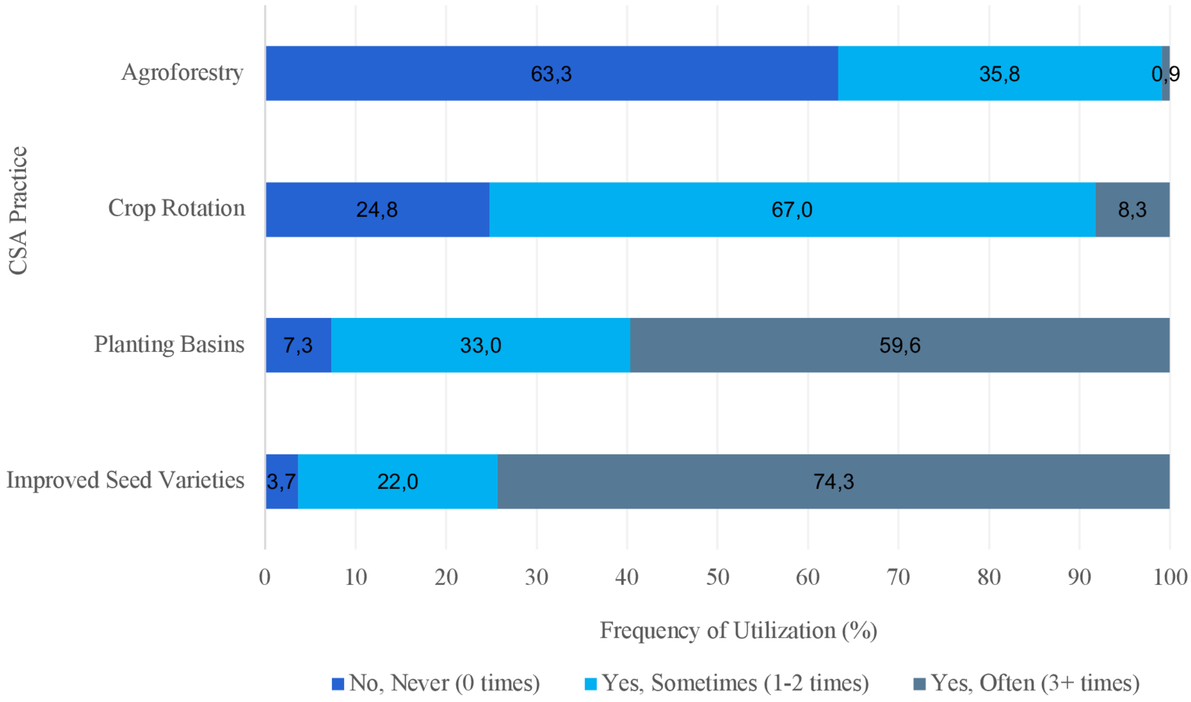


Figure 12. *Frequency of Utilization of CSA Practices.*

The results in **Figure 13** revealed that 84.4% of farmers received information via radio, thus, ranking it the most used CSA information source. Findings by (Nyareza & Dick 2012) support this, by pointing out that the most preferred means of communication amongst peasant farmers was community radio. In Zimbabwe, 'Talking farming' and 'Murimiwanhasi' are agriculture programs aired on television and radio, to disseminate farming knowledge to farmers. The Zimbabwe Agricultural Growth Programme (ZAGP) also hosts a series of such programs on different radio stations, including Star FM, Hevoi FM, and Radio Zimbabwe. The adoption of staggered planting was influenced by access to television and extension services, whilst access to mobile phones enhanced the adoption of improved varieties, as shown by research by (Oyewole & Sennuga 2020).

Farmer to Farmer (F2F) was the second, most used information source, with 76.1% of farmers receiving information via this channel. The farmer input support programs rolled out in Zambia and other countries employ this method. A F2F or Farmer to Farmer Extension (FFE) approach promotes sustainability with regards to continuous information sharing and capacity building amongst farmers (Kiptot & Franzel 2015). The third, most beneficial source of information was extension (70.6%), followed by cooperatives with 39.4%. Farmers received the least information from television (20.2%).

Extension services in Zimbabwe are an official channel of communication between the government and farmers. The main sources of extension services are the Ministry of Agriculture, Department of Research and Specialist Services (DRSS); 2) the Department of Agricultural, Technical and Extension Services (AGRITEX); and 3) SEEDCO. The role of extension officers is to provide farmers with agriculture-related information, as well as training for specific practices, innovations, and technological advancements related to agriculture. The major finding from research by Muchesa et al. (2019) revealed that farmers had a negative perception of government-led extension services. Results showed that 56% of the respondents did not receive any agricultural market support was the main contributing factor to this. An additional 24.85% claimed that no practical solutions to their challenges were offered by the extension officers, 13.02% proclaimed that the officers are not knowledgeable enough, with an additional 8.88% claimed that the officers were not available enough to attend to their needs (Muchesa et al. 2019). Muchesa et al. (2019). further assessed the cause of the poor extension delivery, and results revealed that 84% of the extension offices highlighted the lack of technology and resources as the main reasons.

Cooperatives and farmer groups are started as a channel through which farmers can have access to input subsidies (Murisa 2011; Nkomoki et al. 2019). In Zimbabwe, cooperatives were previously state-formed and run, however, after the Economic Structural Adjustment Program of 1990 – 1995, this has been slowly on the decline (Muchetu 2019). Their role was to empower the marginalized, promote social interrelation, and create employment, hence, boosting agricultural yield, enhancing food security, reducing poverty, and improving rural livelihoods (Mhembwe & Dube 2017). Hyden suggested that this may be a result of political patronage of state-run cooperatives, whereby, corrupt leaders were profiting from cooperatives. This eventually resulted in mistrust amongst locals. The same is true in the case of Zimbabwe. Government and NGO-formed cooperatives lacked both credibility and sustainability (Muchetu 2019). (Hyden 2010) adds that collective actions are being taken and rural occupants and farmers alike are now formulating their cooperatives. Results obtained by Muchetu (2019) further strengthen this, thus, highlighting that in the Goromonzi district, 98% of cooperatives were formed by farmers, exclusive of NGOs, extension officers, and political help. In the case of Zimbabwe, agricultural cooperatives operate under a single-purpose model, meaning that they assist farmers in the provision of farming inputs, and help market agricultural outputs in the final stage. Ishida highlights the lack of profitability of single-purpose, in comparison to multi-purpose models. Such models are adopted in Japan and other parts of Asia.

Such cooperatives provide all-in-one support to farmers, i.e., inputs, assistance during the production process, marketing of output, insurance, and even banking (Ishida 2003). Thus, farmers do not receive agriculture-related information from cooperatives (Muchetu 2019). Therefore, this explains why the levels of information received from cooperatives were low. Nevertheless, cooperatives face several challenges which include but are not limited to lack of financial access and management, poor management skills, limited access to competitive markets (on which to sell produce), and more (Mhembwe & Dube 2017).

Households in Zimbabwe generally prefer to watch soap operas or series, and the main local news, especially during prime time, in place of farming programs. This explains the insignificant flow of CSA information being received via television. Tantisantisom (2011) added that televisions are luxuries for farmers, hence, suggesting that some farmers may not own televisions at all.

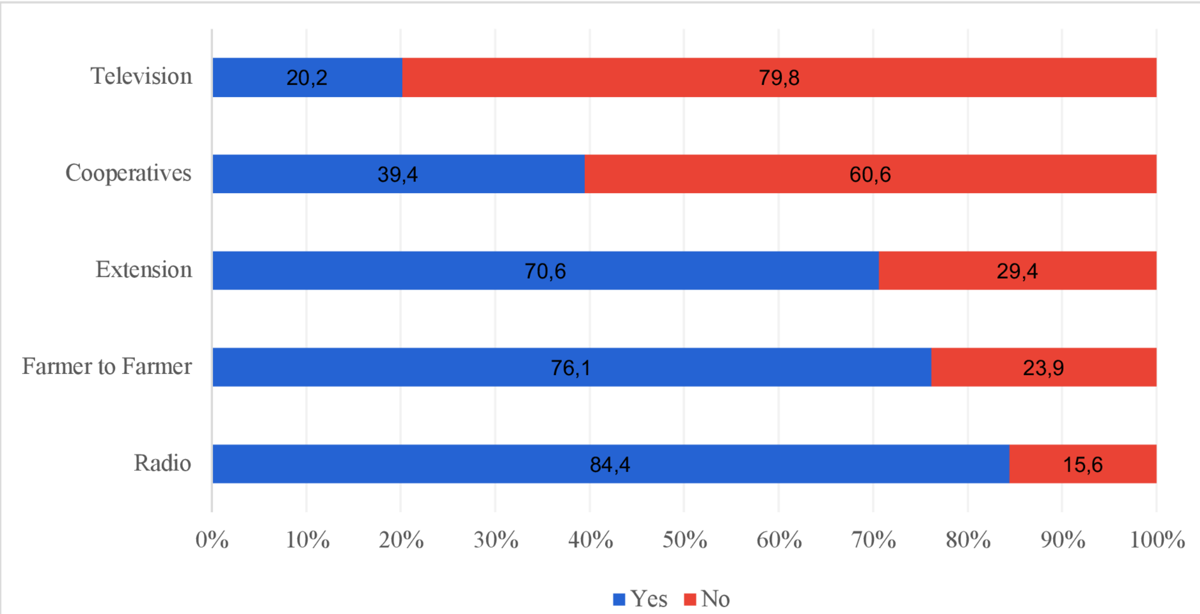


Figure 13. *CSA Information Sources.*

6. CONCLUSION AND RECOMMENDATIONS

The first objective was to determine the perception of smallholder farmers on GISP. Maximum benefit was recorded from an insignificant number of respondents, with 3.7% having improved household food consumption, 2.8% reporting increased crop yields, and a mere 0.9% acquiring better agricultural knowledge (SMPIS). From Pfumvudza, the maximum benefit was seen by 9.2% of the respondents, who obtained improved household food consumption. Finally, increased crop yields and better quality produce were experienced by 7.3% and 2.8% respectively, although only 0.9% had an increased knowledge gain.

Objective number two was to assess the prevalence of household food security in Goromonzi.

The majority of respondents belong to the acceptable food security category (53%), whilst 41% and 6% belong to the borderline and low food security categories, respectively.

The third aim of the thesis was to examine the effect of institutional factors on the adoption of CSA, whilst objective number four was to evaluate the influence of institutional factors on GISP.

Farmers groups and cooperatives were found to be associated with the adoption of CSA.

As a policy implications, policymakers should be recommended to promote combinations of different CSA methods and GISP focused on increasing agricultural yields, which will in turn enhance household food security.

7. REFERENCES

Abdullah, Zhou D, Shah T, Ali S, Ahmad W, Din IU, Ilyas A. 2019. Factors affecting household food security in rural northern hinterland of Pakistan. Journal of the Saudi Society of Agricultural Sciences **18**:201–210. Elsevier.

Abura GO, Gikunda RM, Nato GN, Nyongesa Nato G. 2013. Technical Knowledge and Information Gaps among Smallholder Farmers in the Production of Sugarcane in Kakamega County, Kenya. International Journal of Agricultural Science, Research and Technology in Extension and Education Systems **3**:199–207.

Acheampong PP, Obeng EA, Opoku M, Brobbey L, Sakyiamah B. 2022. Does food security exist among farm households? Evidence from Ghana. Agriculture & Food Security **11**:24.

Adesida IE, Nkomoki W, Bavorova M, Madaki MY. 2021. Effects of Agricultural Programmes and Land Ownership on the Adoption of Sustainable Agricultural Practices in Nigeria. Sustainability 2021, Vol. 13, Page 7249 **13**:7249. Multidisciplinary Digital Publishing Institute.

African Development Bank. 2021. Zimbabwe Economic Outlook | African Development Bank - Building today, a better Africa tomorrow. Available from https://www.afdb.org/en/countries/southern-africa/zimbabwe/zimbabwe-economic-outlook.

AgriNews. 2020. Pfumvudza Programme explained | Agri News Zimbabwe. Available from https://agrinews.co.zw/news/2020/14/pfumvudza-programme-explained/ (accessed March 1, 2022).

Ahmed MH. 2022. Impact of improved seed and inorganic fertilizer on maize yield and welfare: Evidence from Eastern Ethiopia. Journal of Agriculture and Food Research **7**. Elsevier B.V.

Al-Kaisi MM, Lal R. 2017. Conservation Agriculture Systems to Mitigate Climate Variability Effects on Soil Health. Soil Health and Intensification of Agroecosystems:79–107. Academic Press.

Alhameid A, Tobin C, Maiga A, Kumar S, Osborne S, Schumacher T. 2017. Intensified Agroecosystems and Changes in Soil Carbon Dynamics. Soil Health and Intensification of Agroecosystems:195–214. Academic Press.

Arriaga FJ, Guzman J, Lowery B. 2017. Conventional Agricultural Production Systems and Soil Functions. Soil Health and Intensification of Agroecosystems:109–125. Academic

Press.

Asfaw S, Maggio G, Palma A. 2018. Climate Resilience Pathways of Rural Households: Evidence from Ethiopia. United Nations.

Assefa W, Kewessa G, Datiko D. 2022. Agrobiodiversity and gender: the role of women in farm diversification among smallholder farmers in Sinana district, Southeastern Ethiopia. Biodiversity and Conservation. Springer Science and Business Media B.V.

Asseng S, Zhu Y, Basso B, Wilson T, Cammarano D. 2014. Simulation Modeling: Applications in Cropping Systems. Encyclopedia of Agriculture and Food Systems:102–112. Academic Press.

Ayoade JA, Ibrahim HI, Ibrahim HY. 2019. Analysis of women involvement in livestock production in Lafia area of Nasarawa State, Nigeria. Livestock Research for Rural Development **21**.

Bennet B, Figue M, Vigne M, Chakoma C, Katic P. 2019. Beef Value Chain Analysis in Zimbabwe.

Bhattarai N, Joshi L, Singh Karky B, Windhorst K, Ning W. 2017. Potential synergies for agroforestry and REDD+ in Hindu Kush Himalaya.

Birchall SJ, Bonnett N. 2021. Climate change adaptation policy and practice: The role of agents, institutions and systems. Cities **108**:103001. Pergamon.

Centre for Public Impact. 2017. Fast Track Land Reform in Zimbabwe | Centre For Public Impact (CPI). Available from https://www.centreforpublicimpact.org/case-study/fast-track-land-reform-zimbabwe (accessed June 6, 2022).

Chikobvu S, Chiputwa B, Langyintuo AS, La Rovere R, Mwangi WM. 2010. Characterization of maize producing households in Masvingo and Bikita Districts in Zimbabwe.

Chilunjika A, Uwizeyimana DE. 2015. Shifts in the Zimbabwean Land Reform Discourse from 1980 to Present. Journal of Public Affairs **8**:130–144.

Chimhowu A, Woodhouse P. 2008. Communal tenure and rural poverty: Land transactions in Svosve communal area, Zimbabwe. Development and Change **39**:285–308.

Christoplos I. 2010. Mobilizing the potential of rural and agricultural extension.

D'Emden FH, Llewellyn RS, Burton MP. 2008. Factors influencing adoption of conservation tillage in Australian cropping regions. Australian Journal of Agricultural and Resource Economics **52**:169–182.

Deininger K, Ali DA. 2008. Do Overlapping Land Rights Reduce Agricultural Investment? Evidence from Uganda. American Journal of Agricultural Economics **90**:869–882.

Deitchler M, Ballard T, Swindale A, Coates J. 2011. Introducing a Simple Measure of

Household Hunger for Cross-Cultural Use.
Denzin NK, Lincoln YS. 2005. The Sage handbook of qualitative research, 3rd edition. Sage Publications Ltd.
Dizyee K, Baker D, Rich KM. 2017. A quantitative value chain analysis of policy options for the beef sector in Botswana. Agricultural Systems **156**:13–24. Elsevier.
Esabu A, Ngwenya H. 2019. Socio-economic Factors Influencing Adoption Of Conservation Agriculture In Moroto District, Uganda. South African Journal of Agricultural Extension (SAJAE) **47**. Academy of Science of South Africa.
FAO. 2006. Policy Brief Changing Policy Concepts of Food Security.
FAO. 2008. An Introduction to the Basic Concepts of Food Security. Available from www.foodsec.org.
FAO. 2010. The State of Food Insecurity in the World.
FAO. 2011. Part I Women in Agriculture: Closing the Gender Gap for Development.
FAO. 2015a. Income security for smallholder farmers in Zimbabwe | FAO | Food and Agriculture Organization of the United Nations. Available from http://www.fao.org/in-action/income-security-farmers-zimbabwe/en/ (accessed November 13, 2020).
FAO. 2015b. The Zimbabwe Livelihood and Food Security Programme | FAO | Food and Agriculture Organization of the United Nations. Available from http://www.fao.org/resilience/multimedia/videos/video-detail/en/c/283082/ (accessed May 1, 2020).
FAO. 2017. Zimbabwe Country Gender Assessment Series: National gender profile of agriculture and rural livelihoods.
FAO. 2018. Gender and food loss in sustainable food value chains A guiding note. Rome.
FAO. 2021. Zimbabwe | Agricultural livelihoods and food security in the context of COVID-19.
FAO. 2022. FAO GIEWS Country Brief on Zimbabwe. Available from https://www.fao.org/giews/countrybrief/country.jsp?code=ZWE&lang=en (accessed April 29, 2020).
FAOSTAT. 2022. Zimbabwe Crop & Livestock Statistics. Available from https://www.fao.org/faostat/en/#data/QCL (accessed June 27, 2022).
Fenske J. 2011. Land tenure and investment incentives: Evidence from West Africa. Journal of Development Economics **95**:137–156. North-Holland.
FEWS Net. 2021. Zimbabwe Food Security Outlook.
FEWS Net. 2022. Southern Africa Price Bulletin.

Francis CA. 2005. Crop Rotations. Encyclopedia of Soils in the Environment **4**:318–322. Elsevier.

Galhena DH, Freed R, Maredia KM. 2013. Home gardens: A promising approach to enhance household food security and wellbeing. Agriculture and Food Security **2**:1–13. BioMed Central Ltd.

Githongo MW, Kiboi MN, Ngetich FK, Musafiri CM, Muriuki A, Fliessbach A. 2021. The effect of minimum tillage and animal manure on maize yields and soil organic carbon in sub-Saharan Africa: A meta-analysis. Environmental Challenges **5**. Elsevier B.V.

Gwiriri LC, Manyawu G, Mashanda PB, Chakoma I, Moyo S, Chakoma C, Sethaunyane H, Imbayarwo-Chikosi VE, Dube S, Maasdorp B V. 2016. The potential of replacing conventional dairy supplements with forage legume-based diets in Zimbabwe's smallholder dairy sector. African Journal of Range and Forage Science **33**:155–163.

Hellin J, Dixon J. 2008. Operationalising participatory research and farmer-to-farmer extension: The Kamayoq in Peru. Development in Practice **18**:627–632.

Hentze K, Thonfeld F, Menz G. 2017. Beyond trend analysis: How a modified breakpoint analysis enhances knowledge of agricultural production after Zimbabwe's fast track land reform. International Journal of Applied Earth Observation and Geoinformation **62**:78–87. Elsevier.

het Lam A. 2014, October. Land use and farming dynamics in a communal area in Zimbabwe between Abram het Lam MSc minor thesis Plant Production Systems.

Hyden G. 2010. African politics in comparative perspective, second edition. Page African Politics in Comparative Perspective, Second Edition, 2nd edition. Cambridge University Press.

IFPRI. 2017. 2017 Global Food Policy Report.

IPC. 2021. Food Insecurity Driven by Poor Harvests, Reduced Income & High Food Prices Partially Mitigated by Increased Humanitarian Food Assistance.

Ishida M. 2003. Development of Agriculture Cooperatives in Japan (IV): Rural Communities and agricultural cooperatives at the initial phase.

Islam MS, Grönlund Å, Grönlund A. 2010. Agriculture Market Information Services (AMIS) in the Least Developed Countries (LDCs): Nature, Scopes, and Challenges. Pages 109–120 Lecture Notes in Computer Science. Springer Berlin Heidelberg.

ITA. 2021, August. Zimbabwe - Country Commercial Guide. Available from https://www.trade.gov/country-commercial-guides/zimbabwe-agricultural-sectors.

Jagger P, (Marty) Luckert MK. 2008. Investments and returns from cooperative and household managed woodlots in Zimbabwe: Implications for rural afforestation policy. Land Use Policy **25**:139–152. Elsevier Ltd.

Jayne TS, Rashid S. 2013. Input subsidy programs in sub-Saharan Africa: a synthesis of recent evidence. Agricultural Economics **44**:547–562. John Wiley & Sons, Ltd.

Jayne TS, Sitko NJ, Mason NM, Skole D. 2018. Input subsidy programs and climate smart agriculture: Current realities and future potential. Natural Resource Management and Policy **52**:251–273. Springer.

Jones AD, Ngure FM, Pelto G, Young SL. 2013. What are we assessing when we measure food security? A compendium and review of current metrics. Advances in nutrition (Bethesda, Md.) **4**:481–505. Adv Nutr.

Jones S, Matiza G, Mlalazi B, Wiggins S. 2005. Zimbabwe: Protracted Relief Programme (PRP) Output to Purpose Review.

Kalema EP, Akpo E, Muricho G, Ringo J, Ojiewo CO, Varshney RK. 2022. Mapping out market drivers of improved variety seed use: the case of sorghum in Tanzania. Heliyon **8**:e08715. Elsevier.

Kalyanapu P. 2005. Understanding the Causes of Malnourishment in Zimbabwe.

Kassie GT, Abdulai A, Greene WH, Shiferaw B, Abate T, Tarekegne A, Sutcliffe C. 2017. Modeling Preference and Willingness to Pay for Drought Tolerance (DT) in Maize in Rural Zimbabwe. World Development **94**:465–477. Elsevier Ltd.

Kiptot E, Franzel S. 2015. Farmer-to-farmer extension: opportunities for enhancing performance of volunteer farmer trainers in Kenya. Development in Practice **25**:503–517. Routledge.

Kiyani P, Andoh J, Lee Y, Lee DK. 2017. Benefits and challenges of agroforestry adoption: a case of Musebeya sector, Nyamagabe District in southern province of Rwanda **13**:174–180. Taylor & Francis.

Koppmair S, Kassie M, Qaim M. 2017. The influence of farm input subsidies on the adoption of natural resource management technologies. Australian Journal of Agricultural and Resource Economics **61**:539–556. Blackwell Publishing Ltd.

Korsaga S. 2018. Land Tenure Security, Land-Related Investments and Agricultural Performance in Sub-Saharan Africa: Efficiency or Equity? A Microeconomic Analysis Applied to the Case of Burkina Faso.

Kutyauripo I, Mavodza NP, Gadzirayi CT. 2021. Media coverage on food security and climate-smart agriculture: A case study of newspapers in Zimbabwe **7**. Cogent.

Leakey RRB. 2017. Agroforestry Tree Products (AFTPs): Targeting Poverty Reduction and

Enhanced Livelihoods. Multifunctional Agriculture:123–138. Elsevier.

Leakey RRB, Tchoundjeu Z, Schreckenberg K, Shackleton SE, Shackleton CM. 2005. Agroforestry Tree Products (AFTPs): Targeting Poverty Reduction and Enhanced Livelihoods. International Journal of Agricultural Sustainability **3**:1–23. Taylor & Francis Group.

Lipper L et al. 2014. Climate-smart agriculture for food security. Nature Climate Change 2014 4:12 **4**:1068–1072. Nature Publishing Group.

Maggio G, Sitko N. 2019. Knowing is half the battle: Seasonal forecasts, adaptive cropping systems, and the mediating role of private markets in Zambia. Food Policy **89**:101781. Pergamon.

Maiyaki AA. 2010. Zimbabwe's agricultural industry. African Journal of Business Management **4**:4159–4166.

Makuwerere Dube L. 2020. Command Agriculture and Food Security: An Interrogation of State Intervention in the Post-Fast Track Land Redistribution Era in Zimbabwe: Journal of Asian and African Studies **56**:1626–1643. SAGE Publications Sage UK: London, England.

Mallick D, Rafi M. 2010. Are Female-Headed Households More Food Insecure? Evidence from Bangladesh. World Development **38**:593–605. Pergamon.

Manatsa D et al. 2020. Report on Revised Agroecological Zones of Zimbabwe.

Mapfumo A. 2013. An Econometric Analysis of the Relationship Between Agricultural Production and Economic Growth in Zimbabwe. Russian Journal of Agricultural and Socio-Economic Sciences **23**:11–15. Russian Journal of Agricultural and Socio-Economic Sciences.

Mapira I. 2020. EMA Inspecting Urban Land Towards Pfumvudza Programme. Available from http://bhizimusi.com/2020/12/09/ema-inspecting-urban-land-towards-pfumvudza-programme/ (accessed June 28, 2022).

Marongwe N. 2011. Who was allocated Fast Track land, and what did they do with it? Selection of A2 farmers in Goromonzi District, Zimbabwe and its impacts on agricultural production. Journal of Peasant Studies **38**:1069–1092.

Maroyi A. 2009. Traditional homegardens and rural livelihoods in Nhema, Zimbabwe: a sustainable agroforestry system. International Journal of Sustainable Development & World Ecology **16**:1–8.

Marumbi R, Nyamugafata P, Wuta M, Tittonell P, Torquebiau E. 2020. Influence of planting basins on selected soil quality parameters and sorghum yield along an agro-ecological gradient in South Eastern Zimbabwe. Southern Africa Journal of Education, Science and Technology **5**:26–52. African Journals Online (AJOL).

Masiyandima N, Chigumira G, Bara A. 2011. Sustainable Financing Options for Agriculture in Zimbabwe.

Matenga T. 2017. Command agriculture misses targets – Nehanda Radio. Available from https://nehandaradio.com/2017/08/04/command-agriculture-misses-targets/ (accessed March 24, 2022).

Matondi PB, Dekker M. 2011. Land Rights and Tenure Security in Zimbabwe's Post Fast Track Land Reform Programme A Synthesis report for LandAc. Available from www.ruzivo.co.zw (accessed June 28, 2021).

Maxwell D, Caldwell R, Bell B. 2008. The Coping Strategies Index Field Methods Manual Second Edition.

Mazhar R, Ghafoor A, Xuehao B, Wei Z. 2021. Fostering sustainable agriculture: Do institutional factors impact the adoption of multiple climate-smart agricultural practices among new entry organic farmers in Pakistan? Journal of Cleaner Production **283**:124620. Elsevier.

Mazvimavi D. 2010. Investigating changes over time of annual rainfall in Zimbabwe. Hydrology and Earth System Sciences **14**:2671–2679.

Mazvimavi K, Twomlow S. 2009. Socioeconomic and institutional factors influencing adoption of conservation farming by vulnerable households in Zimbabwe. Agricultural Systems **101**:20–29.

Mazwi F, Chemura A, Mudimu GT, Chambati W. 2019. Political Economy of Command Agriculture in Zimbabwe: A State-led Contract Farming Model. Agrarian South: Journal of Political Economy **8**:232–257.

Mbanyele V, Mtambanengwe F, Nezomba H, Groot JCJ, Mapfumo P. 2021. Combinations of in-field moisture conservation and soil fertility management reduce effect of intra-seasonal dry spells on maize under semi-arid conditions. Field Crops Research **270**:108218. Elsevier.

McAllister G, Wright J. 2019. Agroecology as a Practice-Based Tool for Peacebuilding in Fragile Environments? Three Stories from Rural Zimbabwe. Sustainability (Switzerland) **11**:790. Multidisciplinary Digital Publishing Institute.

McCue C. 2007. Data. Data Mining and Predictive Analysis:67–92. Butterworth-Heinemann.

Mhembwe S, Dube E. 2017. The role of cooperatives in sustaining the livelihoods of rural communities: The case of rural cooperatives in Shurugwi District, Zimbabwe. Jamba:

Journal of Disaster Risk Studies **9**. AOSIS OpenJournals Publishing AOSIS (Pty) Ltd.

Miller DC et al. 2021. Forests, trees and poverty alleviation: Policy implications of current knowledge. Forest Policy and Economics **131**:102566. Elsevier.

Mkodzongi G, Lawrence P. 2019. The fast-track land reform and agrarian change in Zimbabwe **46**:1–13. Routledge.

Muchesa E, Nkosi BD, Zwane EM, van Niekerk JA. 2019. The Role Of Extension Support In A Communal Farmers' Market System In Mhondoro-Mubaira, Zimbabwe. South African Journal of Agricultural Extension **47**:72–80. South African Society for Agricultural Extension (SASAE).

Muchetu RG. 2019. Understanding Human Security in African Agrarian Societies: The Case for a Cooperative Model. Journal of Human Security **8**:20–44.

Mudavanhu C, Mandizvidza C. 2013. Sustaining Rural Livelihoods Through Donor Funded Agricultural Inputs Scheme In Zimbabwe: The Case Of Goromonzi District. International Journal of Scientific & Technology Research **2**.

Mugandani R, Wuta M, Makarau A, Chipindu B. 2012. Re-classification of agro-ecological regions of Zimbabwe in conformity with climate variability and change.

Mugwe J, Ngetich F, Otieno EO. 2019. Integrated Soil Fertility Management in Sub-Saharan Africa: Evolving Paradigms Toward Integration. Springer Nature Switzerland AG.

Mugweni LT. 2014. THE ECONOMIC VIABILITY OF SMALL-SCALE DAIRY FARMING IN ZIMBABWE: A CASE STUDY OF MARIRANGWE AND CHIKWAKA.

Mujere N. 2021. Assessing the Potential Contribution of Pfumvudza Towards Climate Smart Agriculture in Zimbabwe: A Review. Preprints.

Muoni T, Rusinamhodzi L, Thierfelder C. 2013. Weed control in conservation agriculture systems of Zimbabwe: Identifying economical best strategies. Crop Protection **53**:23–28. Elsevier.

Murisa T. 2011. Local farmer groups and collective action within fast track land reform in Zimbabwe. Journal of Peasant Studies **38**:1145–1166.

Murken L, Gornott C. 2022. The importance of different land tenure systems for farmers' response to climate change: A systematic review. Climate Risk Management **35**:100419. Elsevier.

Murray U, Gebremedhin Z, Brychkova G, Spillane C. 2006. Smallholder Farmers and Climate Smart Agriculture: Technology and Labor-productivity Constraints amongst Women Smallholders in Malawi. Technology and Development **20**:117–148.

Musafiri CM, Kiboi M, Macharia J, Ng'etich OK, Kosgei DK, Mulianga B, Okoti M, Ngetich

FK. 2021. Adoption of climate-smart agricultural practices among smallholder farmers in Western Kenya: do socioeconomic, institutional, and biophysical factors matter? Heliyon **8**:e08677–e08677. Elsevier Ltd.

Musara JP, Tibugari H, Moyo B, Mutizira C. 2021. Crop-livestock integration practices, knowledge, and attitudes among smallholder farmers: Hedging against climate change-induced shocks in semi-arid Zimbabwe. Open Life Sciences **16**:1330–1340. De Gruyter Open Ltd.

Mutambara J, Dube I V, Mvumi B. 2012. Agroforestry technologies involving fodder production and implication on livelihood of smallholder livestock farmers in Zimbabwe. A case study of Goromonzi District. Livestock Research for Rural Development **24**.

Mutami C. 2015. Smallholder Agriculture Production in Zimbabwe. Consilience **14**:140–157.

Mutandwa E. 2006. Factors Affecting Adoption of Exotic Dairy Breeds by Smallholders Dairy Farmers: Case of Chikwaka Communal Area of Zimbabwe. Southern African Journal of Science Education and Technology **1**:97–103.

Mutenje M, Chipfupa U, Mupangwa W, Nyagumbo I, Manyawu G, Chakoma I, Gwiriri L. 2020. Understanding breeding preferences among small-scale cattle producers: implications for livestock improvement programmes. Animal **14**:1757–1767. Elsevier.

Ndiritu SW, Kassie M, Shiferaw B. 2014. Are there systematic gender differences in the adoption of sustainable agricultural intensification practices? Evidence from Kenya. Food Policy **49**:117–127. Elsevier Ltd.

Ngarava S. 2020. Impact of the Fast Track Land Reform Programme (FTLRP) on agricultural production: A tobacco success story in Zimbabwe. Land Use Policy **99**. Elsevier Ltd.

Ngoma H, Mason NM, Sitko NJ. 2015. Does minimum tillage with planting basins or ripping raise maize yields? Meso-panel data evidence from Zambia. Agriculture, Ecosystems & Environment **212**:21–29. Elsevier.

Nkomoki W, Bavorová M, Banout J. 2018. Adoption of sustainable agricultural practices and food security threats: Effects of land tenure in Zambia. Land Use Policy **78**:532–538. Elsevier Ltd.

Nkomoki W, Bavorová M, Banout J. 2019. Factors Associated with Household Food Security in Zambia. Sustainability **11**:2715. Multidisciplinary Digital Publishing Institute.

Nwakor F, Ifenkwe G, Okoye B, Onummdu F, Anyaegbunam H, Ekedo T, Onyia C. 2011. Socio-Economic Factors Affecting Adoption of Improved Cassava Varieties among Farmers in Abia State. Journal of Agriculture and Social Research (JASR) **11**.

Nwigbo CM. 2021. Assessment Of Factors Influencing Adoption Of Improved Cassava

Production Technologies Among Farmers In Abia State, Nigeria | MOUAU Repository.

Nyaga J, Barrios E, Muthuri CW, Öborn I, Matiru V, Sinclair FL. 2015. Evaluating factors influencing heterogeneity in agroforestry adoption and practices within smallholder farms in Rift Valley, Kenya. Agriculture, Ecosystems & Environment **212**:106–118. Elsevier.

Nyamangara J, Marondedze A, Masvaya EN, Mawodza T, Nyawasha R, Nyengerai K, Tirivavi R, Nyamugafata P, Wuta M. 2014. Influence of basin-based conservation agriculture on selected soil quality parameters under smallholder farming in Zimbabwe. Soil Use and Management **30**:550–559. John Wiley & Sons, Ltd.

Nyamangara J, Masvaya EN, Tirivavi R, Nyengerai K. 2013. Effect of hand-hoe based conservation agriculture on soil fertility and maize yield in selected smallholder areas in Zimbabwe. Soil and Tillage Research **126**:19–25. Elsevier.

Nyareza S, Dick AL. 2012. Use of community radio to communicate agricultural information to Zimbabwe's peasant farmers. Aslib Proceedings: New Information Perspectives **64**:494–508.

Nyathi P, Moyo T, Posthumus H, Stevens J. 2020. Impact of Social and Institutional Factors on the Uptake of Conservation Agriculture: A Case of Zambia and Zimbabwe. Sustainable Agriculture Research **9**:67. Canadian Center of Science and Education.

Odunze DI, Uwizeyimana DE. 2019. Zimbabwe's Special Maize Programme for the Import Substitution (Command Agriculture) Scheme: A Hit-and-Miss Affair. Journal of Reviews on Global Economics **8**:1329–1338. Lifescience Global.

Ogada MJ, Rao EJO, Radeny M, Recha JW, Solomon D. 2020. Climate-smart agriculture, household income and asset accumulation among smallholder farmers in the Nyando basin of Kenya. World Development Perspectives **18**:100203. Elsevier.

Oyewole SO, Sennuga SO. 2020. Factors Influencing Sustainable Agricultural Practices among Smallholder Farmers in Ogun State of Nigeria. Asian Journal of Advances in Agricultural Research **14**:17–24. Sciencedomain International.

Ozioko RI, Nwigwe BC, Asadu AN, Nwafor MI, Nnadi OI, Onyia CC, Enwelu IA, O. OF. 2020. Food security situations among female headed households in Enugu East Senatorial Zone of Enugu State, Nigeria. Journal of Agricultural Extension **24**:100–112. Agricultural Extension Society of Nigeria.

Pazvakavanbwa S, Hungwe V. 2009. Agricultural Land Redistribution: Toward Greater Consensus. Page Agricultural Land Redistribution. World Bank.

Peng W, Berry EM. 2018. The concept of food security. Encyclopedia of Food Security and Sustainability:1–7. Elsevier.

People in Need. 2017a. Food Consumption Score (FCS) | IndiKit. Available from https://www.indikit.net/indicator/27-food-security/20-food-consumption-score-fcs (accessed July 24, 2021).

People in Need. 2017b. Reduced Coping Strategy Index (rCSI) | IndiKit. Available from https://www.indikit.net/indicator/3950-reduced-coping-strategy-index-rcsi (accessed August 28, 2021).

Permin A, Esmann JB, Hoj CH, Hove T, Mukaratirwa S. 2002. Ecto-, endo- and haemoparasites in free-range chickens in the Goromonzi District in Zimbabwe. Preventive Veterinary Medicine **54**:213–224. Elsevier.

Plieninger T, Muñoz-Rojas J, Buck LE, Scherr SJ. 2020. Agroforestry for sustainable landscape management. Sustainability Science **15**:1255–1266. Springer.

Raj A, Chandrawanshi S. 2016. Role of Agroforestry in Poverty Alleviation and Livelihood Support in Chhattisgarh. South Indian Journal of Biological Sciences **2**:326. South Indian Journal of Biological Sciences.

Rukuni M, Tawonezvi P, Eicher C, Munyuki-Hungwe M, Matondi P. 2006. Zimbabwe's Agricultural Revolution Revisited.

Rusinamhodzi L. 2015a. Tinkering on the periphery: Labour burden not crop productivity increased under no-till planting basins on smallholder farms in Murehwa district, Zimbabwe. Field Crops Research **170**:66–75. Elsevier.

Rusinamhodzi L. 2015b. Crop Rotations and Residue Management in Conservation Agriculture. Conservation Agriculture:21–37. Springer International Publishing.

Sanginga N, Woomer PL. 2009. Principles, Practices and Developmental Processes Integrated Soil Fertility Management in Africa: Principles, Practices and Developmental Process.

Sanginga PC, Njuki J. 2013. Women, Livestock Ownership, and Markets.

Santpoort R. 2020. THE drivers of maize area expansion in sub-Saharan Africa. How policies to boost maize production overlook the interests of smallholder farmers. Land **9**.

Scoones I, Marongwe N, Mavedzenge B, Murimbarimba F, Mahenehene J, Sukume C. 2011. Zimbabwe's Land Reform A summary of findings.

SEEDCO. 2021. Agronomists | Seed Co Zimbabwe. Available from https://www.seedcogroup.com/zw/about-us/agronomists.

Sepo Marongwe L, Nyagumbo I, Kwazira K, Kassam A, Friedrich T. 2012. Conservation Agriculture and Sustainable Crop Intensification: A Zimbabwe Case Study Plant Production and Protection division. Integrated Crop Management:17–2012.

Shiferaw B, Kassie M, Jaleta M, Yirga C. 2014. Adoption of improved wheat varieties and impacts on household food security in Ethiopia. Food Policy **44**:272–284. Pergamon.

Shonhe T, Scoones I. 2022. Private and state-led contract farming in Zimbabwe: Accumulation, social differentiation and rural politics. Journal of Agrarian Change **22**:118–138. John Wiley & Sons, Ltd.

Simbarashe M, Runganga R, Mhaka S. 2021. Impact of Agricultural Production on Economic Growth in Zimbabwe Impact of Agricultural Production on Economic Growth in Zimbabwe.

Simpson R. 2021, December 25. Agricultural Success in Zimbabwe - The Borgen Project. Available from https://borgenproject.org/agricultural-success-in-zimbabwe/.

Sinharay S. 2010. An Overview of Statistics in Education. International Encyclopedia of Education:5. Elsevier.

Sobola OO, Amadi DC. 2015. The Role of Agroforestry in Environmental Sustainability **8**:20–25.

Ssemakula E, Mutimba JK. 2011. Effectiveness of the farmer-to-farmer extension model in increasing technology uptake in Masaka and Tororo Districts of Uganda. South African Journal of Agricultural Extension **39**.

Sulaiman R, Davis K. 2012. The “New Extensionist”:Roles, Strategies, and Capacities to Strengthen Extension and Advisory Services. Global Forum for Rural Advisory Services.

Syed A, Raza T, Bhatti TT, Eash NS. 2022. Climate Impacts on the agricultural sector of Pakistan: Risks and solutions. Environmental Challenges **6**:100433. Elsevier.

Tantisantisom K. 2011. Information dissemination for farming communities in Thailand. Recommended Citation. Edith Cowan University Research Online. Available from https://ro.ecu.edu.au/theses/428.

Tatsvarei S, Mushunje A, Matsvai S, Ngarava S. 2018. Farmer perceptions in Mashonaland East Province on Zimbabwe’s agricultural land rental policy. Land Use Policy **75**:468–477. Pergamon.

Teklewold H, Kassie M, Shiferaw B, Köhlin G. 2013. Cropping system diversification, conservation tillage and modern seed adoption in Ethiopia: Impacts on household income, agrochemical use and demand for labor. Ecological Economics **93**:85–93. Elsevier.

The Periscope Report. 2017, May. Zimbabwe’s Command Agriculture Frequently Asked Questions (FAQs) that paint the picture better - The Periscope Report. Available from https://www.theperiscopereport.co.zw/zimbabwes-command-agriculture-frequently-asked-questions-faqs-paint-picture-better/.

Thierfelder C, Matemba-Mutasa R, Rusinamhodzi L. 2015a. Yield response of maize (Zea mays L.) to conservation agriculture cropping system in Southern Africa. Soil and Tillage Research **146**:230–242. Elsevier.

Thierfelder C, Mutenje M, Mujeyi A, Mupangwa W. 2015b. Where is the limit? Lessons learned from long-term conservation agriculture research in Zimuto Communal Area, Zimbabwe. Food Security 7:15–31. Kluwer Academic Publishers.

Tomlinson J, Rhiney K. 2018. Assessing the role of farmer field schools in promoting pro-adaptive behaviour towards climate change among Jamaican farmers. Journal of Environmental Studies and Sciences **8**:86–98. Springer New York LLC.

Triplett GB, Dick WA. 2008. No-tillage crop production: A revolution in agriculture! Agronomy Journal **100**.

Tschora H, Cherubini F. 2020. Co-benefits and trade-offs of agroforestry for climate change mitigation and other sustainability goals in West Africa. Global Ecology and Conservation **22**. Elsevier B.V.

Twomlow S, Urolov JC, Jenrich M, Oldrieve B. 2008. Lessons from the field-Zimbabwe's Conservation Agriculture Task Force. An Open Access Journal published by ICRISAT SAT eJournal | ejournal.icrisat.org-1 **6**.

Uisso A, Masao C. 2016. Women participation in agroforestry farming system: A strategy towards poverty reduction in Morogoro rural district, Tanzania. Ethiopian Journal of Environmental Studies and Management **9**:613–624. African Journals Online (AJOL).

Uledi P. 2019. An analysis of state intervention in Zimbabwean agriculture through the "Command Agriculture scheme" A case study of Chegutu farming area.

UN Comtrade. 2019. 2017 International Trade Statistics Yearbook, Vol. 1. New York.

UNDP. 2017. Zimbabwe Human Development Report 2017 Climate Change and Human Development: Towards Building a Climate Resilient Nation GOVERNMENT OF ZIMBABWE. Harare.

Wall PC, Thierfelder C, Ngwira A, Govaerts B, Nyagumbo I, Baudron F. 2013. Conservation agriculture in Eastern and Southern Africa. Conservation agriculture: global prospects and challenges:263–292. CABI.

Wanyama FO. 2009. Cooperatives for African Development: Lessons from Experience.

Westengen OT, Haug R, Guthiga P, Macharia E. 2019. Governing Seeds in East Africa in the Face of Climate Change: Assessing Political and Social Outcomes. Frontiers in Sustainable Food Systems **3**:53. Frontiers Media S.A.

WFP. 2015. Meta Data for the Food Consumption Score (FCS) Indicator | World Food

Programme. Available from https://www.wfp.org/publications/meta-data-food-consumption-score-fcs-indicator (accessed June 8, 2022).

WFP VAM. 2008. Food consumption analysis: Calculation and use of the food consumption score in food security analysis. Available from https://documents.wfp.org/stellent/groups/public/documents/manual_guide_proced/wfp197216.pdf.

WFP VAM. 2014. WFP Food Consumption Score - Technical Guidance Sheet | Food Security Cluster. Rome. Available from https://fscluster.org/bangladesh/document/wfp-food-consumption-score-technical.

World Bank. 2020. Agriculture Overview. Available from https://www.worldbank.org/en/topic/agriculture/overview (accessed June 27, 2021).

World Bank Group. 2017. Zimbabwe Smallholder Agricultural Productivity : Survey Report 2017.

Yigezu YA, El-Shater T. 2021. Socio-economic impacts of zero and reduced tillage in wheat fields of the Moroccan drylands. Agricultural Economics (United Kingdom) **52**:645–663. Blackwell Publishing Ltd.

Yigezu YA, Mugera A, El-Shater T, Aw-Hassan A, Piggin C, Haddad A, Khalil Y, Loss S. 2018. Enhancing adoption of agricultural technologies requiring high initial investment among smallholders. Technological Forecasting and Social Change **134**:199–206. North-Holland.

Zamchiya P. 2013. The Role of Politics and State Practices in Shaping Rural Differentiation: A Study of Resettled Small-Scale Farmers in South-Eastern Zimbabwe. Journal of Southern African Studies **39**.

Zengeni T. 2014, August 31. The Competitiveness and Performance of the Zimbabwe Poultry Industry. University of Witwatersrand.

Zikhali P. 2008. Fast Track Land Reform, Tenure Security, and Investments in Zimbabwe. Available from https://www.jstor.org/stable/resrep14886?seq=1.

ZIMSTAT. 2020. Mashonaland East Province District Population Projections Report II.

ZimVAC. 2002. Zimbabwe Emergency Food Security Assessment Report.

ZimVAC. 2010. Zimbabwe Livelihoods Zone Profiles. Harare.

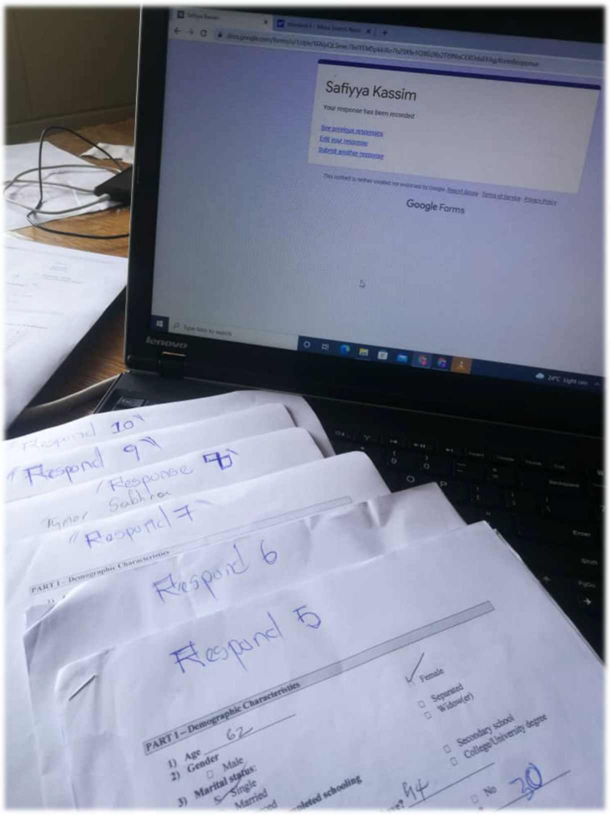
ZimVAC. 2015. Zimbabwe - Vulnerability Assessment Committee: Market Assessment, October 2015 | World Food Programme.

ZimVAC. 2021. Manicaland Province Zimbabwe Vulnerability Assessment Committee (ZimVAC) 2021 Rural Livelihoods Assessment Report.

Zira M, Ignacio CM, Munyaradzi JM, Justice N. 2013. Factors affecting the choice of conservation agriculture practices adopted by smallholder cotton farmers in Zimbabwe. African Journal of Agricultural Research **8**:1641–1649. Academic Journals.

APPENDIX

7.1. Data Collection


Safiyya Kassim
Your response has been recorded
Google Forms
Respond 6
Respond 5
PART I – Demographic Characteristics

7.2. Questionnaire

PART I – Demographic Characteristics

1) **Age** ____________________
2) **Gender**
   O Male   O Female
3) **Marital status**:
   O Single   O Separated
   O Married   O Widow(er)
   O Divorced
4) **Highest level of completed schooling**
   O Illiterate   O Secondary school
   O Primary school   O College/University degree
5) **How many years of schooling do you have?** ____________________
6) **Do you have any farming knowledge?**
   O Yes   O No
7) **If yes, how many years have you been involved in farming?** ____________________
8) **Total land size**____________________
9) **Land under cultivation** ____________________
10) **Land ownership**
   O Leased/rented   O Private
   O Communal
11) **Do you own any livestock?**
   O Yes   O No
12) **Do you own any livestock?**
   O Yes   O No
13) **How many people are living in your household?** ____________________

PART II – INPUT SUPPORT PROGRAM(S)

14) **Did you receive any support from Command Agriculture/Special Maize Programme for Import Substitution (SMPIS)?**
   O Yes   O No
15) **If yes, on a scale of 1 to 5, please indicate how you benefited from the program. 5 indicates a great benefit and 1, is a very small benefit.**

Benefits	**1**	**2**	**3**	**4**	**5**
Increased crop yields					
Better quality produce					
Better agricultural knowledge					
Diverse crop production (many crops)					

16) **Did you receive any support from the Livelihoods for Food Security Programme (LFSP) Pfumvudza?**
   O Yes   O No

17) **If yes, on a scale of 1 to 5, please indicate how you benefited from the program. 5 indicates a great benefit and 1, is a very small benefit.**

Benefits	1	2	3	4	5
Increased crop yields					
Better quality produce					
Better agricultural knowledge					
Diverse crop production (many crops)					

18) **What other support programs did you benefit from ________________________________?**

PART III – FOOD SECURITY

Food Consumption Score

19) **List below the food/s you have eaten in the past 7 days (if 'Sadza' is eaten 4 days per week, record '4' as the "Number of times eaten/used").**

Food Item	Examples	Number of times eaten
Cereals	Maize/Sadza	
	Sorghum	
	Rice	
	Bread/wheat	
	Pasta	
Pulses	Beans	
	Nyemba	
	Soya Bean	
	Chickpea	
Vegetables	Rape/covo	
	Cabbage	
	Mushroom	
	Tomatoes	
	Potatoes	
Fruits	Apples	
	Bananas	
	Oranges	
	Wild Fruit (Mazhanje, Matohwe, etc.)	
Meat	Beef	
	Pork	
	Chicken	
	Goat	
	Fish	
Milk	Cow milk	
	Goat milk	
	Soya milk/other	
Sugar	Brown sugar	
	White sugar	
	Molasses/other	

Oil	Sunflower oil	
	Olive oil, Rapeseed/other	
	Rapeseed/other	

20) **In which months do you have high levels of food shortages? ____________________**

Coping Strategy Index

21) **In the past 7 days, if there have been times when you did not have enough food or money to buy food, how often has your household had to:**

Strategy	Frequency (Number of Times)
Rely on less preferred and less expensive foods?	
Borrow food, or rely on help from a friend or relative?	
Limit portion size at mealtimes?	
Restrict consumption by adults in order for small children to eat?	
Reduce number of meals eaten in a day?	

PART IV – FARMING PRACTICES

22) **Do you have access to credit support/loans?**
O Yes O No

23) **Do you have access to extension services?**
O Yes O No

24) **Do you know what Climate Smart Agriculture (CSA) is?**
O Yes O No

25) **Did you belong to any Farmer Field School (FFS)?**
O Yes O No

26) **How do you receive information concerning CSA?**
O Radio
O Television
O Cooperatives
O Extension
O Local Farmer Group

27) **Please list below your most used CSA method/s for the past 3 growing seasons.**

Practice	Do you use this practice? Yes/No	Often (3+ times)	Sometimes (1-2 times)	Never (0 times)
Zero or minimum Tillage				
Improved Seed Varieties				
Crop Rotation				
Agroforestry				

NB: Agroforestry is either: the keeping of animals and planting of crops; the keeping of animals; planting of crops and trees; or the keeping of animals and planting of trees, at the same time.
Explain to the farmers what “Food Security”, and “Climate-Smart Agriculture (CSA)” are.