

MIDLANDS STATE UNIVERSITY



The contribution of irrigation agriculture to food security in drought prone areas. The case of Chikomba district, Zimbabwe.

By

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A dissertation submitted in partial fulfilment of the requirements of the degree of Bachelor of Arts in Development Studies of the Midlands State University

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Declaration

I hereby declare that this dissertation is the result of my own original work and investigations and that work has not been presented elsewhere for any.

All additional sources of information have been acknowledged by means of references.

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Date

Approval Form

The undersigned certify that they have supervised Anesu Chitani dissertation with the title ‘The contributions of irrigation agriculture to food security in drought prone areas. The case of Chikomba district, Zimbabwe’ submitted in partial fulfilment of the requirements of the Bachelor of Arts in Development Studies Honours Degree.

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Abstract

This study seeks to evaluate the contribution of irrigation farming to food security in Zimbabwe with particular attention to Chikomba district. A mixed methodology that includes both qualitative and quantitative methods was used in the collection of data. Questionnaires, interviews and direct field observations were used as data collection tools. This study identified the crops grown in the irrigation schemes, it also determines the level of productivity and an evaluation on the contribution of the irrigation to household food security was done. Income enhancement, employment, improved health status, nutritious foods and diversity of foods from the irrigation schemes were recorded as benefits of using irrigation agriculture. Factors such as higher cost, lack of capital, lack of knowledge and skills and restrictive institutions were identified as constraints of irrigation development. The research recommends that stakeholders involved in the implementation of irrigation schemes such as ZINWA, RDC and AGRITEX should continue to work with the farmers providing them with information and knowledge about irrigation agriculture so as to improve the practice in the area. Other stakeholders and the financial institutions should be involved to enhance the productivity of the schemes so that benefits are not only limited to household food security but also include creation of employment and boosting the economy.

Dedication

Exceptional dedication of this project goes to my family members for their support which made this education a success.

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Acronyms and abbreviations

AGRITEX – Agricultural Technical and Extension Services

CDC - Centre for Diseases Control

EMA- Environmental Management Agency

FAO - Food and Agriculture Organisation

FSC – forest Stewardship Council

IFAD – International Fund for Agricultural Development

IPCC – International Governmental Panel on Climate Change

MDG – Millennium Development Goal

SDG – Sustainable Development Goal

WFP – World Food Program

ZIMSTAT – Zimbabwe National Statistic Agency

ZINWA –Zimbabwe National Water Authority

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CHAPTER 1: INTRODUCTION

1.0 Introduction

This study focused on the contribution of irrigation to Food Security in Chikomba district of Mashonaland East Province of Zimbabwe. Irrigation was introduced by the Government of Zimbabwe and other development stakeholders as a mitigation measure to avert food shortages in drought prone areas of Zimbabwe. Zimbabwe has been experiencing a high incidence of drought and food shortages have been the major direct effect of drought. According to Wisner et al (2004) drought has been ranked first among other natural hazards and it contributes to about 86.9% of hazard induced deaths but statistics on starvation are usually under reported for political reasons. Zimbabwe, a country which was at once the bread basket' of Africa is now a recipient of food from other countries that have surplus food commodities like Zambia. This chapter will cover the background to the problem that has influenced the study, statement of the problem, conceptual framework, theoretical framework, policy impact evaluation, research objectives, research questions, literature review, justification and significance of the research, summary of research methodology and methods, delimitation of the study, ethical considerations, structure of the dissertation and a summary of the chapter. The research also reviewed literature by other authors and involved field research findings, challenges, prospects for food security, possible solutions and conclusion

Food security is at the centre of development considering the fact that a world that is food secure is the most desirable one. Food security exists when all people, at all times, have affordable access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life as noted by FAO (2015). Though a lot of effort has been put towards achieving food security, IFAD (2017) acknowledged that there are an estimated 925 million hungry people in the world with the majority of them living in the

developing countries. It should be noted that Food security has more effects on people than human health and welfare. It cannot be ignored that food insecurity has secondary effects such as political instability, poor health as well as economic decline as evidenced by the 2007 to 2008 situation in Zimbabwe. In African countries, food shortage can be largely due to climate change that has resulted in shorter rain seasons, dry spells and high temperatures. This has affected the agricultural sector in a negative way. Since agriculture is the major producer of food in less developed countries, this has resulted in massive shortages of food in the global south.

According to the United Nations millennium development goals, eradicating poverty and hunger tops the list of all the eight development goals. Therefore food insecurity requires a multidimensional approach to solve it. There have been a heap of solutions suggested by scientists and development practitioners which have not yielded much success. However, a way that can promote food security is irrigation. Irrigation has become widespread in dry areas with promise of enhancing food security if practiced properly and sustainably.

It is important to note food security and agriculture are interrelated and the best way to do this in the 21st century is to put more focus on the adaptive measures such as irrigation. Irrigation can help to improve food production in drought prone areas hence offering a solution to Africa's era of climate change and drought. Sen (2016) asserts that the use of irrigation can rescue people from food insecurity in several ways such as removing the water deficiency in plants caused by inadequate rainfall, improving the yield of crops and making people prosperous, crops which are produced due to irrigation makes a country self sufficient in food requirements. Also Irrigation makes it possible to grow cash crops which do not only feed the populace but can also give good returns to the cultivators than the ordinary crops they might have grown in absence of irrigation. Fruit gardens, sugarcane, potato, green paper among others are crops that can generate higher returns. Irrigation facilitates bathing, cattle

watering and improves freshwater circulation. Irrigation also makes it possible for off season farming hence increasing food production.

Irrigated agriculture provides 40% of the world's food from less than 20% of the cultivated area highlighting the importance of irrigation in global food security as acknowledged by Turrall (2010). Hedley (2014) it is estimated that 75% of the grain production in China is dependent on irrigation agriculture. Considering the evidence above, it can be noted that the use of irrigation can rescue areas like Chikomba district in Zimbabwe, which is now being threatened by climate change and variability from food insecurity. This research explores the potential of irrigation in ensuring household food security in drought prone areas with much focus on Chikomba area in Zimbabwe.

1.1 Background of study

According to FAO (1996) the 1996 World Food Summit report defined food security as existing when all people at all times have physical, social and economic access to sufficient, safe and nutritious food, which meets their dietary needs and food preferences for an active and healthy life. World Food Program (WFP) (2009) summarized the definition by saying it is a condition that exists when all people at all times are free from hunger and famine. Food insecurity however is a situation of uncertain availability of nutritionally sufficient and safe food. The actual concepts of food security emerged in the mid 1970s, during the 1974 World Food Summit which was held after the global 1973 to 1974 food crisis that left a mark on people's minds.

The 1996 World Food Summit's goal was to halve the number of starving people by 2015. Millennium development goals placed eradicating hunger at the top of the eight development goals but the problem of food security was not solved. Recently the United Nations

sustainable development goals, goal number two is to end hunger, achieve food security and improved nutrition and promote sustainable agriculture. This shows that food insecurity is at the top of development problems of the world. According to FAO (2015) about 10.9 percent of the world population is suffering from hunger and food insecurity. It can be noted that the majority of undernourished people are from developing countries. FAO (2015) noted that 12, 9 percent of the developing regions are under nourished with the majority of them coming from Africa and Asia. In Africa FAO (2015) estimated that 20 percent are suffering from food insecurity, in sub Saharan Africa 23, 2 percent of the people are undernourished. This shows that food insecurity is a problem to the world especially in the sub Saharan Africa region.

Zimbabwe is one of the countries which are severely facing this problem; food security has remained a desire that is not yet achieved. It can be noted that Zimbabwe's food security situation became worse since the beginning of the 21st century. In 2016, an estimated number of about 4.1 million people were food insecure due to the El Niño affects droughts that affected rain fed agriculture in southern Africa. Food security has become a problem that has resulted in people relying on food aid from donors like the USAID. Since June 2015, USAID have contributed about \$127 million in emergency food assistance to respond to the drought in Zimbabwe. Food aid is one of the indicators that can show severe food insecurity in the country.

Food insecurity in Zimbabwe has been blamed on many factors but the most clear and major factor is climate change and variability which has resulted in decrease in the agricultural product, agriculture in Zimbabwe is largely rain fed agriculture which is being practiced only in the rain season. This type of agriculture has been negatively affected by climate change and variability which has resulted in unreliable shorter rain seasons and dry spells. The international community is now focusing on adapting measures to improve agricultural

production so as to ensure food security. Irrigation can be one measure that can be taken to ensure food security in Zimbabwe as rain fed agriculture is being compromised. Countries like china have the most favorable results of the use of irrigation through the increase in rice production. The government of Zimbabwe adopted irrigation as a strategy to increase production and it is being facilitated Ministry of Agriculture, Mechanization and Irrigation Development. In drought prone areas like Chikomba district irrigation can be a viable and suitable way to improve food security as it can counter the effects of climate change. This study is going to concentrate on irrigation as the viable way in enhancing food security in the drought prone areas of Zimbabwe

1.2 Statement of the problem

Food security has become one of the major global problems and Zimbabwe has faced this challenge severely. In Zimbabwe food insecurity has continued to be a problem especially among the rural populace where food is basically produced. This is because agricultural food production has been affected negatively by climate change that has resulted in shorter, unreliable and unpredictable rain seasons. Since agriculture in Zimbabwe is mainly rain feed it has resulted in food security problem, as food production is greatly linked to agriculture production in the rural areas of Zimbabwe there is need to address the issues that lead to poor yields and try to come up with a viable solution in enhancing food security. It can also be noted that the food security situation in Zimbabwe differs with seasons as food is highly available during the end of the rain season and some few months after the rain season. Some scholars pointed out that about 50 percent of the households in rural areas are likely to have inadequate food in three months after the rain season. Indigenous knowledge system acknowledges that shortage of food reaches its peak when the rain season is approaching. Food assistance programs in Zimbabwe also reflect that there is high demand for food aid during the period from September to the end of January. This means that the food that is

being produce from rain fed agriculture is usually insufficient to feed the households until the next rain season. As a result there is need for development stakeholders to come up with strategies to produce food during the dry season. The government of Zimbabwe has recognized irrigation agriculture as a way to meet the impacts of climate change and it appears to be a way that can lead to food security. Consequently there is need to evaluate the contribution of irrigation towards food security.

1.3 Conceptual framework

The conceptual outline of food security has developed along with the incidences of hunger, famine and malnutrition in developing countries. In the 1970s food security was regarded as adequacy of food supply at international and national levels. This view focused on food production variables and ignored the multiple forces that affected food access such as entitlements. It is important to note that there is no widely agreed definition of food security as various scholars has come up with several definitions of food security. Committee on World Food Security (2011) Food security exists when all people at all times have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. The four pillars of food security are food availability, access to food, utilization and stability and the nutritional dimension, which is integral to the concept of food security. It can be noted that there is a considerable debate on whether food security is due to food shortage or it is due to failure to access food. Scholars like Thomas Malthus (1999), emphasizes that there will be food shortages in the future which will be mainly caused by the growing population. However Sen (1989) argues that with the improvement in technology food will be available but the problem will be how to access that food. Therefore food security is centered on food production and access to food.

In addition food insecurity can be chronic (a continuous failure to access food) or transitory (a temporary decline). Maxwell and Smith (1992) noted that chronic food insecurity is a

symbol of poverty which shows a long term structural deficit in food production and lack of purchasing power and transitory food insecurity implies short term variability in food prices, production and income. Degefa (2002) transitory food insecurity is a temporal or seasonal shortage of food because of unanticipated factors for only a limited period often triggered by seasonal instability in food supply or availability and fluctuation in prices and incomes.

It is also important in this case to unveil the meaning of irrigation. Irrigation is basically the artificial supplying and systematic dividing of water for agriculture and horticulture in order to obtain higher or qualitatively better production. According to CDC (2015) Irrigation is the artificial application of water to the soil through various systems of tubes, pumps, and sprays. Irrigation is usually used in areas where rainfall is irregular or dry times or drought is expected. There are many different types of irrigation systems, depending on how the water is distributed throughout the field. Some common types of irrigation systems include:

- Surface irrigation, water is distributed over and across land by gravity, no mechanical pump involved.
- Localized irrigation water is distributed under low pressure, through a piped network and applied to each plant.
- Drip irrigation a type of localized irrigation in which drops of water are delivered at or near the root of plants. In this type of irrigation, evaporation and runoff are minimized.
- Sprinkler irrigation, water is distributed by overhead high-pressure sprinklers or guns from a central location in the field or from sprinklers on moving platforms.
- Centre pivot irrigation, water is distributed by a system of sprinklers that move on wheeled towers in a circular pattern. This system is common in flat areas of the United States.

- Lateral move irrigation water is distributed through a series of pipes, each with a wheel and a set of sprinklers, which are rotated either by hand or with a purpose-built mechanism. The sprinklers move a certain distance across the field and then need to have the water hose reconnected for the next distance. This system tends to be less expensive but requires more labour than others.
- Sub-irrigation water is distributed across land by raising the water table, through a system of pumping stations, canals, gates, and ditches. This type of irrigation is most effective in areas with high water tables.
- Manual irrigation, water is distributed across land through manual labour and watering cans this system is very labour intensive.

1.4 Theoretical framework

Sustainable development approach has been used in trying to solve development problems such as poverty and food insecurity and it appears to be a most suitable framework. This research used the sustainable development approach as it recognizes the need to develop while maintaining the sustainability of natural resources for present and future generations. Chambers and Conway in (1992) defined sustainable rural livelihood as “A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation and when it contributes net benefits to other livelihoods at the local and global levels”. From the above definition it can be noted that sustainable livelihood approach helps rural people to realize their own strengths and potentials and develop them, while at the same time acknowledging the effects of policies and institutions, external shocks and trends. This is done so as to remove the notions about

what exactly rural people are seeking and how they are most likely to achieve their goals, and to develop an accurate and dynamic picture of them in their environment.

Food security cannot be separated from livelihoods according to Maxwell and Smith (1992) food security is but one element of livelihood security. Young (2001) noted that food insecurity may cause severe damage to livelihoods, thereby reducing self reliance. It can be noted that food insecurity can lead to malnutrition and mortality thereby affecting people's livelihoods negatively. According to FSC (2012), a sustainable livelihood has the following feature:

- Ability to cope with and recover from shocks and stresses.
- Economic effectiveness or use of minimal inputs to generate a given output.
- Ecological integrity, ensuring that livelihood activities do not irreversibly degrade natural resource within a given ecosystem.
- Social equity, which suggests that promotion of livelihood opportunity for one group does not effectively foreclose option.
- Maintain the long term productivity of natural resources. Another important feature of sustainable livelihoods is the issue of agenda setting. The poor should be at the centre of this process. They should be given chance to identify projects that are of importance to the poverty alleviation process as defined by the poor.

This research used the sustainable livelihood approach to assess the effectiveness of irrigation in bringing about a sustainable livelihood in rural areas like Chikomba district. The approach was used to measure the sustainability of irrigation as a way of developing food security status of rural people.

1.5 Research aims and objectives

To examine the contribution of irrigation to food security in Chikomba District

Specific Objectives`

1. To assess the causes of food insecurity in Zimbabwe.
2. To examine the nexus between food security and irrigation agriculture.
3. To evaluate the contribution of irrigation agriculture to food security
4. To unearth other factors that can contribute to food security.

1.6 Research questions

1. What are the factors that cause food insecurity?
2. is there a nexus between food security and irrigation agriculture?
3. What is the impact of irrigation agriculture on food security in Zimbabwe?
4. What can be done to enhance irrigation agriculture in Zimbabwe?
5. What other factors impact on food security in Zimbabwe?

1.7 Significance of the study

This study will be of benefit to several development stakeholders such as policy makers, farmers, environmental protection agencies, nongovernmental organizations, and farmers as well as the community at large. The study discovers the potential of irrigation in enhancing food security. It can also help the policy makers through highlighting the strengths, weaknesses as well as opportunities associated with irrigation. The study can also be used by environmental protection agencies in the promotion of the use of sustainable ways of irrigation. Farmers in Chikomba district may also use the study as a guideline on how to practice irrigation agriculture and also the study may also encourage farmers to practice irrigation agriculture so as to meet the food demands of the community. This study can also give nongovernmental organizations an insight on the area of intervention. This study seeks to improve food security at large hence the community in general will benefit. Policy makers will also benefit in the sense that the results provides informed suggests on how policy can be

improved. The study can also help to reduce mortality rate through suggesting ways on how to bring again back the much needed food and stop malnutrition and starvation related deaths.

1.8 Limitations of the study

The study is limited to the Rambakombwa area the eastern side of Chikomba district which is researchable and familiar to the researcher instead of the entire Chikomba district. There are a number of factors that limited the research such as time frame, lack of resources such as finance to print and distribute the questionnaires, poor road networks of Chikomba district as well as political and religious belief of the respondents. However the researcher maximized the available resources and conditions so as to come up with a valuable research.

1.9 Ethical considerations

Gray (2005) defines ethics as a set of moral principles or norms that are used to guide moral choices of behaviors and relationships with others. Ethical dilemmas are likely to emerge during collection of data and publication of research findings. This research will try by all means to adhere to the Nuremberg code of 1947, which is the most important document in the history of ethics of research. During the collection and presentation of data the researcher will show a sense of expertise giving the respondents respect. In addition the researcher will sought permission from the responsible local authorities first before undertaking the research. Participants will be assured that the information they give would be confidential and used solely for the purpose of the study.

1.10 Data collection tools

The research will used questionnaires to collect data from the respondents. A questionnaire is a set of written questions and prompts which is used for the purpose of gathering information from the despondences. This instrument will mainly be used to collect mainly quantitative data. The research is also used of interviews which are conversations where questions are

asked and answers are given in response. This data collection tool will be mainly used to collect both qualitative and quantitative data from the despondence.

CHAPTER 2

2.1 Chapter overview

Literature review discusses to what extent other researchers have been involved in the topic. It brings out other researchers' contributions to the problem under investigation. The literature review also facilitates the choice of suitable methods that will be used in data collection and analysis. According to Haslam (1990), literature review is a very important step that determines the success or failure of the research. Thus, the literature research is useful in that it promotes a better understanding of the problem. It is important to know what others have done before embarking on the research. In this regard there is a lot of literature covering, irrigation and food security issues. Food security has become a topical issue in development discourse. As a result there is a lot of literature that has been written on food security as well as on irrigation. In Zimbabwe the literature has given too much concentration on isolated large scale irrigations. Thus there was need for research to cover areas like Chikomba district. This chapter is going to go over the available literature on irrigation and food security.

2.2 Definition of Food Security

It is important to note that there is no widely agreed definition of food security. Various scholars have come up with several definitions of food security. Committee on World Food Security (2011) Food security exists when all people at all times have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. This is the most accepted definition of food security. According to Committee on World Food Security (2011) the four pillars of food security are food availability, access to food, utilization and stability and the nutritional dimension, which is integral to the concept of food security. The food security equation by Rukuni and Benstern (1987) has two interrelated components which are food availability and food accessibility. Food availability is defined when there is the existence of food through

food production, storage or trade. The capacity of the household to get hold of food through production, purchases in the market from income earned or transfers is referred to as food accessibility. Thus literature also reviews the meaning of food security.

2.3 Food security situation in the world

Though a lot of effort has been put towards achieving food security, IFAD (2017) acknowledged that there are an estimated 925 million hungry people in the world with the majority of them living in the developing countries. FAO (2015) noted that 12, 9 percent of the developing regions are under nourished with the majority of them coming from Africa and Asia. In the African continent, FAO estimated that 20 percent of the people are suffering from food insecurity. In sub Saharan Africa region 23, 2 percent of the people are undernourished as note by FAO (2015). The above statistics shows that food security situation in the world is not good. It also reviews that the developed world is much better while the developing world is much worse with the sub-Saharan region having one of the worst food security situation. It is important therefore to consider the food security situation of Zimbabwe as it is a country in the sub Saharan region.

It can be noted that Zimbabwe's food security situation became worse since the beginning of the 21st century. Literature shows that food security has remained a fantasy that has not been achieve due to climate change and other socio-political factors. FAO (2017) noted that in 2016, an estimated number of about 4.1 million people where food insecure due to the El Nino effects droughts that affected rain fed agriculture in southern Africa. According to WFP (2017) an estimated 1.5 million people, that is 16 percent of the population are anticipated to be food insecure at the peak of the 2015-16 lean season, the period before the next harvest when domestic food stocks get scarce. This represents a 164 percent increase in food insecurity compared to the previous seasons. Food insecurity has become a problem that has resulted in people relying on food aid from donors like the USAID. According to USAID

(2016) Since June 2015, USAID have contributed about \$127 million in emergency food assistance to respond to the drought in Zimbabwe. Emergency food assistance can be regarded as an indicator of a food insecurity situation. Consequently it can be noted that the food security situation in Zimbabwe is very bad and it is important therefore to look into the major causes of food insecurity in Zimbabwe.

2.4 Causes of food insecurity in Zimbabwe

The unpleasant food security situation in Zimbabwe has resulted in a lot of research and research papers trying to find out what are the major causes of food insecurity in the country. Some scholars blame drought and excessive weather events. These conditions have resulted in reduced or failed harvests which in turn caused food scarcity and high prices of the available food. Some scholars have argued that pests, livestock diseases and other agricultural problems have contributed to food shortage in Zimbabwe as these problems also affect agriculture in a negative way. Climate change also has resulted in unpredictable rain seasons which are now becoming short and hot with little rainfalls. These climatic conditions reduce grain production especially that of rain fed crops. Lack of emergency plans has also been another reason for shortage of food in Zimbabwe considering that the agriculture system has invested little in emergency relief strategies like food stocking and the practice of off season agriculture. Corruption and political instability can also be blamed as it can be noted that the political instability of 2000 to 2002 caused a decrease in food production as farmers lost their confidence and security hence they were forced to move away. Also, cash crops dependence resulted in a decrease in food production as more farmers were now concentrating on cash crop production like tobacco farming at the expense of food crops. This was after farmers have realized that cash crops have much more income as compared to food crops and as a result food production was reduced. Rapid population growth can also be blamed for shortage of food in Zimbabwe based on the fact that as the Zimbabwean population is growing the

demand for food is also growing. According to Malthus' theory the production of food will grow at a slower rate were as population size will grow at a faster rate resulting in food shortage and this is not far from the truth considering the Zimbabwean food security situation.

2.5 Evolution of Irrigation Farming and Irrigation development in Zimbabwe

Irrigation agriculture is one of the oldest techniques used to boost agricultural production and it has been used by early humankind such as the ancient Egyptians. Punnet (1982) argued that irrigation has been carried out for hundreds of years around the world and it started with traditional methods like the Sakia and Shaduf. The early human kind used a technique whereby they developed rivers that supplied water to their field for farming. This was after they realized that there had been frequent droughts in Egypt and many of the dry parts could not reserve food for the whole year and the situation was being worsened by the growing demand for food as the population was now increasing. Troeh et al (1980) alleged that as early as 500BC the Egyptians cultivated land made fertile by the flood waters of the Nile River. By about 3000BC they had built Canal system that carried water from the Nile to their fields. Miller (1982) concludes that irrigation therefore facilitated the growing of crops in the flood plains of the Nile valley so that supplementary food could be accessed. Hence it was one of the ancient measures to ensure food security in area prone to droughts.

In Zimbabwe, the history of irrigation agriculture can be traced back to the coming of missionaries in the early decades of the 20th century. Rukuni and Eicher, (1994) noted that smallholder irrigation was first introduced in the early 1930s by Emery Alvord who was a missionary in the low altitude and low rainfall areas as a necessity to achieve food security. Thereafter, the colonial government dedicated itself to a program of poverty alleviation which was aimed at attaining self sufficiency in food production. This was done through assisting farmers through the provision of subsidies and irrigation equipments. Since then

irrigation agriculture started to be improved chronically. When Zimbabwe attained its independence the new government inherited the use of irrigation agriculture as a way boosting the economy and also to improving the livelihoods of the black majority. Thus until today irrigation agriculture is still being seen a viable way of enhancing agricultural production.

2.6The Influence of Irrigation agriculture on food security

Rukuni et al (2006) put forward that irrigation development represents the most important interface between water and land resource this means that irrigation is the most reliable way of connecting the two important resources crucial for agricultural production which are water and land. Sithole (1995) indicated that irrigation increased household food security marginal to poor rainfall areas. He went on to say that incomes of irrigators were higher than incomes of non irrigator. This was supported by Barau et al (1999) who emphasis on irrigation development as a way to increase food and raw material production as well as rural development. Burrow (1987) noted that small holder irrigated horticulture had proven to be a viable and attractive option for poor farmers in developing countries. He also acknowledged that returns from intensive irrigated horticulture even on tiny plots could greatly exceed returns from rain fed cereal production. This implies that irrigation agriculture is much reliable and have more benefits related to food security than the rain feed serial production. . Hussain (2011) points out that agricultural water irrigation has been regarded as a powerful factor for providing food security, protection against adverse drought conditions and greater opportunity for multi cropping and crop diversification. From the above it can be noted that irrigation agriculture can be used as an adaptive measure to cope up with the effects of climate change. Thus the available literature shows irrigation agriculture as progressive way of enhancing food security.

The literature also shows the importance of irrigation in helping the vulnerable groups of the society, like the rural poor people, women and children. Mamvura et al (2006) noted that irrigation also empowers women and emancipates them socially. Women empowerment through irrigation agriculture can also improve food security as women are playing a leading role in agriculture. In Zimbabwe it can be acknowledged that about 70% of women are farmers. More so, irrigation farming is the source of income for the disadvantaged rural people that are mostly women, widows, orphans and people living with HIV and AIDS. It can also be noted that irrigation contributes positively to the nutrition of the above people as irrigation allows plant diversification which in turn gives them a balanced diet. Thus irrigation can be a good development initiative as it also empowers the poorest of the poor.

2.7 Constraints facing Irrigation Schemes in Zimbabwe

Although irrigation agriculture has been seen as a viable initiative needed to solve the food security problem in Zimbabwe, it has remained a less fruitful due to challenges being faced. As a result there is literature trying to explain the limitations of irrigation. Scholar like Rukuni et al (2006) have noted a number of challenges facing irrigation agriculture such as lack of access to water, lack of proper investment in irrigation, and also poor markets for agricultural products. It can also be noted that the use uncivilized kinds of irrigation can also be named as a challenge to irrigation development. Thus there is need to address the constraint to irrigation. These challenges are mainly challenges that affect the already well established and big irrigation schemes hence there is lack of coverage on the challenges facing by the general people venturing into irrigation farming. To add on these challenges are general covering the whole country hence challenges which are specific to areas like Chikomba district are less covered by literature.

2.8 Irrigation agriculture and the environment

For any development to be sustainable, it is important to look at the relationship between the development initiative and the environment so as to ensure that the initiative does not bring more harm than good on the environment. Every development initiative is shaped by the environment and as a result it is the environment that determines the success of the development. According to the FAO (1999) the introduction of irrigation in a particular farming system brings in both positive and negative aspects to the system. The positive result is that irrigation enhances plant diversification. From an environmental point of view vegetation can help reduce the amount of carbon in the atmosphere. However some scholars have given much concentration on the negative impacts of irrigation on the environment. Irrigation agriculture has been blamed for further depleting the already scarce water resource; it has also been blamed for water pollution as well as siltation of rivers. Consequently, scholars have highlighted the need for using sustainable ways of irrigation so as to reduce the negative effects of irrigation on the environment and in this regard applying the sustainable development concept seems to be the most appropriate way forward .

2.9 Climate change and irrigation

Lobell et al. (2008) noted that impact of climate change on agricultural production will be greatest in the tropics and subtropics, with sub Saharan Africa predominantly helpless due to the range of projected impacts, multiple stresses and low adaptive capacity. This would mean that climate change in sub Saharan Africa will affect many sectors including agriculture negatively. IPCC (2007) asserted that climate change situations for sub Saharan Africa include an increase in seasonal and extreme temperature events and intensity of droughts. In Zimbabwe rain fed agriculture production is expected to decrease by 50% by 2020. This means that for Africa to adapt to climate change there is need to engage in non rain fed agriculture. This can be supported by the fact that the United Nations Convention on Climate Change submitted that, it is estimated that annual rainfall levels sub Saharan Africa are

expected to decline by 60% by 2080. As a result of low rainfall levels, river flow rates are predicted to decrease by 70% by 2050 as averred by Argalawal (2010). From the above predictions, the literature also shows that climate change has a negative impact on irrigation agriculture too. Some scholars have suggested that irrigation can be a way of mitigating and adapting from the impact of climate change if it is practiced in an environmentally friendly manner.

2.10 Chapter conclusion

The chapter presented the results from previous research related to the topic under study. Results about definition of food security, food security situation in the world, causes of food insecurity in Zimbabwe, evolution of irrigation agriculture, the influence of irrigation on food security and constrains facing irrigation in Zimbabwe were presented. The chapter also analyzed what was said by the scholar and area lacking literature were reviewed in this chapter.

CHAPTER 3: RESEARCH METHODS AND MATERIALS

3.1 Research design

Burns and Grove (2003) define a research design as a blueprint for conducting a study with maximum control over factors that may interfere with the validity of the findings. Parahoo (1997) noted that research design is a plan that describes how, when and where data are to be collected and analyzed. Neuman and Hirsch (2002) view research design as the format and structure under which the study will be carried out. In simple terms a research design is a plan on how to carry out a research and it saves the purpose of directing the research. The researcher focused on Chikomba district as a case study so as to add flesh to reflective studies done in the same field about the same problem. The case study confines the researcher to his area of study so as to avoid generalization of study results. The researcher employed a mixed methodology which is the combination of qualitative and quantitative techniques. Brewer and Hunter (1989) noted that the use of mixed methodology helps to reduce the gaps and bias in research studies. Its central premise is that the use of quantitative and qualitative approaches, in combination, provides a better understanding of research problems than either approach alone. In gathering data in the field, the researcher used questionnaire surveys, interviews and observations.

Qualitative and quantitative approaches were used by the researcher resulting in data triangulation where questionnaires, interviews, and observations were utilized. Data triangulation allowed the researcher to look at information from more than one stand point and supplied the researcher with extra information on the study area. To attain the above mentioned data, closed questions were used. Closed ended questions were used because they restricted respondents to choose answers only from particular options which made the data collected smooth to analyze. Closed questions allowed the collection of qualitative data on

the impact of irrigations on household food security. Open ended questions allow the respondent freedom to choose on side, composition, point and extent of his or her answers.

Mason (2002) Through qualitative research we can explore a wide array of dimensions of the social world, including the texture and weave of everyday life, the understandings, experiences and imaginings of our research participants. Qualitative research model allow the researcher to gain an understanding of peoples view, values, attitudes, opinions as well as interpretations. According to Struwig and Stead (2001) qualitative research model involves the use of non numeric data to describe and generate an understanding about a given phenomenon. This means that qualitative methodology allows one to explain situations that are difficult to be explained through the use of numbers or statistics for example tracing the history of irrigation in the area. Qualitative data related to types of crops grown, their uses, opportunities brought by irrigation agriculture and challenges, assistance offered by government, nongovernmental organizations and local authorities. The information was obtained through observations, and interview surveys conducted by the researcher. Qualitative approach enabled thorough capturing of data on the usefulness of irrigation in improving household food security. This allowed the researcher to have a better understanding of local social politics, culture, climate, traditions as well as economics and how they affected the progress of irrigation farming in Chikomba area.

A quantitative research method is a research method that uses statistics and anything that is quantifiable in a logical way of analyzing a phenomenon and its relationships. It is used to answer questions on relationships within measurable variables with an intention to explain, predict and control a phenomenon Leedy (1993). In simple terms quantitative research methodology is the collection and analysis of data using statistics. Quantitative research was used in coming up statistical measures of the impact of irrigation, the numbers of people involved in irrigation agriculture, estimating income and yields from agriculture and also in

estimating the areas under irrigation. Data for quantitative research is measurable hence was obtained through records analysis and questionnaires administered to respondents. Quantitative methodology is of great importance considering

3.2 Target population

Target population is the whole group of individuals or objects to which researchers are attracted in simplifying conclusions as noted by Newman (2000). The researcher was attracted to people and objects related to irrigation and food security in Chikomba. According to ZIMSTATS (2013) Chikomba district had around 121 162 people that is 58 000 males as well as 63 162 female as a result the researcher focused on only those who could meaningfully give the data required by the research and met the sampling procedures outlined in this research, because, for example, some age groups especially minors could not be able to comprehend some questions on irrigation and food security. Farmers were targeted since they constitute the number of people who are directly involved in irrigation and food security. This was also done to ensure that the information obtained was valuable and reliable since farmers are the ones who knew about the types of crops they produce, their intended uses, benefits and challenges they are facing in the management of irrigation schemes. Farmers provided information on the various forms of assistance from any stakeholders in promoting irrigation farming and enhancing food security.

3.3 Sample study

It can be noted that the targeted population mentioned above is very large and impossible to be controlled by the researcher as a result the researcher needs to use sampling techniques. Sampling can be simply defined as processes of selecting a few individuals and items to represent the whole group. Some scholars argue that the population can be referred to, as a set while a sample becomes a sub set. This is based on the thinking that information or data obtained from a small group is usually similar to information obtained from the whole

targeted population. A sample should display all the characteristics of the population for it to be described as representative enough to draw valid conclusions. So sampling is a vital part of research process and the strategies for choosing a sample will influence both the results and interpretation as noted by Budiriro (2013)

3.4 Sampling techniques

For the local farmers at large, the researcher employed convenience sampling as the researcher realized the convenience of asking any farmer in Chikomba as they were all faced with the same problem of food insecurity and they also have quality information about the use of irrigation. Also the researcher will use cluster sampling whereby the researcher will put farmers in three groups, 1) those who have never used irrigation, 2) those who have used irrigation on a small scale, 3) those who have used irrigation on a large scale. From each group the researcher will pick any 4 respondents using random sampling.

In addition, the researcher also employed a purposive sampling which can also be called judgmental sampling. Purposive sampling is a sampling technique that involves coming up with a sample based on the knowledge of the population and the aims and objectives of the study. The researcher selected some individual based on the knowledge they have about irrigation and food security in the area. Purposive sampling can be very useful for situations where you need to reach a targeted sample quickly and where sampling for proportionality is not the main concern as noted by Webster (1985). In this regard the researcher was targeted individuals with knowledge and professional judgment about the contribution of irrigation to food security the area. In this case AGRITEX officer, farmer's cooperation chairpersons, officials from district council's office as well village heads helped the researcher with general information as well as specific information on any activity in the area. AGRITEX officer was chosen as they are responsible for training farmers. Farmers cooperation chairpersons are have the knowledge challenges facing the farmers in irrigation as well as how much is being

produce through irrigation among the members of the cooperation. The local authority provided the researcher with general information as they have the knowledge of every development initiative in the area.

Table: sample size

Stakeholder	Level of involvement	Number of participants
Council officials	officers	2
Farmers cooperatives	Chair persons	2
Key Informants	Members of the community	10
Key informants	farmers	12
Total		26

3.5 Research instruments

3.5.1 Questionnaire

A questionnaire is a tool that has series of questions made to obtain responses for the purposes of gathering data. According to Franklin and Osborne (1971) a questionnaire is an instrument consisting of a series of questions designed to elicit responses which can be converted into measures of the variable under investigation. A questionnaire was used as a research tool after realizing the advantages of using it. Milner (2017) some of the advantages of using a questionnaire includes the fact that, responses are gathered in a standardized way, so questionnaires are more objective, certainly more so than interviews. He also noted that, generally it is relatively quick to collect information using a questionnaire. Also, potentially information can be collected from a large portion of a group. This potential is not often realized, as returns from questionnaires are usually low. Furthermore a questionnaire

promotes the easiness to compare and analyses secrecy which promotes honest responses and easy to administer to considerable group and ability to get lords of data as noted by Cooper and Schindler (2003) This was the reason the researcher employed the use of questionnaire as a data collection tool. Questionnaire was used to collect data about the demographic structure level of productivity types of crops grown and also to evaluate the contribution of the irrigation agriculture to food. The researcher designed a number of questionnaires and he personally administered them to the selected farmers and households.

3.5.2 Interviews

Interviews were also used as a data collection tool as the researcher realized that it is a powerful technique in having accurate information. An interview can be defined a face to face interaction between the interviewee and the interviewer. Different scholars have defined interviews differently; Robson (1993) defines interviews as purposeful conversations initiated by the interviewer for the specific purpose of obtaining research relevant information to satisfy set research objectives. Kahn and Cannel as cited by Saunders et al (2007), defined an interview as a purposeful discussion between two or more people. From the above it can be noted that interview involved direct interaction between two people. With the coming improvement in technology interviews can also be done through the use of calls. The researcher interviews to gather information from those chosen through purposive sampling. The researcher interviewed officials from rural district council, AGRITEX officers; farmer's cooperatives chair persons as well as village heads. The researcher contacted the potential interviewees in advance and the interview date and time were arranged to avoid some unnecessary inconveniences. Also the researcher made sure that the times for interviews were different avoids clashes. The researcher administers the interviews in person and thanked the interviewees' after the interview.

3.5.3 Direct field observations

The researcher also used direct field observation as a way of gathering information about the contribution of irrigation on food security. DeWalt (2002) states that observational research is a social research technique that enables researchers to learn about the activities of the people under study in the natural setting through observing and participating in those activities. This method is very important considering the fact that it allows the researcher to see things on the ground so as to avoid bias and collect accurate information. Some scholars argue that this method can be helpful considering the fact that it does not rely on the ability or willingness of people to provide information. This shows that the method can be used to observe some of the issues that are difficult to explain using words. This method also allows the researcher to collect data when and where an activity is occurring. This would mean that the researcher will acquire a lot of first hand information. Another important thing about direct field observation is that the researcher is able to see what people are actually doing rather than relying on what people say they are doing. The researcher used direct field observation where the researcher visited the gardens and the irrigation fields and also the market places. This method produced a concrete description of what has been observed. This was made easy by the fact that the researcher is well known in the area as he grew up in Chikomba district. The farmers knew the researcher and this helped to overcome restrictions such as security restriction among others since their anticipation was that he will help. The researcher also helped the farmers a little with some ideas as well as manual work, thereby making it a participating observation as he was involved in the activities. Throughout these activities the researcher was recording the observations the farmers were aware of the observation.

It can be noted that for a direct field observation to be successful there is need for the researcher to target certain people and certain objects. In these cases farmers, their fields, households were targeted. This technique was used to compare the food security situations of

households using irrigation and those that are not. It was also used to supplement information gathered through the use of questionnaires, interviews and other written documents. Data captured include types of crops, area under irrigation, and also the volumes of yields. This method of gathering information data included the use of cameras for photographing where the researcher took photos of crops under production, food being consumed and crop residue as a way of supporting his research.

3.5.4 Secondary data

The researcher also used secondary data as a way of collecting information. Secondary data collection is a research tool that involves the collection of data that is not the user. The common sources of secondary data includes, censuses, information collected by the government and local authorities, organizations records, as well as farmers records. The researcher reviewed literature by AGRITEX, the local authorities and also the records of farmer's cooperatives and farmers in general. In addition to that the researcher also reviewed a lot of literature on irrigation and food security so as to acquire background information about the area of study. This research method was used so as to help the researcher overcome some of the challenges that he faced as it helped in saving time and money as well as giving new insights to the research. The method was employed and the researcher went through farmers' records among other document and in the process he gained background data which was useful in comparing with primary data which was collected in the field.

3.6 Data analysis and presentation

Data analysis is the process of arranging raw data into organized data so that useful information can be extracted from it. The process of organizing and thinking about data is important to understanding what the data does and does not contain certain information that is not conversant with the variables under study. The purpose of analyzing data is to obtain usable and useful information. The analysis, irrespective of whether the data is qualitative or

quantitative, may describe and summarize the data, identify relationships between variables, compare variables, identify the difference between variables, forecast outcomes. The sub topics were used to classify data. The researcher employed a number of strategies to analyze data. Quantitative was presented using tables, graphs as well as charts. The qualitative data was presented in form of paragraphs.

3.7 Ethical consideration

Gray (2005) defines ethics as a set of moral principles or norms that are used to guide moral choices of behaviors and relationships with others. Ethics involves considerations such as fairness, privacy, honesty, respect for the integrity and dignity of the individual and confidentiality of certain information. Ethical dilemmas are likely to emerge during collection of data and publication of research findings. This researcher adhered to the Nuremberg code of 1947, which is the most important document in the history of ethics of research. The researcher ensured that participants or subjects were accorded their human rights. Participants were also made fully aware of the nature of the research and their role within it. During the collection and presentation of data the researcher has shown a sense of expertise giving the respondents respect. In addition the researcher sought permission from the responsible local authorities first before undertaking the research. Participants were assured that the information they give would be confidential and used solely for the purpose of the study.

3.8 Chapter Summary

This chapter talked about the research designs and identified the targeted population as well as the case study. Sampling techniques were also discussed in detail in this section. The chapter explained the research tools used in the study and these were the questionnaire, field observation and interviews. Strengths of the data collection instruments were discussed. Finally, the chapter discussed the issue of ethical considerations in research. The next chapter, Chapter 5 looks at Data Presentation and Analysis.

CHAPTER 4: DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

The objective of this chapter is to present, analyze and discuss data that was collected so as to give the findings meaning, the objectives of the study needs to be repeated. The objectives that the chapter aims to satisfy includes to assess the causes of food insecurity in Zimbabwe to examine the nexus between food security and irrigation agriculture, to evaluate the contribution of irrigation agriculture to food security, and to unearth other factors that can contribute to food security. The sources of data discussed in this chapter are answered questionnaires from the respondents which in this case are the members of the community and farmers, separate interviews of the district council officials and farmers' cooperatives' chairpersons as well as results of the direct field observation by the researcher. These were done in a bid to examine the food security situation and also the contribution of irrigation to food security in Chikomba district.

4.2 Information about the sample

Twenty two questionnaires were administered to the twenty two respondents who composed the target population in Chikomba District. The researcher had time to administer the questionnaires and this enhanced the answering of 20 out of 22 of the questionnaires. Two of the questionnaires were not answered due to several factors such as ignorance, miss trust among others so the results are of the 22 administered questionnaires. As a measure to improve reliability and validity of the data, interviews were used so as to complement the questionnaire. The researcher conducted interviews with two rural district council officials, AGRITEX officer as well as two chairpersons of farmer's cooperative groups.

Questionnaire respondents (number of respondents = 20)

<i>VARIABLES</i>	<i>CHARACTERISTICS</i>	<i>FREQUENCY</i>	<i>PERCENTAGE</i>
Age	<i>30- 40 years</i>	3	15
	<i>41- 50 years</i>	5	25
	<i>51 and above years</i>	12	60
Gender	<i>Female</i>	9	45
	<i>Male</i>	11	55
Household head	<i>Female</i>	3	15
	<i>male</i>	18	85
Educational level	<i>primary</i>	7	35
	<i>secondary</i>	10	50
	<i>tertiary</i>	3	15

4.3 Age of respondents and education levels

Respondents' age ranged from 30 to 40 years. 41 to 50 years and 51 and above years, that is 60 percent were respondents 51 years and above, 25 percent were 41 to 50 years respondents and 15 percent were 30 to 40 years respondents. The median age was 55 years showing that the population is old. This is so because the population that is highly involved in agriculture is old and also the young people in the area are occupied by school work. Also the population has suffered from migration especially rural to urban migration were most of the young generation have move to cities and towns in search of greener pastures. The researcher also noticed that the young population does not own much of the needed capital and asserts to be involved in agriculture. 10 percent of the despondence were widowed while 90 percent of the despondence were married.

House hold head, Household composition, Gender and Marital Status

Chikomba area is a mainly patriarchal society with men dominating the leadership positions and all decision making positions. Male dominated household headship as evidenced by 85 percent of the household being male headed while only 15 percent were female headed. The domination of men comes from the religious as well as cultural and traditional belief that men are the head of the household the researcher also looked for information on household composition as it determines the amount and type of food needed to feed everyone in the family and the respondents indicated that 90 percent had more than 7 members in the family only 10 percent had 3 to 7 members. 55 percent were males and 45 percent were females showing that males were dominant in crop production also 10 percent of the respondents were widowed while 90 percent were married.

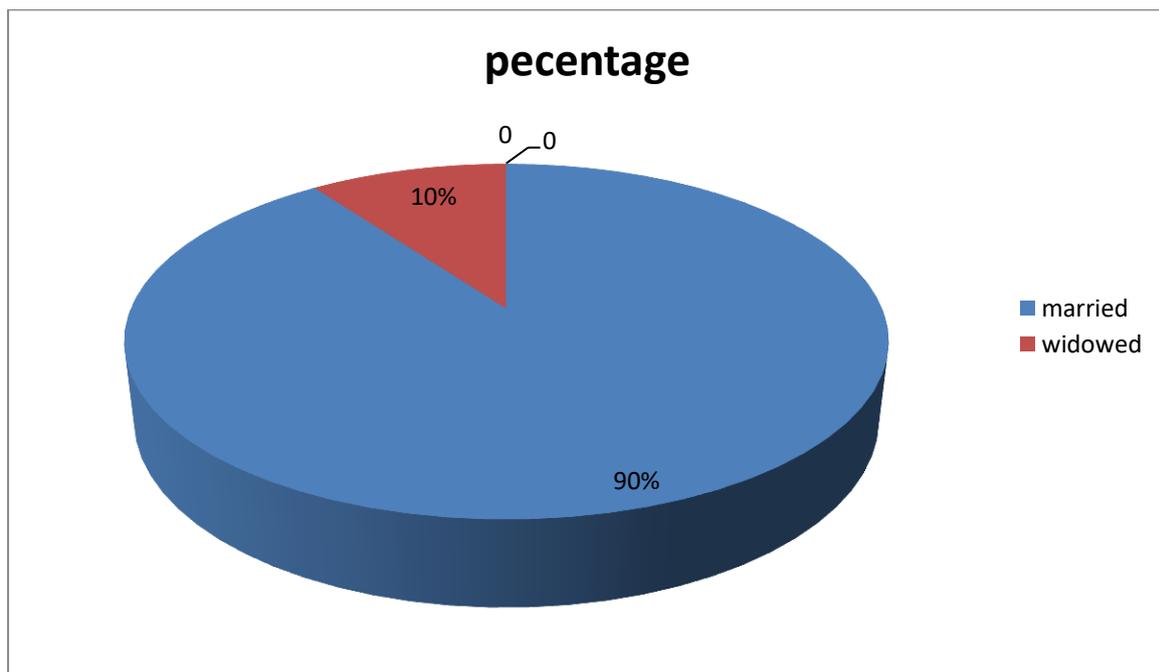


Figure 1 marriage status of respondents

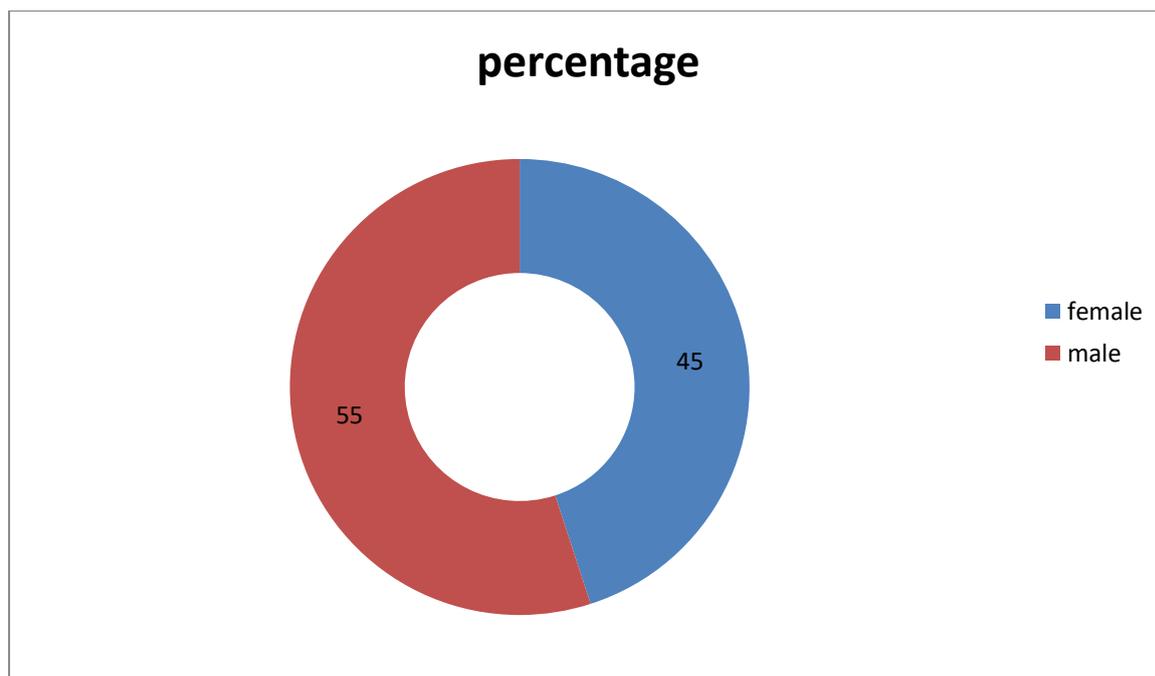


Figure 2; gender of respondents

4.4 Food security situation in Chikomba

Interviews and questionnaires reviewed that food security situations in the area were different across the members of the society. Respondents reviewed that food insecurity affects almost everyone but in different magnitudes. Some households are food insecure throughout the whole year, some are food insecure during the dry season and a very few are food secure the whole year. It was reviewed that food security issues differs from household to household due to a number of factor. Interviews brought to light some of the factor. The most important factor that was reviewed was income level. The local authorities pointed out that household with higher income are less likely to receive food aid hence they can be deemed food secure households. Those with higher income were said to be involved in irrigation agriculture. According to the village head of Chinyama village among those who are food insecure the whole year are the household with a higher number of members who are formally employed. Another factor that was indicated through the interviews was that

household with more assets are more likely to be food secure than those. The assets mentioned includes land, livestock, building as well as farm machinery. The research also revealed that those relying on rain fed agriculture are likely to face food shortages towards and during the commencing of the rain season. The interview indicated that most of food insecurity problems in the area was due to climate change and also lack of the use of adaptive measure also dependency on rain feed agriculture was also among the causes of food insecurity.

Data gathered from the questionnaires interviews and direct field observation reviewed that the food security situation in the area was bad. According to Chinyama village heard only 5 households had never received food aid for the past 5 years. Data gathered from the questionnaires indicated that 80 percent respondents have received some form of food aid in the past 5 years. The council officials agreed that food that has been received from the donors has not been enough to the extent that it has been a source of conflict in the area. This indicate that food security situation in the area is not pleasing. It was also indicated that Chikomba like any other district in Zimbabwe experience the highest food security situation during the period from September to January hence showing that irrigation agriculture can feel the gape.

4.5 Causes of food insecurity in Chikomba

From a general point of view there are a number of factors that are leading to food insecurity in the world such as climate change, conflicts, as well as the growing of non food crops. These factors also affect the food security situation in Chikomba but there are other factors that are specific to Chikomba district as was obtained from the research. One of the major causes of food insecurity as mentioned by farmers cooperative is the shift from food crop production to cash crop production. Due to the higher income associated with cash crops such as tobacco many farmers in the area are now focusing more on cash crop production. As

indicated by the data from the interviews many farmers who are venturing in to cash crop production will end up being food insecure not only because they are not producing food but also due to the fact that most farmers have little experience with tobacco production hence they acquire little profits from cash crops resulting in them not being able to buy enough food. Another important issue that was raised is the lack of input as well as information on agricultural policies AGRITEX officer noted that farmers do not have adequate knowledge about farming they also are not aware of the direction of the agricultural policies explaining that he noted that farmers are still holding on to the old methods of farming like the use of high bride seed also farmers are accepting irrigation farming at a very slow rate yet it is the most reliable way of doing it. This caused by the fact that Chikomba has poor network, the roads are in a very bad situation hence it is hard for AGRITEX officers to reach people and educate them.

4.6 The practice of irrigation in Chikomba

4.6.1 Crops grown in the irrigation fields

Direct field observation, questionnaires and interviews identified several crop which are being grown in the irrigated field among the listed were wheat tomatoes beans onions rape cabbage and maize. Wheat was identified as the most dominant crop which is grown using irrigation in the area the main reason was that wheat is used to supplement grains acquired from rain fed agriculture. From the research wheat was credited for being nutritious as it is used to make bread and Sadza in some instances. Besides being used for consumption within the households another important role of wheat is that it is a source of income for the rural population. The farmers' cooperative chairpersons indicated that farmers with irrigation field can enhance their income by selling wheat grains to the grain marketing board.



Figure 3 farmers showing their wheat fields

Tomatoes were indicated as another dominant crop grown in the area through the use of irrigation the reason for growing tomatoes is not limited to consumption but also includes income generating. Tomatoes have become one of the basic food staffs as it is vital in preparing a complete meal. The above reason has increased demand for tomatoes in the area hence some farmers are making money from it.



Figure 4 tomatoes field under drip irrigation

Beans was one of the top ranked crop being grown using irrigation and the interviews reviewed that it take little time for it to be ripe. The AGRITEX officer noted that beans have a shorter lifespan and as a result farmers practicing irrigation agriculture are encouraged to grow the crop. He also added that this will help farmers to harvest their produce before

depletion of water sources. Beans can be used as *usavi* to go with Sadza, they can also be cooked mixed with maize grains to make *mutakura* and the community recognizes beans as the cheapest source of protein hence it has high demand. It was also noted that beans was a source of income for some household to some extent.

The research reviewed that onions and rape were also among the most grown crops irrigation farming. Mostly grown for home consumption but due to increase in market demand for rape the farmers are accepting the idea to increase leafy vegetables as being advised by AGRITEX.

Cabbage and potatoes are also among the most grown crops in the Chikomba area these are usually grown to supply the demand on boarding schools such as Kwenda mission school and Jemedza high school. They are also grown for home consumption by households. Potatoes are mostly grown income generation as it has high demand especially in the surrounding urban areas like Chivhu, Marondera and also Harare.

Maize is also another dominant crop grown using irrigation. This is so considering the fact that maize is used as the main source of income. Maize is mostly sold as green maize cobs and also for family consumption. When the maize grain pass the stage of being sold as green maize cobs households dry up the remaining grains for Sadza. The maize stumps are used to feed livestock. Thus, showing the great importance of growing maize

4.6.2 Level of productivity of the crops grown using irrigation

Production in the scheme has no season since water is available throughout the year for irrigation. The estimate was based on a farming period of 4 months since most of the crops grown are of 3 months to harvesting the other month being for preparation. Questionnaire and interview results also attribute the importance of AGRITEX in the increased level of productivity the training, seminar sessions and teachings on crops productivity. The graph

below shows the average crop output per household per hectare in a single farming season farming season.

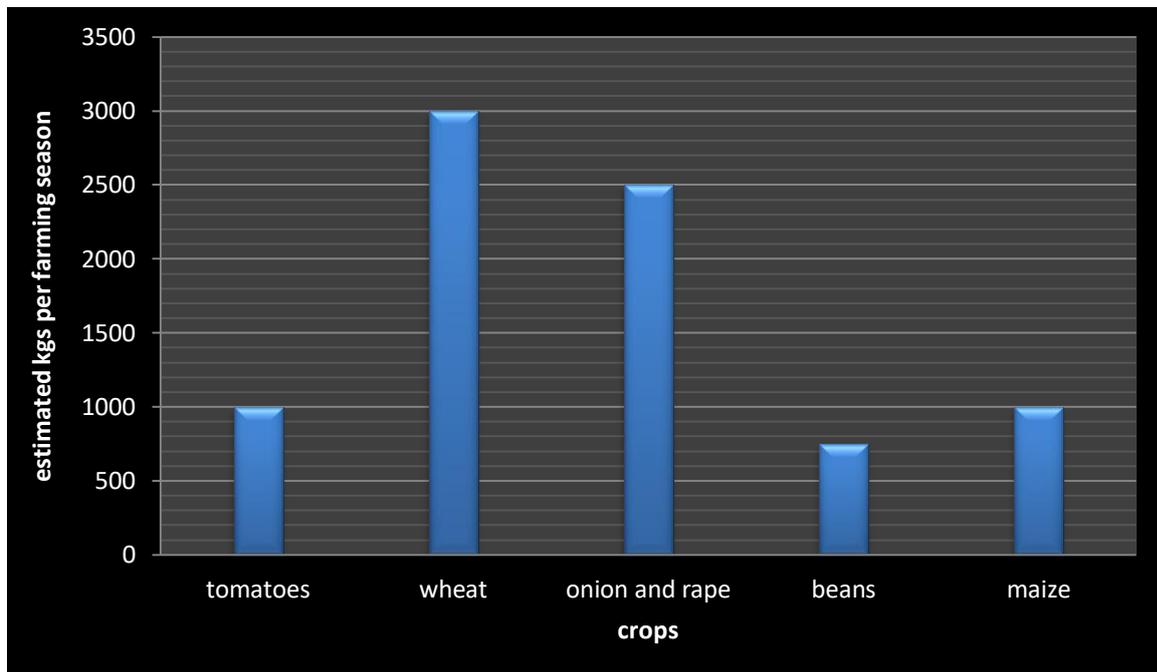


Figure 5 graph showing estimated production per season

As shown in the graph above the researcher found that wheat was the most grown and most productive crop with an estimated average of 3000 kg per farming season per farmer. onion and rape were the second dominant crop in the irrigation fields producing an about 2500 kg per farming season per farmer, tomatoes and maize were maize around 1000 kg per farming season per farmer hence occupying the third position. Beans were the least productive crop with about 750 kg per farming season.

Fertilizer and manure use

Levels of productivity are greatly influenced by fertilizer or manure use. Responses from questionnaire reveal that farmers using fertilizers has greater yields compared to those using manure. Other households prefer manure because it is easily accessible. Manure types include cow dung, humus from nearby forest. Compound D is main fertilizer used in the scheme due

to its use mainly in maize. Ammonium Nitrate and single super are also on some crops usually due to the advice by AGRITEX officer.

4.7 Evaluation of the contribution of irrigation farming to household food security

The evaluation of irrigation on food security will be based on how households become food secure through the use of irrigation. Questionnaires and interviews reviewed that households using irrigation schemes became food secure through both direct and indirect links. Direct link involves the production of food stuffs in to the households and indirect links involved generating income to purchase food and also acquisition of property that puts them in a better position to access more food. The impact of irrigation on all the aspects of food security such as food availability, food accessibility and food utilization will also be used for evaluate the contribution of irrigation farming to household food security The evaluation of the contribution of the irrigation schemes to food security can also be based on comparison between irrigators and non irrigators. Chikomba district is prone to drought hence it can be valid to compare irrigator with those relying on rain fed agriculture and food aid.

The research reviewed that farmers using irrigation do not receive any food aid and they relied on food from the irrigated fields. It was also noted that households in irrigation farming used income generated from irrigation agriculture to buy food. Generally household's standards of living were raised since income generated from the schemes is used to cover any reasonable household's needs. Some farmers sited things like paying school fees and health services. This shows that irrigation helps to improve the livelihoods in a sustainable way. According to AGRITEX most of the farmers in irrigation are now improving and are adopting more sustainable irrigation methods such as the use of pipes and drip irrigation. Also farmers are reducing the use of fertilizer and chemicals while replacing it with the use of organic manure. Sustainable development can be described as development that allows the

present generation to enjoy benefits without compromising the abilities of the future generating. The above helps to reduce water resource depletion hence it can be noted that irrigation development in the area is more sustainable.

Noteworthy is that food availability is determined by the physical quantities of food that are produced, stored, processed, distributed and exchanged. FAO calculates national food balance sheets that include all these elements. Food availability is the net amount remaining after production, stocks and imports have been summed and exports deducted for each item included in the food balance sheet. It can be noted that irrigation in Chikomba play an important role towards food availability this can be valid considering the amount of food being produced in irrigation occupies a significant portion of the total food available in the area. From the questionnaires and interview it was noted that the use of irrigation can improve production. It was estimated that one farmer can provide at least one village with a single product and some farmers also realized excess food. Some noted that irrigation allows farmers to grow a variety of crops hence making food available. However, It was also noted that some of irrigation produce are difficult to store for example tomatoes among other fresh irrigation products hence it affect the availability of food for a longer period.

Food accessibility is a measure of the ability to secure entitlements, which are defined as the set of resources (including legal, political, economic and social) that an individual requires obtaining access to food. As noted above irrigation agriculture increases food production this automatically means the cost of food is reduced. According to the respondents during the dry season a 20 liter bucket of tomatoes cost only about 5 USD? Some of the respondents acknowledged that if there were no irrigation farming in the area a 20 liter bucket of tomatoes would cost about 20 to 30 dollars. A food price is one of the major factors that determine food accessibility from the above it can be noted that irrigation plays a positive role towards food accessibility. To the farmer irrigation farming enhance their access to food considering

that they are the direct beneficiaries as they use the produce from irrigation to feed their households. Also farmers can also gain more income that can be used to buy food some respondents said that the money that they realize from the field can be used to some non crop food stuffs for example meat. It can be concluded that farmers using irrigation have a double chance to access food. It can also be noted that the benefits are not only for the farmers using irrigation but it also covers for the whole community. Thus irrigation plays a very crucial role in improving access to food in Chikomba district.

Another very important aspect of food security is food utilization. Food utilization refers to the use of food and how a person is able to get essential nutrients from the food consumed. It includes the nutritional value of the diet, including its composition and methods of preparation; the social values of foods, which state what kinds of food should be served and eaten at different times of the year and on different occasions; and the quality and safety of the food supply, which can cause loss of nutrients in the food and the spread of food borne diseases if not of a sufficient standard. In Chikomba climate change among other causes has brought negative changes that affected food utilization in the area. It can be noted that irrigation agriculture has a potential to improve food utilization as observed from the research. It was noted that most of the produce of irrigation scheme have high nutritional value. Irrigation agriculture allows farmers to grow many types of crops including wheat, tomatoes, potatoes, onions, rape, maize, and beans among others. The above provides people with all necessary nutrients hence avoiding malnutrition. The respondents argued that most of food stuffs from rain fed agriculture provide them with carbohydrates mainly hence irrigation helps to supplement with other nutrients. Some respondents also mentioned the importance of wheat in making of breakfast bread and the importance of rape, beans, onion and tomatoes in making *Usavi*. Thus irrigation also plays an important role in improving food utilization in Chikomba area.

Differences between irrigators and non irrigators

To assess the contribution of irrigation agriculture to food security in Chikomba district the researcher compared the irrigators and non irrigator so as to see if there is any difference. The table bellow shows the differences between irrigators and non irrigators in terms food security.

irrigators	Non irrigators
Higher income that allows them to access food	Lower income and limited access to food from markets
Owned a lot of valuable assert hence improving their capabilities	Owned few asserts hence poor capabilities to produce food
Produce sufficient food for themselves	Rely heavily on food aid
Diversification of crops	Grow few types of crops
Non seasonal farming	Seasonal farming
Intensification (use of small piece of land)	Intensification (use of large piece of land)

4.8 Other benefits of using irrigation

Besides advantages related to food security irrigation is also associated with other advantages that enhances the standards of people in the area. Council officials and farmers asserted that irrigation agriculture is a platform that allows full utilization of water resource. The explained by saying that irrigation allows them to use the abundant water resources in the area rivers like Dzidze river was cited as one of the sources with plenty of water. In addition it can be noted that irrigation farming is a source of income in the area. It was noted that most of the irrigation produce have higher value and are also on demand. Some farmers argued that they realized income from irrigation produce which they used to pay for social

services like education and health services. On average a single farmer can realize about 200 USD per month as obtained from the research.

In furtherance irrigation agriculture was also noted as a factor that accelerates the process of asserts ownership. The table bellow shows the asserts ownership of irrigator as compared to non irrigators

Employment creation was also noted by the respondent one of the respondents said that “*Ma irrigations anotibatsira nekuti tinonoshandako kusakura nekukohwa tichiwanawo tumari.* Irrigations help us with income because sometimes we work in the fields (weeding and harvesting) for income.

Some farmers noted irrigation does not only help us with crops but it plays a major role in livestock feeding. They noted that they use *mashanga* to feed their cattle and also the irrigation systems play a crucial role of providing livestock with drinking water. In areas with no irrigation a large population of livestock is lost through either death due to shortage of food and water or due to destocking by farmers. Destocking is mainly caused by overpopulation of animals this means that the resources will be insufficient to feed the animals.

4.9 Challenges faced in the use of irrigation.

Results from questionnaire interview and direct field observation reveal challenges farmers face in day to day operation in their irrigation farms. The high cost of improving and maintaining the mechanical structures of the irrigation schemes seem to be a pressing issue. Farmers argue that the pumps and pipes they use need regular services and to service one it requires a lot of money. The construction of dams and water canals were also identified as initiatives associated with higher costs. Water bill seem to be a serious issue farmers complained about the involvement of ZINWA noting that charges by ZINWA are so high that

it is threatening the productivity since water sometimes is closed if the bill is not settled. Interview by AGRITEX, highlighted ignorance by farmer especially during training sessions since some will be not willing to advance to modern ways of farming than their traditional ways



Figure 6 a farmer in the process of constructing a dam

AGRITEX noted that the crops grown are horticultural crops hence they heavily depends on chemicals to have a high yield, hence shortage of inputs like fertilizers, insecticides and herbicides are vital to enhance higher yields in the scheme. Labor demands in the scheme is very high especially for weeding farmers are reluctant to use herbicides as advised by ZINWA, considerable losses to income is noticed to pay for labor. Farmers also highlighted that there is no credit facility for them from any bank saying we are treated same as dry land communal around.

It was also noted that irrigation has been accused of fuelling environmental degradation. Farmer's cooperatives chair persons indicted that several development agencies have highlighted that irrigation contribute to environmental degradation. It was noted that ZINWA

accused irrigators in the area for water pollution. EMA also have argued that irrigation should be practiced with caution as it may result in Stalinization. The strict monitoring of irrigation activities has been a challenge to the farmer as they can no longer execute their work efficiently.

4.10 Chapter summary

This chapter talked about information obtained from the research. It presented data on, information about the sample, age of respondents and education levels, House hold head, household composition, gender and marital Status, food security situation in Chikomba, causes of food insecurity in Chikomba, crops grown in the irrigation fields, level of productivity of the crops grown using irrigation, evaluation of the contribution of irrigation farming to household food security, other benefits of using irrigation, as well as challenges faced in the use of irrigation.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

It can be noted that irrigation agriculture had a positive impact on rural household food security in the study area. This is clearly evidenced by improved socio-economic status of households involved in irrigation farming. Households make use of irrigation fields and gardens had enhanced on food availability accessibility and consumption patterns as a result of increased income, assets accumulation as well as improved food productivity. The importance of irrigation farming as an adaptive approach in drought prone areas of Chikomba in natural farming region three reveals that sustainable decrease in hunger can be accomplished in the view of supporting local ideas. However, financial, mechanical and technical support needs to be given to households in order to boost irrigation production from current levels and reduce negative impacts associated with irrigation agriculture. Lastly, local communities must incorporate indigenous crops due to increased knowledgeable changes in weather conditions and need to progress not only in household food security but also national food security.

Research results show that the irrigation farming is a dominated by men, married couples, widowed and the economically active population. The outcomes also demonstrate that irrigation is efficient in mitigating the unconstructive impacts of drought in dry land areas this is in line with the sustainable livelihood approach. Food security has also assured higher nutrition levels, improved access to food and availability of food to the households involved in irrigation agriculture. It is clear then that irrigation largely achieve its stated objectives, especially rural household food security in dry land areas as the benefits of irrigation trickledown to include none irrigators. Such ventures therefore demonstrates a genuine, reasonable and practical potential plan for stirring towards accomplishing sustainable

development goal number two which is to end hunger, achieve food security and improved nutrition and promote sustainable agriculture.

5.2 Recommendations

- There must be uninterrupted research in all scopes of irrigation agriculture in order to have sustainably managed projects. Research should be used to introduce new way of improving irrigation produce without using many resources. In this case research can also help to reduce production costs and also research should be done so as to bring in sustainable irrigation
- Irrigation farming should be amplified as a means to increase employment opportunities in rural areas in view of the very limited job opportunities on the formal labor market. This can help to improve the standards of living for most of the rural people.
- Financial support is also needed to help with input for irrigation farming schemes. The Agricultural Bank (AGRIBANK) should support smallholder irrigation farmers by offering soft loans for input purchase. This can also help to improve on irrigation infrastructure which is deemed expensive.
- Households should form joint ventures amongst them to complement irrigation schemes with other small scale projects like poultry, pig and goat production. Such projects will help to increase nutrition at the household level.
- Training farmers by AGRITEX should also focus on proper storage, use and application of chemicals to reduce negative environmental impacts and on personal safety. Proper storage can also improve on food security as people will acquire skills to store their produce for a longer period and also for future use.

- The improvements of institutions guiding the use of water and land resources. The government and other stakeholders should find a way of mitigating conflicts between authorities and farmers. As a way of promoting a good takeoff, the authorities should relax some of the law restricting people from using water resources hence this may encourage many people to be involved in irrigation agriculture.
- The third sector should be active in the agriculture sector especially the irrigation development branch. Instead of the third sector assisting with food aid they should put more focus on improving irrigation that way their aid will be more sustainable.
- Farmers in the irrigation sector are encouraged to improve the technology they use for irrigation. It can be noted that the use of mechanisms that are designed to save water are essential. Water saving techniques like the use of drip irrigation are in line with the changing climatic conditions as it encourages efficient water usage.
- The use of farmers cooperative groups is also encouraged as it was noted that farmers in cooperative groups are more organized and have amplified access to inputs loans and markets

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APPENDICES

APPENDIX 1: Questionnaire for farmers and community members in Chikomba district

My name is Anesu Chitani a student at Midlands State University doing his research on “the contribution of irrigation agriculture to food security in drought prone areas: The case of Chikomba district.

Confidentiality and Consent: ‘I am going to ask you some personal questions that some people may find difficult to answer. Your answers are however completely confidential. Your name will not be written on this form, and will never be used in connection with any of the information you give me. However, your honest answers to the questions will be greatly appreciated.’”

SECTION A: SOCIO-DEMOGRAPHIC INFORMATION.

Tick in the appropriate box

1) Sex: Male Female

2) Age: 30-40 41-50 51 <

3) Marital status:
Single Married Widowed

4) Educational level:
Primary secondary Tertiary
Other (Specify) -----

5) Occupation:
Miner Farmer Others (*specify*)
Specify -----

6) How long have you lived in Chikomba
1-5yrs 5-10yrs 10-15yrs 15+

7) Household head

Male headed Female headed

8) Sources of Income

9) Level of education

10) Household asset ownership

11) Family size

1-4 people 4-7 people above 7 people

Section B: Questions

12) Do you practice irrigation agriculture, if yes on what scale? -----

13) What are the types of crops grown using irrigation in the area? -----

14) Identify the seasons for crops grown? -----

15) Identify the crop grown by majority irrigators and why? -----

16) State most grown crops and estimated output per season

Crop name	Estimated output per season
1	
2	
3	
4	

17) Did you produce enough for family consumption from irrigation farming?-----

18) Identify the benefits of consuming irrigation produce -----

- 19) What the favourable seasons per given crop? -----

- 20) Do farmers use fertilizers and on which crops? -----

- 21) Any assistance in resources to the farmers from any organisation? -----

- 22) Any improvements to the levels of productivity of irrigation by farmers during the
past few years -----

- 23) If there are what changes and what influenced them? -----

- 24) Did you purchase cereals (food grain) for your family consumption? -----

- 25) Indicate the total money you spent to purchase food grain in a year:-----
- 26) What were your sources of income? -----
- 27) Did you get income from the sale irrigation produce products if yes how much? -----

- 28) Are you regular user of credit service for your agricultural activities? -----

- 29) Have you ever received food aid for the past 5 years:-----
- 30) Food assistance is given through which organisation? :-----

THANK YOU

APPENDIX 2: observation checklist

The contributions of irrigation farming to food security in Chikomba district
Zimbabwe.

WHAT TO OBSERVE	RESEARCHER'S COMMENTS
Nature of the households	
Irrigation infrastructure	
Scale of irrigations	
Types of crops grown	
Sources of water	
Assets owned	
Visible effects of irrigation	
Storage facilities	

APPENDIX 3: interview guidelines

Interview guideline directed to the farmers cooperatives chairpersons, council officials, and village heads.

- 1. What your position in Chikomba area*
- 2. Can you give an overview of the food security situation in the area*
- 3. Causes of food insecurity in the are*
- 4. How frequent is irrigation farming in the area*
- 5. Identify crops grown in irrigation fields*
- 6. How does irrigation contribute to food security*
- 7. How does the crops help to enhance food utilisation*
- 8. Can you give benefits associated with irrigation*
- 9. Can you give major differences between irrigator and non irrigators*
- 10. What are the estimated productivity in irrigation*
- 11. Seasons favourable for irrigations*
- 12. Any improvement on irrigation agriculture*
- 13. In what area is irrigation lacking*
- 14. Is irrigation sustainable in the are*
- 15. What are the challenges facing irrigators in the area*
- 16. What can be done to develop irrigation in the area*