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The Impact of Small Scale Irrigation Projects on Food Security: The case of Inkosikazi Irrigation Project, instituted by World Vision in Wards 4 and 5, in the Bubi District, Zimbabwe.

by

MAJORITY MTONGA

3517-412-9

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SUPERVISOR: MR S R PLAATJIE

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Declaration

I declare that: **The Impact of Small Scale Irrigation Projects on Food Security:** ***The case of Inkosikazi Irrigation Project, instituted by World Vision in Wards 4 and 5, in the Bubi District, Zimababwe*** is my own unaided work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

_____ _____

SIGNATURE DATE

(Mr MAJORITY MTONGA)

Student Number: 3517-412-9

Dedication

This thesis is dedicated to my wife, Nolicy, and our two small sons, Mlungisi and Mehluli, who gave up their precious family time to allow me to concentrate on and to complete my studies.

“The eyes of the Lord are on the righteous, and His ears are open to their cry.” (Psalm 34:16, NKJV).

Acronyms

1. GOZ Government of Zimbabwe
2. FAO Food Agricultural Organisation
3. FDI Foreign Direct Investment
4. IMF International Monetary Fund
5. GDP Gross Domestic Product
6. TNCs Transnational Corporations
7. WTO World Trade Organisation
8. ARDA Agricultural Rural Development Authority
9. CRS Catholic Relief Services
10. GMB Grain Marketing Board
11. Fewsnet Famine Early Warning Systems Network
12. CSO Central Statistical Office
13. WEO World Economic Order
14. RDP Reconstruction Development Programme
15. AGRITEX Agricultural, Technical and Extension Services
16. ICRISAT International Crops Research Institute for the Semi-Arid Tropics
17. IWMI International Water Management Institute
18. NAC National Aids Council
19. SADC Southern Africa Development Community

20. SLF Sustainable Livelihood Framework

21. WVI World Vision International

22. ZIMVAC Zimbabwe Vulnerability Assessment Committee

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CHAPTER THREE RESEARCH METHODOLOGY

Abstract

This study provides an overview of the impact of small scale irrigation on food security using the case study of Inkosikazi irrigation scheme in the Bubi District of Zimbabwe. The study discovers a set of political, economical, social, technological, legal, and environmental factors that are holding the district under food insecurity. The communities have been relying on food aid from international NGOs like World Vision, the Catholic Relief Services and Care International. This dependence has further crippled them into more vulnerability and poverty as their productive capabilities cannot be explored. The communities of Wards 4 and 5 established the Inkosikazi irrigation scheme with the assistance of World Vision with the sole objective of improving their nutritional status. Even though the project took six years to complete, it would also cater for improved income levels of the communities. This study assesses the impact of the Inkosikazi irrigation scheme using the activities of 240 irrigation farmers on landholding plots of 0.25ha each. No doubt the establishment of the irrigation scheme has contributed to new life improvement perspectives for a community that was once perceived as vulnerable, poor, fragile, exposed and incapacitated. The project stands out as one of the lasting initiatives to reduce the food trap in the district and indicates similar initiatives can be applied for other communities in Zimbabwe in general for the same reasons.

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CHAPTER ONE

1.0. Introduction

This is an evaluative study to ascertain the impact of small scale irrigation projects on food security as an initiative that can be used to ensure food security. The study uses Inkosikazi small - scale irrigation scheme as a case study. Inkosikazi small-scale irrigation scheme was instituted by World Vision in Wards 4 and 5 of Bubi district, in Zimbabwe. Inkosikazi Communal Area lies in the Bubi district which is located in Matabeleland North Province of Zimbabwe. Inkosikazi is situated 135km northeast of Bulawayo, Zimbabwe's second capital city. Bubi district has a population of 125,000 people, (Central Statistics Office, 2002), with more than 90% of the population depending on subsistence agriculture. The district lies in agro-ecological region IV, with the area receiving less than 600mm average rainfall per year (GoZ, World Vision, 1998). World Vision established an Area Development Programme (ADP) to cover the six wards lying in Inkosikazi area to help intervene and meet the need for food security. The main intervention was the establishment of an irrigation project by construction of a weir across the Mbembesi River in 1999 and creating a reservoir whose water is used to irrigate 60 hectares of arable land. This study therefore aimed to measure whether the irrigation scheme, that took six years to complete, has been effective in improving the livelihood of the communities of wards 4 and 5. This first chapter outlines the background of the study, the focus of the study, the statement of the problem, the objectives of the study, the justification of the study, and lastly, the layout of the whole study.

1.1. Background of the Study

As the international development community makes frantic efforts to halve the number of hungry and undernourished people by 2015 as enshrined in the Millennium Development Goal (Gowing, 2003:2), food security has remained a formidable challenge in Sub-Saharan Africa. Sub-Saharan Africa (SSA) is the world's most vulnerable region regarding food security with 44% estimated to be food insecure in 2011, and the food insecure projected to

increase by 17 million people by 2021 (United States Department of Agriculture, 2011:4).

Zimbabwe has been struggling to feed its 12 million people in the last decade (FAO, 2012:3). Despite the economy being dominated by agriculture, contributing 33.9% of Gross Domestic Product in 2010 and 19.3% in 2011 (Government of Zimbabwe, 2011), production of food has been plummeting due to a complex nexus of socio economic, political and environmental factors. Convergence of factors such as climate change related disasters in the form of droughts and floods, political upheavals, economic challenges, poor government policies and resource prioritization, declining infrastructure, market distortion, structural challenges in accessing agricultural inputs and adverse impact of HIV and AIDS, have exponentially increased the number of people who are slipping through the social safety net into extreme poverty (Food and Agricultural Organisation, 2009:24; Moyo, 2010:30-31; Bjornlund, 2004:74; Oxfam 2007:4-5; United Nations 2008). These factors have changed Zimbabwe from the bread basket status to a net importer of food and perennial recipient of food aid. According to the World Bank (2009:1) Zimbabwe was once a bread basket for the Southern Africa region, but the period between the years 2000-2008 witnessed a dramatic transformation from a food surplus to a food deficit country at the household and the national levels. In 2011 WFP and FAO had also estimated that in 2012, approximately 2 million people would need food hand-outs. Food security levels in Zimbabwe tend to follow the agro-ecological regions. As postulated by Vincent and Thomas (1960:8), Zimbabwe has five agro-ecological regions (AER) classified according to the characteristics of rainfall as shown in the Table 1 below.

AER	Percent total area	Average annual rainfall	Rainfall characteristics	Agricultural potential
I	1.56	>1 000 mm	Well distributed throughout year	forestry, fruit, intensive livestock; smallholders <20 percent;
II	18.68	700-1 000 mm	Confined to summer	Intensive farming, some cash crops and livestock; irrigation for winter wheat; smallholders
III	17.43	650-800 mm	Infrequent/heavy; seasonal drought	Semi-intensive farming, extensive beef ranching; smallholders 39 percent; important role of irrigation (periodic seasonal droughts, prolonged mid-season droughts, rain starting date unreliable);
IV	33.03	450-600 mm	Erratic: frequent seasonal drought	Communal lands too dry for successful crop production without irrigation; millet/sorghum and some cash crops; smallholders respectively 50 and 46 percent
V	22.2	<450 mm	Very erratic: drought prone	
	3.1	Unsuitable for any form of agricultural use		

Table 1: The Agro Ecological Regions in Zimbabwe: Adapted from FAO, 1998

As noted by Rukuni, et al. (1990:43) and Nhundu and Mushunje (2008:3), regions IV and V have the largest number of food insecure households in Zimbabwe, and accessing food through dry land production has been unsuccessful for most communal households given the prevailing agro-ecological factors.

The government of Zimbabwe and academics alike have advocated for small scale irrigation projects as a food security and poverty reduction strategy especially in dry areas such as agro regions IV and V. Rukuni et al. (2006:43), Nhundu and Mashanje (2008:44) and the World Bank (2008:167) have all acknowledged the development of irrigation as requisite for dealing with food security and as a development spinner in rural communities. Irrigation is not only a powerful factor for providing food security, but it also brings resilience against adverse drought conditions, increases prospects for employment, stable income, and greater opportunity for multiple cropping and crop diversification (GoZ, 2012). The Zhulube and Silalabuhwa irrigation schemes in Insiza district, Zimbabwe, are good examples of an improvement in food security using the projects (Munamati, Mhizha, and Sithole, 2005:19). The Silalabuhwa irrigation scheme initially covered 360ha, and expanded to 440ha, with 843 plot holders and their families working on the irrigation scheme producing maize, wheat, vegetables, sweet potatoes, tomatoes, and sugar beans. The scheme has been able to supply other nearby towns like Gwanda (the Matabeleland South Province capital) and Filabusi with grains, beans, and vegetables, and is also a major supporter of the government food stock through sales to the Grain Marketing Board. (Munamati, Mhizha, and Sithole 2005:19). Zhulube irrigation is much smaller covering 20ha and is worked by 80 plot holders with their families, also producing maize, wheat, vegetables, sweet potatoes, tomatoes and sugar beans (Manzungu, Mabiza and Zaag, 2011:4). Mudima (2010:26) studied five irrigation schemes in Zimbabwe and concluded that irrigation is one way of generating employment in rural areas. He affirms that all the schemes studied were found to hire labour additional to that provided by the irrigating households to assist in land preparation, planting, weeding and harvesting (Mudima, 2010:26).

Small holder irrigation in Zimbabwe dates back to 1928, through the colonial period and continues to be advocated for in the post-independence era. Although the government of Zimbabwe has put small scale irrigation as a prime food security strategy on paper, in practice, resource allocation for small scale irrigation in poor regions remains negligible thereby undermining their potential to bring food security and contribute significantly to the national

economy (Manzungu and van der Zaag, 1996:12). In terms of design, small scale irrigation schemes are electric/ diesel powered or gravity fed, and employs sprinkler or surface irrigating methods. Most diesel or electricity powered schemes experience viability and sustainability challenges as operational costs are quite high and often suffer from shortages of energy which regularly bedevil the Zimbabwean economy. Mudima (2010:28) affirms that although the Hama Mavhaire and Chitora irrigation schemes are some of the successful electric-powered projects in Zimbabwe, there exist some disruptions caused by load-shedding due to electricity shortage in the country. Mudima (2010:28) marvels at the success of the two irrigation projects and ellucidates:

The establishment of the irrigation schemes has resulted in the provision of infrastructure around which other economic activities take effect. The electrification of the pumping station at Hama Mavhaire, for example, has resulted in the nearby shopping centre being also electrified. A study of the scheme found that before the scheme there was only one general dealer shop, one bottle store and one diesel-powered grinding mill. Now there are four general dealer shops, two bottle stores, one hardware store, one butchery and five electrically driven grinding mills. At Chitora before the scheme the nearest shopping centre was at Mutoko, 60 km away. However after the establishment of Chitora irrigation scheme and two other adjacent schemes, a vibrant business centre namely Corner store was established only 16 km from the scheme as a result of the increased economic activities brought about by the irrigation schemes.

The Inkosikazi Communal Area lies in the Bubi district which is located in Matabeleland North Province of Zimbabwe. Inkosikazi is situated 135km northeast of Bulawayo, Zimbabwe's second capital city. The Bubi district has a population of 125 000 people (Central Statistics Office, 2002), with more than 90% of the population depending on subsistence agriculture. The district lies in agro-ecological region IV, with the area receiving less than 600mm average rainfall per year (GoZ, World Vision, 1998). World Vision established an Area Development Programme (ADP) to cover the six wards lying in the Inkosikazi area to help intervene and meet the need for food security. The

wards include wards 2, 3, 4, 5 and 16 with a total population of over 50 000 households. The main intervention was the establishment of an irrigation project by construction of a weir across the Mbembesi River in 1999 and creating a reservoir whose water is used to irrigate 60 hectares of arable land. The poor rainfall variability, coupled with the poor sodic soils, makes the area generally unfavourable for rain fed crop production, thereby making the district one of the most food insecure in Zimbabwe (FAO, 2006:8; Mushunje & Mukarumbwa, 2010:3; World Vision, 1998). The main livelihoods activity in the area is dry land subsistence agriculture and cattle heading. The main crops being grown at subsistence level include: rapoko, millet, sorghum, maize, groundnuts, round nuts, sweet potatoes, watermelons, pumpkins, cowpeas and vegetables. The livestock kept include cattle, donkeys, sheep, goats, and chickens (World Vision, 1998:16).

Inkosikazi area, covering six wards, is among the worst food insecure areas of Bubi district because the area lies in a perennially drought stricken region that receives annual rainfall of below 600mm. The Inkosikazi area is approximately 35km from the district centre, Inyathi Growth Point, and 135km away from Bulawayo. The erratic rainfall and cyclonic effects in some seasons, economic crunch, coupled with the negative impacts of HIV/AIDS have greatly affected agricultural output in this area. The communities in the whole District have been relying on food aid from international NGOs like, World Vision, the Catholic Relief Services and Care International because their crops repeatedly failed.

The small irrigation project is under the management of the Community Irrigation Committee, 60ha have been put under gravity fed surface irrigation benefiting 240 families from the two wards of which 47% are women. With the main objective being to contribute towards increased food production and income for 240 poor and vulnerable households in response to climate change, each farmer was allocated 0.25 hectares of land and agricultural inputs. The project was done in three phases. The first phase was completed in mid 2008, the second in mid 2009 and the last in 2010, and farmers of the

last phase were expected to harvest their first crop in the third quarter of 2011.

1.2. Focus of the Study

This study focuses on wards 4 and 5 of Bubi district in Zimbabwe. Bubi district, with a population of 125 000 (Central Statistical Office, 2002), is subdivided into four political constituencies and 19 administrative wards. Inyathi Growth Point is the commercial and administration centre servicing all the 19 rural wards. The infrastructure in all sectors is generally deteriorating with road, energy and education sectors being the worst hit.

The area is under the jurisdiction of Chief Ndiweni and headman Bhidi. The two wards have a total population of 13 700. Ward 4 has an approximate population of 9700 people, of which 4520 are males and 5180 are females, and Ward 5 has an approximate population of 4012 people, of which 1606 are males and 2406 females. Each ward has 6 Village Development Committees (VIDCO's) in the ward made up of 10 villages and each village has approximately 120 households on average (World Vision, 1998:24).

Ward 5 hosts the Inkosikazi dam which has been built on Mbembesi River, which during pluvial periods can reach a maximum capacity of 154, 227 mega litres (World Vision, 2002). The feeder dam which was commissioned in 2001 occupies over 1200 hectors of land and was solely constructed to water small irrigation estates of the communities some 5km away.

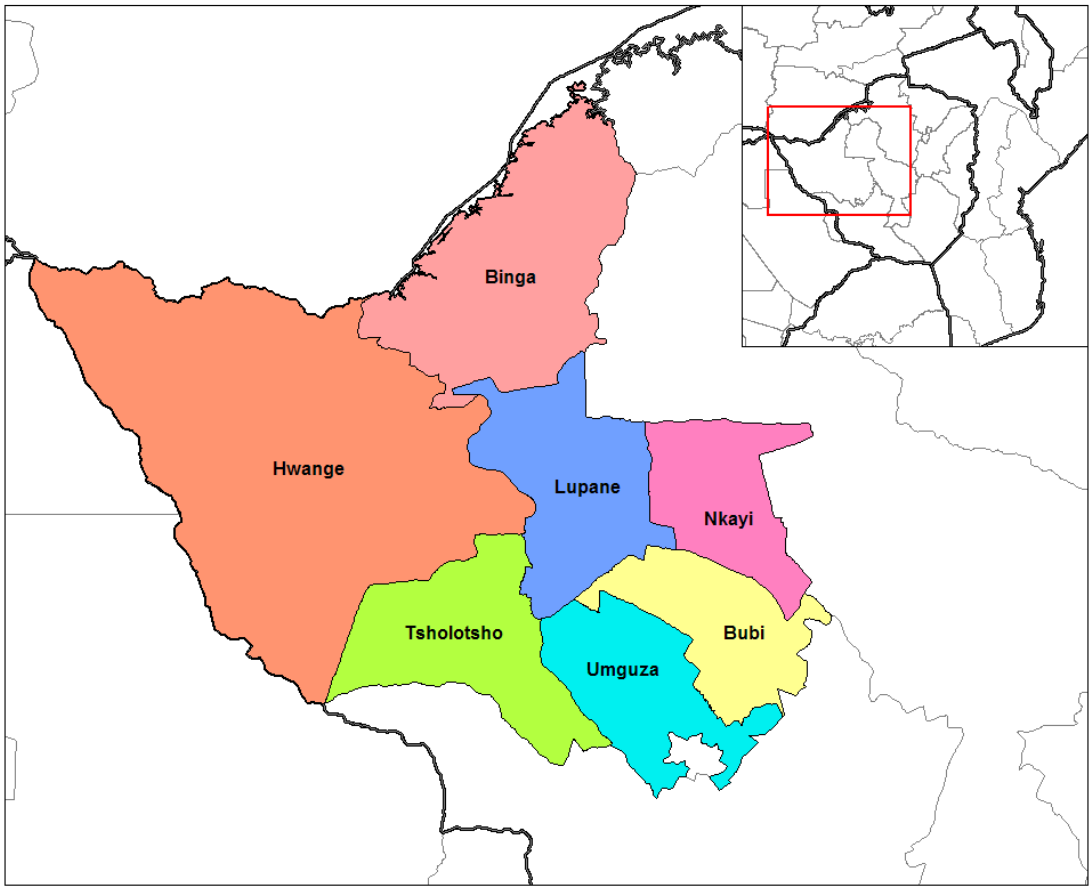


Figure 1: ***Location of Inkosikazi Irrigation Project, Bubi District, Matabeleland North Province, Zimbabwe. Latitude 19.3217° S and longitude is 28.3599° E and altitude is 1,137m****. (Adapted: zw.geoview.info/Matabeleland, 2012).*

The irrigation scheme which has been established in phases of 20ha per year since 2005 is located on the down side of the feeder dam five kilometres away and utilizes the gravity fed system. Water is transported from the dam via a pipeline which is connected at the base of the dam, and distributed to the fields through the use of canals.

1.3. Statement of the Problem

According to FAO (2006:13) estimates, about 70% of Zimbabwe's communal farmers live in agro-ecological region IV and V. The regions are characterized by low, erratic and poorly distributed rainfall of less than 650 mm/year (Mushunje & Mukarumbwa, 2010:6). For the past ten years since 1999, the Zimbabwe economy has been ravaged by widespread rainfall deficits, the impact of HIV/AIDS and an acute foreign currency shortage which has resulted in a livelihoods crisis for the majority of the country's rural and urban poor causing them to experience food insecurity (FAO, 2008:12). Bubi district, which lies in agro-ecological region IV, has been among the worst hit districts in terms of food insecurity. Due to climatic change, Bubi west, the area that covers Inkosikazi area and in which wards 4 and 5 are located, has been faced by recurrent and prolonged droughts coupled with periodic flash floods in the recent years. Rukuni, et al. (2006:13), FAO/WFP (2008), and World Vision (1998) observed that the droughts, coupled with poor access to productive resources by the community due to limited investment by government and private sector into agriculture, has left the two regions, IV and V (in which the two wards 4 and 5 of Inkosikazi are located), experiencing acute food insecurity and being heavily dependent on external food hand-outs like the rest of the district Wards. The situation has been further compounded by high and rising levels of poverty, the impact of HIV/AIDS, unemployment and several years of macro-economic and political instability in the country (Mushunje & Mukarumbwa 2010:6).

The pivotal role that agriculture plays in the Zimbabwean economy warrants that policies designed regarding household food security and the type of crop to be produced should be guided appropriately and the focus should be directed to communal farmers who reside in semi-arid regions (regions IV and V) (Mushunje & Mukarumbwa, 2010:5). Studies by FAO/WFP (2008) reported that household food security in Zimbabwe has declined due to a drastic reduction in food and agricultural production following erratic rainfall and the gross lack of key farming inputs. These erratic rainfall and shortages of affordable inputs meant that poor "net consuming" households in Zimbabwe's

semi-arid regions had difficulty in ensuring household food security (Chipika et al., 1999, *as quoted in Mushunje & Mukarumbwa*).

FAO (2008), Mushunje & Mukarumbwa (2010), and Rukuni et al., (2006) all concur that natural regions IV and V where most communal farmers reside and derive a living are too dry for successful crop production without irrigation but they grow crops in these areas despite the low rainfall. Small scale irrigation schemes have, therefore, been put on the fore front as a strategy in addressing food security at district and ward level in Bubi district with its perceived potential to increase food and income levels. Inkosikazi dam is one of the medium sized dams in the Matabeleland North province, and several small scale irrigation schemes exist in the farms in the province, but Bubi district remains one of the highest net importer of food and a perennial recipient of food aid. Communities in wards 4 and 5 have not been spared from food shortages, whilst unemployment and income generating activities remain very subtle to warrant any food security through purchasing. In 1998, with the support of World Vision, the community established the Inkosikazi irrigation scheme as a way of addressing the food security concerns in the area. However, as argued by Peter (2011:113), there is so much effort and investment in rural water supply for irrigation purposes to improve rural households' food security through improved productivity, but in spite of all these efforts food insecurity still prevails. This necessitates this study to establish whether small scale irrigation schemes can bring about any significant change to food insecurity in the Bubi district.

1.4. Objectives of the Study

The objectives of this study were:

a. To assess the impact of the Inkosikazi irrigation scheme on food security in Wards 4 and 5 in the Bubi district.
b. To determine the key factors that promote or hinder the Inkosikazi irrigation scheme as a food security intervention strategy.

c. To assess how the irrigation project has changed the agricultural production, income sources and expenditures, and the lifestyles of the households.

d. To make recommendations about the place of small scale irrigation schemes in local food security intervention strategies in Zimbabwe.

1.5. Justification of the Study

The study is of significant value to the various stakeholders interested in food security and rural development. To the government it provides insights that they can incorporate in defining policy directions and resource allocation to small scale irrigation as a food security strategy. To district authorities, the study is of significance in informing them whether or not small scale irrigation should be promoted to reduce food insecurity in the district.

To development-oriented civic society organisations such as World Vision, the private sector and communities, the research findings are important in informing them on viability, replicability, and impact of small scale irrigation. The study helps in identifying strengths and weaknesses of the food security intervention, thereby informing the modification of strategy to yield maximum results. This study helps in providing evidence that can be used to lobby and advocate for the formulation of pro-poor food security policies that help in achieving Millennium Development Goal number one aimed at eradicating extreme poverty and hunger.

Furthermore, the study contributes to the wider body of knowledge on rural development in Zimbabwe through offering insights on what does or does not work. Given the increasing food insecurity in Zimbabwe and the Sahel region, the study provides insights that can be used by subsequent investigations and comparative analysis of small scale irrigation schemes as part of the search for models that produce optimal results in food security.

1.6. Chapter Layout

The study comprises of five chapters. Chapter one focused on the overall design of the study, that is, the background to the food security problem, the problem statement, and the research outline. Chapter two will concentrate on literature review. Literature review is where articles, documents, books, journals, magazines, and many other sources on food security and its challenges are widely reflected. The chapter will also clarify some conceptual issues on food security in general world over, and further analyse ongoing discussions on food security in Zimbabwe in particular. Chapter three discusses the methodology used to collect and analyse data in this study. The chapter expounds on research designs such as mixed, qualitative, quantitative and descriptive/survey methods. It also tackles the population sampling and techniques involved, and the research instruments used in the collection of data, and finally looks at ethical considerations and the limitations and resolutions observed in the data collection process. Chapter four discusses the results of this study and what they mean in the broader context of irrigation as a food security intervention strategy. Chapter five gives a summary of the whole study and concludes by giving recommendations on improving food security where small scale irrigation projects have been used as interventions.

CHAPTER TWO

LITERATURE REVIEW

2.0. Introduction

This chapter focuses on reviewing literature of different scholars on linkages between food security and small scale irrigation schemes. The discussion opens with definitions and debates on food security and goes further to define and debate food insecurity and irrigation and then explains levels of food security for conceptual clarity. This is to allow readers to understand the concepts in the context in which they are used here. Major factors affecting food security in Sub-Saharan Africa and Zimbabwe in particular are discussed. and major concepts on irrigation explored. Discussion is focused on major concepts related to irrigation, and the status of irrigation and the various constraints associated with it in Zimbabwe and the Bubi district in particular. Arguments and debates on the linkages between irrigation and food security are analysed. The key stakeholders in food security and small holder irrigation are identified and their roles discussed in the chapter. The discussion is important because it help gives the final direction of the fieldwork research and the evaluation of the impact of small scale irrigation schemes on food security using the Inkosikazi small scale irrigation project.

2.1. Theoretical Framework

2.1.1. Historical Background on the Concept of Food Security

Food security is a complex concept that involves economic, social, cultural, environmental and political aspects. Between 1975 and1995, there were over 30 definitions and by 2008, the number had increased to over 200 definitions pencilled by scholars and institutions (Maxwell and Frakenberger, 1995:73; FAO, 2008:2). Although there is no universal definition of food security, the term has evolved over time from mere economic and quantitative considerations towards a more humanistic and qualitative direction as the world shifts into the rights based programming paradigm. Weingärtner (2000:3) summarised the evolution of the food security definition in Figure 2.1 below:

The Evolution of Food and Nutrition Security Concerns

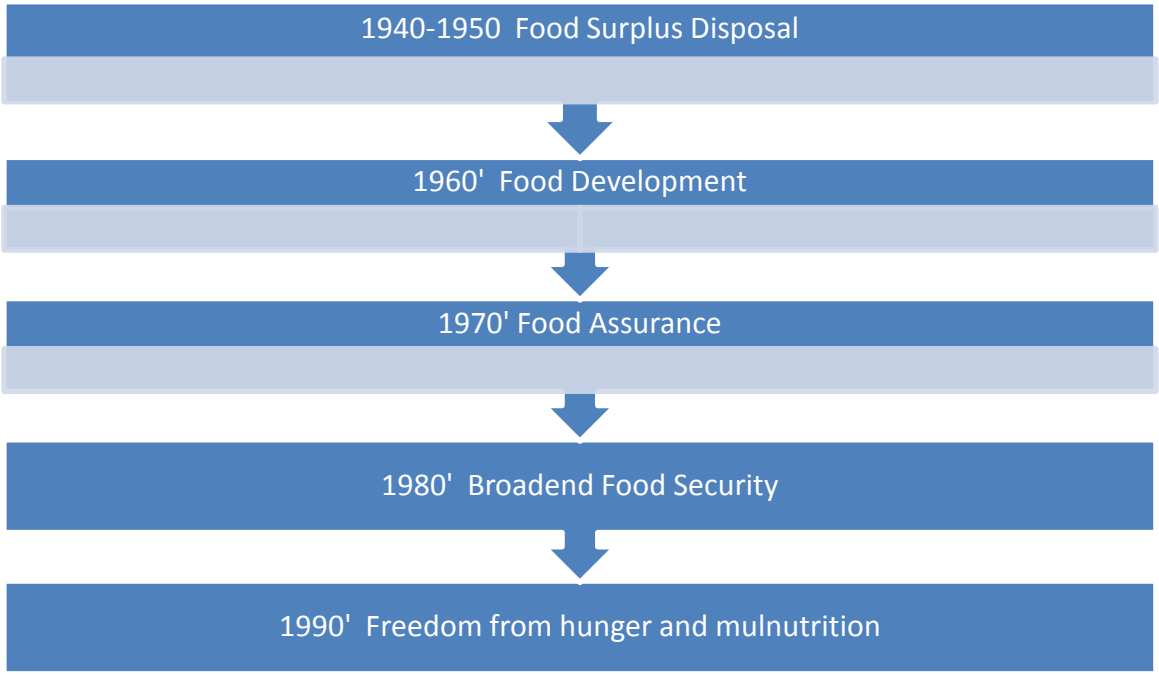


Figure 2.1. Evolution of food security Concerns: Weingärtner 2000:3

The diagram indicates that global food and nutrition security has a history of more than 50 years. In 1943 the Hot Springs Conference on food and agriculture adopted the concept of a "secure, adequate, and suitable supply of food for everyone", which was accepted internationally (FAO 2000:3). This was followed by the creation of bilateral agencies of donor countries like the USA and Canada in the 1950s and they started to dispose of their surplus agricultural commodities overseas. In the 1960s it was noticed that food aid may be a barrier to development for self-sufficiency, and the concept of food for development was introduced and institutionalised – hence the creation of the World Food Program (WFP) in 1963 (Weingärtner 2000:3). In the 1970s there was a shift from food surplus within donor countries to shortages. This food crisis between the years 1972-1974 brought about instability in food supplies and prices. Food security insurance schemes which assured international access to physical food supplies were developed. Finally, there was improved food security assurance promoted by better coordination between donor organisations and agencies and the recipient countries (FAO, 2000:3). In the 1980s the green revolution helped increase food production, hence availability. It was noted that food emergencies and famines were not

caused much by shortfalls in food production, but by sharp declines in the purchasing power of specific social groups (Weingärtner, 2000:3). Food security was broadened to include both physical and economic access to food supply. This further led to the promotion of poverty alleviation and the role of women in development (FAO 2000:4). In the 1990s there was a move to set up and define concrete plans to eradicate or at least drastically reduce hunger and malnutrition. There was further international re-affirmation of the human rights aspect to adequate food and nutrition. This led to national governments being committed to a more proactive role. This has reduced international public food aid support by donor agencies to crisis management and prevention (FAO 2000:3).

According to Ganapathy et al., (2005:27), Power (1998:15) and Gittinger et al., (1990;46), food security is a bi-variate concept composed of anti-hunger or anti- poverty goals on one hand and goals related to the food system on the other. The former was the basis of pre-1990 definitions of food security and tended to concentrate on the ability of a region to ensure an adequate supply of food for its current or projected population, and measured in terms of quantity and quality. This observation gives an emphasis on quantity and quality of food that is available, how food is produced, and how this impacts on its production, distribution and consumption on individuals and communities. Maxwell and Frankenberger (1992:75) distilled the earlier definitions and defined food security as secure access at all times to enough food. This underlines the fact that the food has to be enough for survival, and for an active and healthy lifestyle of households.

2.1.2. Towards a More Comprehensive Definition

These different dimensions of food security culminated in the World Food Summit definition in 1996 that was widely accepted as it provided a more holistic view of food security concerns and linked the previous definitions to the new dispensation.

World Food Summit (1996) definition

The summit defined food security as a situation which “exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 2002:18, FAO, 2008:3). This definition was adopted by 183 countries and became the working definition of the FAO and the United Nations. This definition streamlines the earlier definitions with the human rights focus which gained momentum in the 1990s, and the focus moved from national food security towards household and individual food security.

This study adopts the definition enshrined in the Food and Agricultural Organisation (FAO) publication, (2002:6), and adopted at the 1996 World Food Summit in Rome, which says:

Food security *exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Household food security is the application of this concept to the family level, with individuals within households as the focus of concern.*

FAO (2002:6) also defines *food insecurity as a situation that exists when households or communities do not have adequate physical, social or economic access to nutritious food that enables them to live productive healthy lives.* Food insecurity occurs when the individuals or communities are unable to cope with a particular hazard or combination of hazards. The study adopts this definition because it touches on the whole food security spectrum at national, community, household and individual levels. As noted by FAO (2000:10), despite the differences, the definitions of food security emphasise four types of development:

a. From macro level based on national stocks to access and entitlement issues by households and individuals in communities.
b. From concern of ensuring adequate level supply to concern towards meeting demand.

c. Breakdown of household consumption supply has revealed high vulnerabilities in certain populations hence concern towards household level supply and individual food security.
d. From short term food security concerns to long term sustainable food security concerns.

Food security should be defined by more than just quantity and quality issues, but should also include the food systems especially how food is made available and how it is produced. Koc et al. (1999:6) expanded the concepts of food security goals by raising four dimensions of food security. Koc et al.'s proposed four dimensions of food security:

a. Availability

Food availability addresses the "supply side" of food security and is determined by the level of food production, stock levels and net trade. It checks whether food is physically available in sufficient quantities of food of appropriate quality, supplied through domestic production or imports (including food aid) (FAO 2000:5, Khanya aicdd, 2006:3).

b. Accessibility

It refers to access by individuals to adequate resources (entitlements) for acquiring appropriate food for a nutritious diet. Entitlements can be defined as the set of all commodity bundles over which a person can establish command given the legal, political, economic and social arrangements of the community in which they live (including traditional rights) such as access to common resources (Devereux, 2001:246). There are two basic ways to get food – either produce it yourself or exchange something else for it. As noted by Khanya aicdd, (2006:8), although there is adequate food to feed everyone on a global scale, not everybody has access to food, either because they do not have the resources to produce enough food for themselves (lack of land, genetic resources, water, tools), or the skills to produce it, or lack financial resources or other assets that can be liquidated to purchase food.

c. Acceptability

Acceptability in food security address the cultural and symbolic value attached to food in society. The food available and accessible should respect the dignity and values of communities and individuals.

d. Adequacy

Koc et al. uses the term to denote the long-term sustainability of food systems. The term underpins the ethos that food systems should help to satisfy basic human needs of the current era, without compromising the ability of future generations to meet their food needs.

FAO (2002:4) reorganised the above and proposed four dimensions of food security which were derived from the 1996 world food summit definition. These are physical availability; economic and physical access; food utilisation; and food stability, as shown in Table 2.1 below.

Physical Availability of Food	Food availability addresses the supply side of food security and is determined by the level of food production, stocks levels and net trade
Economic and Physical Access to Food	An adequate supply of food at national and international level does not in itself guarantee household level food security. Concerns about insufficient food access have resulted in a greater policy focus on income, expenditure, markets and prices in achieving food security objectives.
Food Utilisation	Utilisation is commonly understood as the way the body makes the most of various nutrients in the food. Sufficient energy and nutrient intake by individuals is the result of good care and feeding practices, food preparation, diversity of the diet and intra-household distribution of food. Combined with good biological utilisation of food consumed, this determines the nutritional status of individuals.
Stability of the other three dimensions over time	Even if your food intake is adequate today, you are still considered to be food insecure if you have inadequate access to food on a periodic basis, risking a deterioration of your nutritional status. Adverse weather conditions, political instability, or economic factors (unemployment, rising food prices) may have an impact on your security status.

Table 2.1: FAO's four main dimensions of food security- adapted from FAO ***'Food Security Information for Action Practical Guides'*** *(2008: 1)*

In the FAO definition ***"all people"*** illustrates that different people have varying levels of food security status because they are affected by adverse events differently, and there is a need to assess variations in food security status between different groups of people. Humanitarian and development agencies most commonly differentiate between groups according to their main livelihood (source of food or income), in addition to other factors such as

geographical location and wealth (FAO, 2008:6). The phrase ***"at all times"*** recognizes that people's food security situation may change. Even if people's food intake is adequate today, they are still considered to be food insecure if they have inadequate access to food on a periodic basis, risking a deterioration of their nutritional status. Adverse weather conditions (drought, floods), political instability (social unrest), or economic factors (unemployment, rising food prices) may impact on their food security status (FAO, 2008:7). FAO goes further to say the phrase also refers to the **stability** dimension of food security by emphasizing the importance of having to reduce the risk of adverse effects on the other three dimensions: food availability, access to food and food utilization (Ibid:8). With the drive towards human rights based programming, food security issues have gone beyond Koc et al.'s four dimensions. As stated above, food security should include issues of social justice, self reliance, and community economic development, including emphasis on organisation and cooperation among all players from local level to regional level systems.

2.1.3. Components of Food Security

From the above World Food Summit definition and synthesis of earlier definitions, Toronto Public Health (2006:21) deduced five components of food security. The five main components of food security are universality, stability, dignity, and two related to food availability namely quantity and quality of food. Toronto Public Health (2006:22) summarised the various components of food security in Figure 2.2 below.

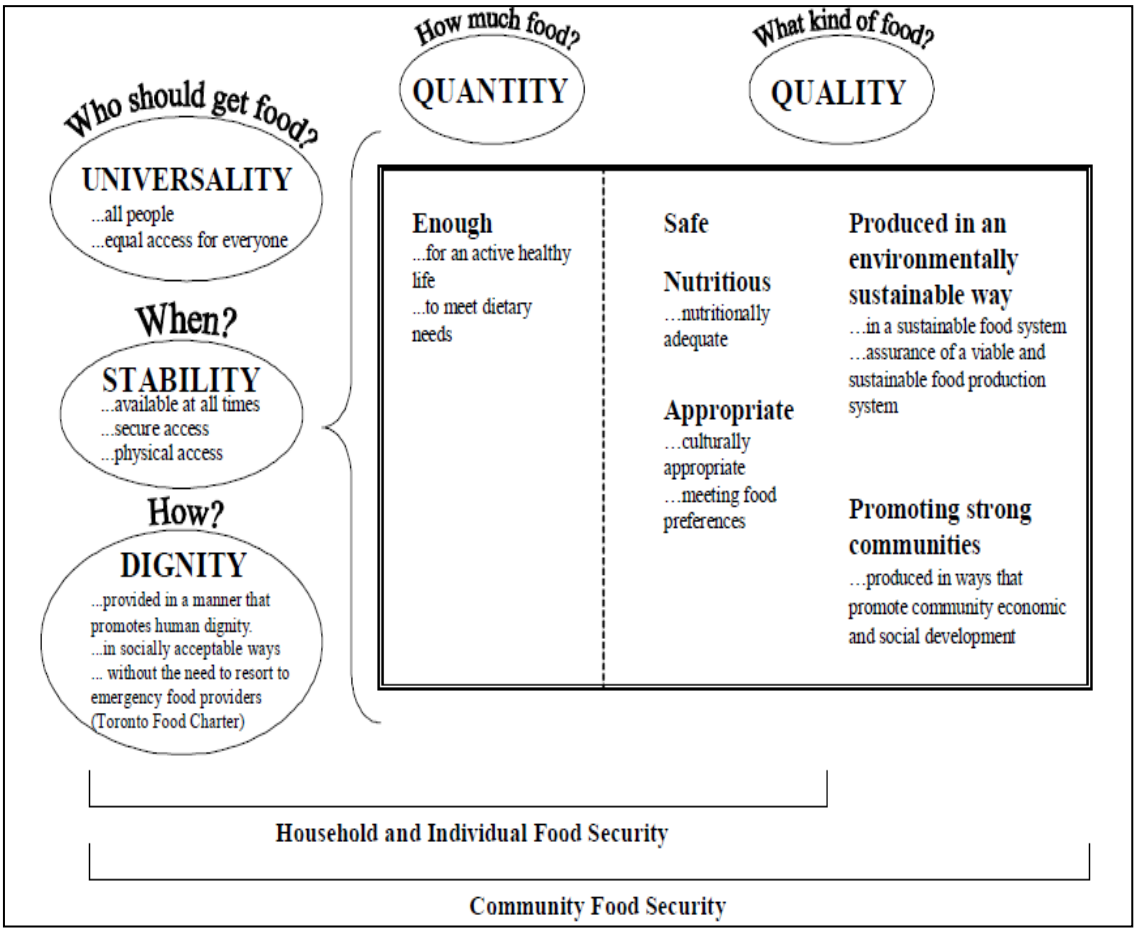


Figure 2.2. A diagrammatic representation of components of food security (Toronto Public Health 2006)

Figure 2.2. points out that the broadest definitions of food security answer five specific questions as given in the table below:

	Question	**Answer**
a.	Who should get the food?	**Universality** – everyone / all people must equally have access to food.
b.	When?	**Stability –** food must available at all times. There must be a sustained and secure physical access to food at all times.
c.	How?	**Dignity –** Food must be provided through normal food channels that are socially acceptable and promote human dignity, not through handouts from emergency food assistance programs.
d.	How much food?	**Quantity –** enough food must be available for an active healthy life to meet dietary needs.
e.	What kind of food?	**Quality –** food must be: (i) safe and nutritious (ii) Culturally appropriate to meet normal food preferences.

		(iii) Produced in environmentally sustainable food system that has a viable and sustainable food production. (iv) Promote strong community economic and social development.

Despite the different classifications of food components discussed above, the most widely adopted pillars of food security are availability, accessibility, utilisation and stability. With the first three already defined above, utilisation refers to the use that households make of the food to which they have access, and individuals' ability to absorb and metabolize the nutrients (FAO, 2008:5). Food utilization depends on how food is stored, processed and prepared, feeding practices, particularly for special needs individuals; sharing of food within the household; and the extent to which this meets individuals' nutritional needs. (Weingartner, 2000:7). This study has also adopted this classification for analysis purposes.

In terms of thresholds of analysing food security, there has been focus mainly on two levels namely the household / individual level and the community food security.

Household and individual food security

A household is food secure when it has access to the food needed for healthy life for all its members (adequate in terms of quality, quantity, and safety and culturally acceptable) and when it is not at undue risk of losing such access (FAO, 2003:3). As the food security concept continues to be further developed, attention has been placed on household and individual 'entitlements.' Since food is now viewed more as a right, it is important to analyse experiences of hunger and issues of stability in accessing nutritious food at household level. It is the analysis at this level that brings in differing vulnerabilities between individuals and households in communities. The food security status among the households differs due to great variation in household's resources and the ability to shift their resources into growth sectors with specific capital, climatic or infrastructure requirements (Nhundu and Mushunje, 2008:43). However as noted by Maxwell and Smith (1990:10), the concept of household food security requires us to make assumptions

about household structure and organisation to identify the activities, relationships and processes to improve food security and nutrition status. It assumes that members in households share a common set of preferences in resource allocation; that household resources are pooled and allocated to ensure maximum welfare of all members; and households with similar endowments respond similarly but independently to price, income and other exogenous exchanges. However, reality shows that a household is a collection of individuals who might have different access to food hence the need for intra-household analysis as well.

Community food security

According to Ontario Public Health Association (OPHA, 2002:24), community food security is a strategy for ensuring secure access to adequate amounts of safe, nutritious, culturally appropriate food for everyone, produced in an environmentally sustainable way, and provided in a manner that promotes human dignity. The concept goes beyond entitlements to look at the food systems and how the food is produced and the factors that promote or inhibit food security at large. Issues of environmental sustainability become crucial. Even though household and community food security are closely linked, household food security focuses on physical and economic access to food (Power, 2005:31). Community food security not only stresses sustainability of food systems but also extends its reach to issues of social justice, self-reliance and community economic development including an emphasis on organisation and cooperation among all players in local or regional food systems (OPHA, 2002:24).

Food security levels and the levels of socio-organisation

According to FAO, (2000:9) the levels of food security have further been developed and fitted into the **socio-organisational dimension structure.** The social organisation dimension divides the communities into three levels and these are: **Micro level** (the individual and the household), **Meso level** (the community: village / sub district, district / town, province / city) and **Macro level** (the nation, regional and global) structures. The relative importance of each element of malnutrition changes with the level of social organisation. At higher levels of social organisation the overall political, economic and ecological conditions become more important. In any given situation food and

nutrition security must be approached holistically at all levels of social organisation because the various factors that determine the nutrition status of human beings and the different levels of society in which they interact, are interrelated (Gross et al., (2000:9). Availability, accessibilty, utilization of food and the stability of these three elements differ in their nature, causes and effects at the macro, meso and micro levels. Food may be available in a country but not in certain disadvantaged districts or among discriminated groups; and the seasonality of food availability and utilisation due to cyclic appearances of diseases, may be a rural but not an urban phenomenon.

2.1.4. Types of Food Security

Food security can be classified according to the duration of the food insecurity. According to FAO (2008:12), Anderson (1988:26) and the Overseas Development Institute (ODI, 2001:8), there are two broad types food insecurity:

a. Transitory food insecurity

Transitory food insecurity refers to short-lived episodes of food insecurity in which much large numbers of people become temporarily food insecure due to a shock experienced by a food system. These shocks may be induced by climatic factors such as droughts and floods, or man-made factors such as short term financial crises or structural challenges in the food distribution system. Transitory food insecurity usually has a *cyclical pattern* especially those induced by seasonal fluctuations in climate, cropping patterns, work opportunities (labour demand) and disease (FAO, 2008:16). Short term food insecurity becomes even more worrisome when a large number of people suffer from such shocks. An example is Zimbabwe in 2008-9 where the complex interplay of socio economic and political factors produced widespread hunger in the country. When large numbers of people experience severe food shortages, especially if they have suffered an abrupt decline in food intake, the situation may be described as ‘famine’ (ODI, 2004:13-14). There is a very close relationship that exists between, hunger, food security, and malnutrition. When not managed, transitory food insecurity may lead to wasting. The diagram below illustrates the relationship between food security, hunger and malnutrition.

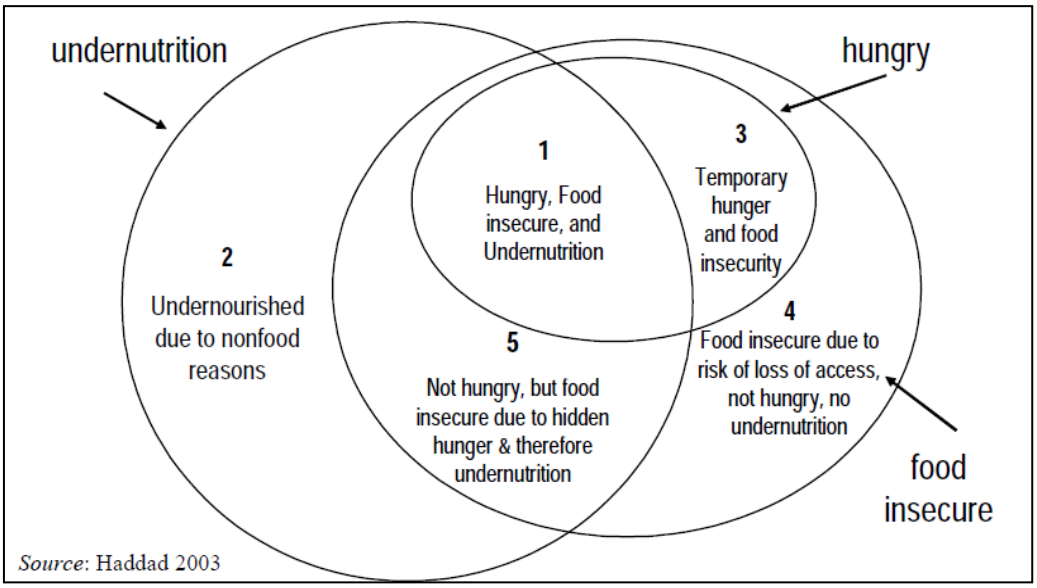


Figure 2.3 The relationship between hunger, food security and malnutrition

The diagram summarises the relationship between food security, hunger and malnutrition. Food insecurity at household or individual level is often viewed with a focus on its manifestations within households and individual experiences of hunger and other forms of dietary compromise (Toronto Public Health 2006:28). **Hunger** (scientifically referred to as **food deprivation**) is an uncomfortable or painful sensation caused by insufficient food energy consumption. The diagram above further shows that, in **(1)** when an individual is hungry due to lack of access to proper food, they feel food insecure and **(2)** undernourished (FAO, 2008:3). The poor food with an unbalanced diet steers in them **(3)** temporary hunger and **(4)** a feeling of prolonged food insecurity due to the risk of loss of access to adequate food. In **(5)** if a household or individual is food insecure, they compromise the quality of food they take, as a result of which they always suffer from temporary hunger caused by lack of balanced diet, hence they experience malnutrition. **Undernourishment** refers to the proportion of the population whose dietary energy consumption is less than a predetermined threshold. Malnutrition **(2)** may be an outcome of non-food factors such as inadequate care practices for children, insufficient health services, and an unhealthy environment. **Malnutrition** results from deficiencies, excesses or imbalances in the consumption of macro- and or micro-nutrients (FAO 2008:3). Toronto (2006:28) further notes that researchers usually conceptualise this to mean the quantity (not enough

food), and a narrower view of quality (having to rely on only a few kinds of low-cost foods, unbalanced diet). Therefore, food insecurity, hunger and undernourishment always exist together and are inseparable.

b. *Chronic food insecurity*

Chronic food insecurity occurs when there are sustained periods of unavailability and lack of access to enough nutritious food by communities. The table below by FAO, (2008:13) describes the key features of chronic food insecurity:

	CHRONIC FOOD INSECURITY	**TRANSITORY FOOD INSECURITY**
is...	Long-term or persistent	Short-term and temporary
Occurs when...	People are unable to meet their minimum food requirements over a sustained period of time.	There is a sudden drop in the ability to produce or access enough food to maintain a good nutritional status.
Results from...	Extended periods of poverty, lack of assets and inadequate access to productive or financial resources	Short-term shocks and fluctuations in food availability and food access, including year-to-year variations in domestic food production, food prices and household incomes.
Can be overcome with...	Typical long term development measures also used to address poverty, such as education or access to productive resources, such as credit. They may also need more direct access to food to enable them to raise their productive capacity.	Transitory food insecurity is relatively unpredictable and can emerge suddenly. This makes planning and programming more difficult and requires different capacities and types of intervention, including early warning capacity and safety net programmes.

Table 2.2: Concepts of transitory and chronic food insecurity, Adapted (FAO, 2008:1)

The table is a presentation of the duration and severity of food insecurity, explaining the characteristics of chronic and transitory food insecurity. With **chronic food insecurity**, there is a persistent inability of a household to meet their minimum nutrient intake requirements. The household is unable to meet the food requirements of its members over a long period of time. The

household is faced with the consequence of continuously inadequate quantity and quality of food taken as a result of poverty (FAO, 2008:10). If it is not well managed, chronic food insecurity can lead to stunting (Devereux, 2006:34). Zimbabwe is one country which has been experiencing chronic food insecurity. With the successive droughts of 2001 - 2004, and 2007 - 2009, coupled with a nexus of socio-economic challenges and political upheavals, Zimbabwe has failed to regain its former status of being a bread basket of Southern Africa. On the other hand **transitory food insecurity** occurs when a household is faced with a temporary inability to meet its food needs, usually associated with a specific shock or stress such as drought, floods or civil unrest. The situation results in a sudden reduction of a household's access to an adequate quantity and quality of food intake. This affects households that are generally able to meet their minimum food needs at normal times, and only unable to do so after a specific shock.

2.1.5. Overview of Small Scale Irrigation Schemes

Defining small scale irrigation is highly variable from place to place as the definition differs. Smot and Shaw (1999:24) and Kedir and Alamireuw (2006:17), define **small scale irrigation** as irrigation usually on small plots in which farmers have the controlling influence and use the level of technology they can operate and maintain. The schemes are farmer managed and usually the farmers are involved in the establishment of the schemes. These schemes can be owned by individuals or they are community owned. There is no concurrence between authors on how big the plot or how many people should be involved in a small scale irrigation scheme. Smout and Shaw (1994:23) in their studies in India observed that most small scale irrigation schemes serve a group of farmers, typically comprising between 5 and 50 households. Van't Hof (2001:9) in his irrigation research studies in West Africa proposes a multi- criteria definition of small scale irrigation with three dimensions: (1) the command area must be less than 40 ha; (2) the average area per irrigator is less than 10 ha; and (3) management is by the entire group of irrigators. However Seleshi in India argues that the hectarage can go to 200ha, but the catch phrase is that, the irrigation is community owned and benefits a sizeable number of community members. In Zimbabwe, FAO,

(1997:8) discovered that the small scale irrigation schemes range from 2ha to 228hectares of land but individual plots are usually less than 10ha as suggested by van't Hof (2001:9).

2.1.6. Irrigation Types and Methods in Small Scale Irrigation Schemes

The type and method of irrigation schemes vary from place to place depending on various factors such as source of water, topography, availability of financial and human resources, availability of energy sources, and the size of the area to be irrigated. Smout and Shaw (1994:34) identified three types of irrigation used by small-holder farmers:

a. ***Flood cropping.*** This is usually practised where there are flooding variations in a river. Rising flood cropping (planted before the flood) is done and irrigated when the river floods. Ridges made in the fields will retain the water.

b. ***Gravity fed systems.*** This system varies considerably depending on type of water sources. It utilises the difference in gradient (height) between the head of water and the area to be irrigated. A gravity fed irrigation system is a cheap effective way to provide water for a smaller sized crop area. It would be especially cost effective if the climate of the area can provide enough precipitation to consistently keep a reservoir filled using rain water harvesting techniques (Kendzierski, 1999:14). Bjornlund (2004:21) in his assessment of irrigation schemes in Zimbabwe concluded that farmers in gravity fed irrigation schemes are less vulnerable in times of market fluctuations compared to those utilising pumping due to the low costs of running the irrigation schemes.

Common types of gravity fed irrigation include:

- Permanent stream diversion and canal supply.
- Water reservoirs, water harvesting tanks and overnight storage dams are constructed on higher ground and feed fields by gravity
- Water pipes are connected at the base of larger water bodies such as dams and the water is released into canals or sprinkler network by gravity.

c. *Lift/ motorised irrigation (pump supply).* In this method water is pumped from either an open water source or underground water using pumps powered by

different energy sources such as diesel, petrol, electricity or solar energy.

2.1.7 Irrigation Methods

De Lange et al., (1995:38) in his studies of irrigation in South Africa identified several methods of irrigation, some which are also used in Zimbabwe. These include:

a. *Sprinkler systems:* Awulachew et al., (2005:10*)* defines sprinkler systems as individualized small-scale technologies for lifting, conveying and applying irrigation water on the cultivated land. This is sprinkling of irrigation water on crops by an overhead technology. A major advantage of *sprinkler systems* is that a farmer can start small and expand as he learns how to use and can afford the system. Chancelor, (2000:4-8) noted that although sprinklers are the solution to high costs of land levelling, the cost of technology repairs and maintenance of the equipment including pumps has greatly affected their sustainability.
b. *Centre pivots:* This is watering of large areas of cultivated land by using a network of water pipes joined together by a system of pivots covering a large area (Awulachew et al., 2005:11). Centre pivots are ideal for plots 10ha and above. They are designed to irrigate relatively large areas ranging in size up to 100ha in area. The equipment cost per hectare is very high for smaller pivots; therefore, small farmers using centre pivots have to share the equipment, which invariably leads to management and operational problems. Maintenance requires technical expertise as they are mechanically complex and require skilled maintenance and are therefore not usually recommended for small farmer schemes.
d. *Micro and drip (trickle irrigation):* Lamm, Ayars et al., (2007:5) defines micro irrigation as the slow application of water on, above or below the soil by surface drip, bubbler and micro-sprinkler system. A micro-irrigation system is for frequent application of small quantities of water on or below the soil surface: as drops, tiny streams or miniature spray through emitters or applicators placed along a water delivery line. However, the problem with the system is that it needs high technical expertise, it is labour and time intensive and difficult to use for larger pieces of land.

e. *Surface irrigation:* Surface irrigation is the introduction and distribution of water in a field by the gravity flow of water over the soil surface. According to Walker (1989:12-13) surface irrigation can be divided into four: basin irrigation; border irrigation; furrow irrigation; and uncontrolled flooding. There is substantial field evidence that surface irrigation systems can apply water to croplands uniformly and efficiently. The advantages of surface irrigation are that it is cheap, and easier to maintain by farmers. The system is that it usually can be designed to operate at very low running costs with gravity feed, without pumping or any mechanical equipment. This is the method employed in most irrigation schemes in Zimbabwe because it is relatively cheaper to use than other methods.

2.1.8. Irrigation and Food Security

Studies in Agriculture and food security show that it can hardly be disputed that the majority of the world's poor still live in rural areas and depend crucially on agriculture for their livelihoods (IFAD, 2001:2). It seems reasonable then that raising the profitability of agriculture will be helpful to the poor, and this involves taking steps either to increase agricultural productivity per acre or encouraging a switch to higher valued crops (FAO, 2002:45). Increased agricultural productivity raises profits and hence incomes for those who own land. This may help reduce poverty if the poor also own some land and participate in the productivity increase (FAO, 2002:45). With the ever increasing food insecurity in Sub-Saharan Africa, irrigation has been brought forward as a strategy of ensuring food security. Rukuni is cited as acknowledging that irrigation development represents the most important interface between water and land resources (Nhundu and Mushunje, 2008:3). With only 4% of the 871 million hectares of land in Africa being under irrigation, small-holder irrigation has been hailed as the panacea for food insecurity in dry regions, especially in light of climatic change. However literature gives conflicting conclusions on the viability and sustainability of smallholder schemes. The following analysis gives views of the different scholars who argue on the current benefits and future potential of irrigation schemes in bringing about food security, whilst on the other hand, there are those who have concluded that evidence so far runs contrary to the above assertion if cost benefit analysis is to be applied.

Studies by Ersado (2005) and Tolossa and Tafesse (2008) in Ethiopia concluded that small scale irrigation significantly increases food production and food security hence it should be accorded priority and be given institutional support. Hussain et al., (1999) and Barau et al., (1999) argue that irrigation not only increases food and raw material production but also acts as a nuclei of rural development. It is a powerful factor for providing food security, protection against drought effects, increasing prospects of employment and great opportunity for multiple cropping and crop diversification. In his evaluation of irrigation schemes in the Malibeni and Mangweni communities of Swaziland, Peters (2011) agrees with the above but accentuates that if the irrigation is focused on the household, it improves food security through physical and economic access. Economic access can be defined as the ability of a household to purchase whole or part of their dietary requirements depending on need and affordability (FAO, 1997).

Gupta (2001), Haddad (2001), Bjornlund (2004), Rukuni (2006), Sithole (1995) and FAO (1997a), in their various evaluations of small scale irrigation schemes for food security, all agree that irrigation acts as a magnet that attracts the poor from the surrounding dry areas in search of year round jobs. Thus irrigation not only increase food availability to the surrounding areas, but also generates income which contributes to the local economy. Studies by Manzungu and Van der Zaag (1996), Samakande (2002), Chancellor (2004), Chibisa et al., (2008), and Nhundu and Mushunje (2008) in Zimbabwe; Webb (1991) in Gambia; Sithole and Testerick (1993) in Swaziland, and Christine et al (2003) in Ethiopia, all show that small holder irrigation schemes have great potential for improving livelihoods and contributing to poverty reduction in rural areas. Hussain et al., (1999) further acknowledges that irrigation encourages farmers to adopt new technologies and intensify crop cultivation which results in higher production yields and opens up new opportunities which will increase the economic base for the community. Diversification of the local economy will reduce the vulnerability caused by the seasonality of agricultural production as well as external shocks. In the study of 161 small-scale irrigation schemes in the Oromia Region of Ethiopia, the International Water Management Institute (IWMI) (2005:17) has this to say:

Schemes implemented in the region are diverse, especially in terms of water sources. Some schemes procure water through river diversions, while others are either pump schemes, drip irrigation schemes, or schemes relying on various forms of water harvesting. Surface ponds, traditional irrigation structures, flood diversions, as well as hand-dug wells, are the major water harvesting technologies in use. The choice of beneficiaries for these interventions largely depends on the resource potential of the beneficiary communities, and is usually demand-driven. That is, projects are usually initiated as a response to some form of need, interest or demand expressed by the beneficiary communities, either explicitly or implicitly. The existence of indigenous knowledge, especially in traditional schemes, sometimes creates a demand for the intervention, as well as a higher level of food security observed in these communities.

On the other hand some scholars criticise small scale irrigation as a strategy for food security intervention based on an investment versus output analysis. Peacock (1995:46) in his comparative study of food aid versus small scale irrigation schemes concluded that it is far much cheap to ensure community food security via food aid than to invest in irrigation. He argues that small holder irrigation development is not economically viable and not necessary for food security. Rukuni (1984:17) questions the viability of small scale irrigation in Zimbabwe to bring food security as there is no cost recovery of establishing the schemes. Instead, he argues that they are riddled with numerous problems that make them fail to rise above subsistence production. The SADC report (1997:4) also castigated the small scale irrigation schemes for their failure to recover establishment costs. The report says that such schemes will not recover the cost of development and operation hence economically they are not viable, and they have a negligible impact on national and household food security. Webb (1991:31) in his studies in Zambia adds that increases in income from such schemes come from increases in investments in construction, production and trade which makes it overall expensive. The IWMI (2005:16) in their study of small-scale irrigation schemes in the Ahmara Region of Ethiopia also highlights the failures:

Only two schemes failed as a result of sedimentation problems; namely Gobeya in South Wello Zone, planned to irrigate 106 ha and benefit 540 people, and Adrako

South Gonder Zone, intended for 75 ha and 300 beneficiaries. In addition, there are two more schemes reported with subsurface seepage problems.

Amede and Mariam et al., (2011:7-8) give a more conciliatory argument that small scale irrigation can bring food security or not depending on a wide range of factors. They maintain that for those that failed, (*such as the Gobeya and Adrako in Ethiopia as cited in the IWMI Report above)*, irrigation is more than just technology but involves production, marketing, credit, social policy and institutional issues. They continued to recommend that an innovation systems approach is required to enable the failing schemes to bring the expected impact on the livelihoods of people including a systematic attempt at addressing the challenges they face.

The arguments given above can further be viewed widely to come up with a conclusive reality. When doing a cost-benefit analysis of both small and large irrigation projects in the Philippines, Bautista, (1995:144), argued that large investment in irrigation schemes had been made at the expense of road and other amenities infrastructure that could have possibly benefited large numbers of communities in the country. Income from agricultural growth was highly concentrated to a few households. He concluded that only those who had access to irrigation land were highly food secure and enjoying the benefits of the investments, while the rest of the periphery population reeled in poverty. Most irrigation projects that failed, had failed because of poor management and maintenance (IWMI, 2005:18). The institute noted that the failed and under-utilised schemes in Ethiopia were established by international NGOs who had put in so much investment, but when these NGOs left, the schemes were taken over by local government structures to manage. The structures lacked capital, management and technical skills, sustainability and innovative skills to maintain the irrigation schemes, hence the schemes failed due to poor management. All the advocates arguing against irrigation development base their arguments at a **macro level** (national/regional/global) and a **meso level** (community: village/district/town/province) of the socio-organisational structure of the community (as explained above), while those for the irrigation schemes base

their views at **micro level** (household/family/individual) (FAO, 2000:9). Availability, accessibilty, utilization of food and the stability of these three elements differ in their nature, causes and effects at the macro, meso and micro level. Food may be available in a country but not in certain disadvantaged districts or among discriminated groups; and the seasonality of food availability and utilisation due to cyclic appearances of diseases, may be a rural but not an urban phenomenon (FAO, 2000:9). This scenario shows that if all households /individuals are given a chance to own pieces of irrigation agricultural land, they will be able to produce their own food, be food secure and their poverty reduced.

A case study on 12 Latin American countries reached the conclusion that a growth path biased toward agriculture is effective in reducing the number of rural poor and the incidence of rural poverty (De Janvry and Sadoulet, 1995). Various other case studies; Bautista et al. (1999) and Torbecke and Jung (1996) both on Indonesia, Kakwani (1993) on Ivory Coast, Zeller et al. (2000) on Madagascar, Bautista et al. (1998) on Zimbabwe, and Khan (1999) on South Africa; consistently point to the substantial role of agricultural growth as an element of poverty reduction. Timmer (1997), investigated the relationship between economic growth and poverty in a cross section of 35 developing countries and found that in countries where the income gap is relatively small, labour productivity in agriculture is slightly but consistently more important in generating income in each of the five quintiles. A research in India by Ravallion and Datt (1996), and Datt and Ravallion (1998) also indicated that when growth in agricultural yields became strong in India in the early seventies, not only did the number of people in poverty, as measured by the headcount index, decline, but poverty also became less severe, i.e. the consumption of the poorest of the poor also increased.

The increase in small-scale farmer income is associated with an increase in agricultural productivity. In a situation where the resulting agricultural growth benefits small-scale farmers and rural labourers, the additional income is spent largely on food and on basic non-farm products and services in rural areas, such as the services of merchants, artisans, mechanics, etc, and on

simple agricultural implements and household goods (Stamoulis and Zezza, 2008:20). The nature of these goods and services is that they can only be traded locally within a small area, either because they are perishable or because of high transport costs. Furthermore, these commodities generally require the supply of low inputs of capital and skills, and are ideally suited to the capabilities of the rural poor (FAO, 2002:46). These non-farm enterprises offer the poor a potential escape route from poverty, since they usually require little capital or training to set up and are labour intensive. Stamoulis and Zezza, (2008:21) and FAO, (2002:47) posit that the extra income from agricultural growth can create demand for these goods and services, thus starting a virtuous cycle in which agricultural and rural off-farm income grow and sustain each other's growth. This precisely indicates that an extra income from agricultural growth creates a demand for locally non-tradable goods, if this extra income is not hoarded, but spent locally (FAO, 2002:45). In a society characterised by small-holder farmers it is more likely that the extra income will be spent locally, than when farming is dominated by large landlords. Such broad-based development opens up new opportunities for reducing poverty and hunger. Stamoulis and Zezza, (2008:22) and FAO, (2002:48) concluded that increases in agricultural productivity (higher output per hectare or shift to high value crops) create a series of ripple effects in the rural areas through the growth of rural off-farm activities.

Finally, it must be noted that food security is linked to the availability of large water sources. Irrigation is usually based on availability of large water bodies like dams, and these provide water for human and livestock drinking, cooking, laundry and brick moulding, and gold panning as noted by Manzungu et al, (1996: 6-8). This multiple and daily use of large amounts of water, associated with the incidence of global warming, droughts, seasonality of most rivers that run across most dry areas in Africa, prospects of desertification, and the receding water table across the continent, makes the scarcity of water real and imminent in the continent. This is also aggravated by the lack of technological skills to harvest and distribute enough water to the needy communities residing in dry and semi arid areas across the Sub-Sahara region. These concerns make it difficult to assume sustainability of irrigation

development, and in turn raise concerns on sustainability of food security based on irrigation projects.

2.2. Food Security in Zimbabwe

2.2.1. Poverty and Vulnerability to Food Insecurity

In Zimbabwe and Sub-Saharan Africa in general, notions of poverty, malnutrition and vulnerability are closely intertwined to food insecurity (Mudimu, 2004:13; Mushunje & Mukarumbwa, 2010:5). Poverty is a key determinant of access to food. Jayne (1994:15) identifies groups most vulnerable to chronic and transitory food insecurity and these include asset-poor rural people in rural and resettlement areas that farm but are often net purchasers of food. This group is said to lack the resources to produce enough income to buy their residual food requirements and this group includes female households and households in war-torn and environmentally disrupted areas, and urban households with unemployed or more frequently underemployed family members (Mushunje & Nhundu, 2012:45). These groups typically have low levels of income and are considered as poor landless labourers. The IASC (2008) defines *vulnerability* as the conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community or group to the impact of hazards. Mudimu (2004:22) noted that 60% of the population in Zimbabwe is poor with 46% of rural population classified as very poor. *'Very poor'* can be defined as those whose incomes could not afford enough food, even if they spent all their income on food alone. Given how the complex socio-economic and political factors affect people differently, two groups can be easily identified at any given time. These are *the current food insecure* and the *likely to become food insecure* as socio, economic, political and environmental factors continue to deteriorate.

The food insecurity among the vulnerable households can be categorised into two:

a. The first is inability of households to produce food because of lack of access to and diminishing quality of productive resources combined with an unfavourable production environment

b. Inability to acquire food from the market due to inadequate household income, unreliable markets and inhibitive food prices.

Given the high levels of chronic poverty levels in Zimbabwe, any small external shock has great impact on food security of communities especially in agro-regions four and five. In order to cope, the poor usually end up adopting some harmful coping strategies. These include restricting the consumption of certain food, reducing meal frequencies and portion sizes, switching to the cheapest possible foods, and consumption of other goods and services, including taking their children out of school (FEWSNET, 2011:5). The most vulnerable groups include the unemployed, female headed households, households with chronically sick and the elderly headed households (Oxfam, 2007:29, Mudimu 2004:38).

2.2.2. Agrarian Structure in Zimbabwe

The Zimbabwean government views access to land by the majority as the basis for eradicating poverty and increasing food security (Mudzonga & Chigwada, 2009:4). According to 'The WFP Portfolio Analysis,' (2012:1):

Since 2000, Zimbabwe has experienced a collapse of its economic and social fabric as a result of extreme hyperinflation, political confrontation, weak governance, and insufficient resources (human and financial) for basic services in health, social, education, and agriculture. The collapse of these productive sectors caused high unemployment rates and a drastic increase in poverty. In 2008, a confluence of a weak national economy and the world food, fuel, and financial crisis resulted in extreme economic hardship and uncertainty for many Zimbabweans, especially the rural and urban poor. As a result, the period of 2006 to 2010 represented a turbulent time of rapid change and uncertainty.

Until 2003, Zimbabwe had a dual agricultural system developed by the British colonisers and made up of large commercial farms (owned by the privileged white) and communal small holder farms (owned by Africans) which are primarily located in regions 4 and 5 with poor rainfall levels (AfricaFocus, February 2013:8). Zimbabwe's economy has always been largely anchored on Agriculture with this sector accounting for 70% of the country's employed population. FEWSNET, (2012:3), and WFP, (2012:ii) note that Zimbabwe used to be the net exporter of agricultural products, with tobacco being the top most and greatest earner of foreign currency. The agricultural sector has continued to decline between the years 1999 to 2009 due to the Government's forced land redistribution programme. Until 1999, of Zimbabwe's 15 million hectares of agricultural land, 12 million were occupied by 6000 white commercial farmers, while the majority of blacks were crowded in mostly unproductive land found in poor agro-ecological regions 4 and 5 (AfricaFocus, 2013:3). The aim of the Land Reform programme was to redistribute land evenly between white and black communities in order to address the land distribution inequality in the whole country. However, this became chaotic when large groups of blacks moved into large white commercial farms forcing the whites out and taking the land distribution into their own hands. Mudimu (2006:10) had this to say:

The food security implications of the land and agrarian reforms have yet to be measured. However, it is clear that the agrarian reform have both short-term and long-term implication on food security. In the short-term, the programme disrupted food and cash crop production. The land that could have been put to maize, wheat, sunflower, and cotton in the large-scale farming areas was taken out of production during the process of redistribution. The historical situation has been that large-scale food crop production was more stable than Communal Land food crop production due to the more favourable agroecological environment (in Mashonaland Central, Mashonaland East, and Mashonaland West) and investment in supplementary irrigation. With the land not in production, the country was more vulnerable to the 2001/2002 drought.

The government then regularised the process by following up and dividing the taken over farms into small A1 plots of 6 hectares each per household. Due to this chaotic fast track land reform, the new agrarian structure consisting of two farming sub-sectors, A1 and A2 farms was established, even though the dual system was maintained. The A1 is the smallholder model for previously landless people. The farmers are essentially on smallholder farms with small individual arable fields of 6ha each, and having communal grazing areas, held under permit and customary tenure. This sub-sector includes the old communal land and resettlement farms, and the new A1 resettled farmers. On the other hand, the A2 sub-sector is made up of the old large-scale farms, former small-scale commercial farms, large estates and the new A2 self-contained farming units (Mutisi, 2008:16). These are smaller than the former white-owned farms, but are still large and capital-intensive, and applicants had to prove they had money to invest (AfricaFocus, 2013:4). Most of the blacks in the A2 model who own the large-scale commercial farms bought the farms and are usually counted among the elite.

Even though the fast track land reform programme was initially disruptive, agricultural production is rapidly increasing and the production level is now returning to the level of the 1990s, with resettlement farmers already growing 40% of the country's tobacco and 49% of its maize (AfricaFocus Bulletin, February 2013:8). The Bulletin further elaborates, 'On average, the fast track framers are doing well, raising their living standards and increasing production, and over the next decade can be expected to continue growing, the best are doing very well, and the middle group is still catching up' (p.8). For the best A1 farmers, maize, tobacco, pumpkins, and soya beans give them higher profits than the salary of a teacher or civil servant. Increased production provides a better house and better life for themselves and their children. Land ownership is regarded as the most valuable means to promote agriculture and this is seen as a means of betterment and wealth accumulation.

2.2.3 Food Security Strategies in Zimbabwe

Since independence, the Zimbabwean government has placed agriculture as nuclei for economic growth, and currently it accounts for over 20% of the gross domestic product (Mushunje & Mukarumbwa, 2010:6). Mudimu (2006:12) notes that the strategies adopted by the government since 1980 were twofold. The first type was the strategies that were adopted to stimulate increased production to improve national food security, and the second type were strategies adopted to counter the impacts of droughts and to address household food and nutrition insecurity. The pre 1990 policies were geared to stimulate increased food production to meet the national food security needs. This was followed by a policy of liberalisation as part of the structural adjustment program adopted by the government in the early 1990s. The most comprehensive policy was the Agricultural Policy of 1995. The Zimbabwean Agricultural Policy (1995-2020) framework's objectives were to: increase agricultural production at a faster rate than previously experienced; improve earnings of the farming population in real terms; increase foreign currency earnings from agricultural earnings; produce additional supplies of raw materials for the manufacturing industry; improve distribution of incomes for smallholders and farm workers; and ensure much greater food security at household level (Mutisi, 2008:23). However to date the policy remains a pie in the sky due to the factors discussed above. The Fast Track Land Reform program adopted from 2003 has been ill conceived and chaotic which has resulted in Zimbabwe being isolated by Western Powers thereby further condemning the fragile agricultural sector into abyss.

As part of the strategies adopted to counter the impacts of droughts and to address household food and nutrition insecurity, the Zimbabwean government has been supporting the idea of small scale irrigation since 1980. Given the challenges faced by rain-fed agriculture, especially in agro regions 4 and 5 due to recurrent droughts, the government, civil society and development practitioners have been calling for the development of small scale irrigation schemes in communal areas and lately in A1 farmer settlements. Most of the 245,000 new farmers settled under the fast track programme are farming their

land and they have raised their own standard of living; have reached the production levels of the former white farmers; and, with a bit of support, are ready to substantially increase their production (AfricaFocus, 2013:11). Most A1 farmers are formerly landless people counted among the poorest of the poor and their farms are located in agro-regions 4 and 5 which have low rainfall. The group is currently having a remarkable farming enthusiasm and eager to continue increasing production, hence improve their food security.

2.2.4. Overview of Current Food Security Situation in Zimbabwe

Zimbabwe has suffered from food insecurity in the last decade. ***Food insecurity*** *exists when people do not have adequate physical, social or economic access to food (FAO 2000:10).* ZimVAC (2009:2) observes that since the year 2000, Zimbabwe has been experiencing economic and humanitarian challenges resulting from a complex web of overlapping factors, some of which include erratic weather patterns; hyperinflation; a shrinking economy and a receding international community. This has induced severe hardships on the already impoverished households resulting in worsening vulnerability for both rural and urban populace. Due to a nexus of multidimensional environmental, socio-economic and political factors, year after year, the country has ceased to be self-sufficient on food. Some regions like Matabeleland North and South provinces, Masvingo and Mashonaland East provinces, have been experiencing transitory food insecurity year in year out (ZimVAC, 2009: 6). The years 2008-2009 saw over 7 million Zimbabweans were food insecure. Although the number reduced to 1.5 million in the 2009-2010; 1.3 million in 2010-2011; 1.45 million 2011-2012; and the projected 1.6 million in 2012-2013 season, any external shock will see the numbers multiplying given the fragile economy of Zimbabwe, and the worst hit districts are in the provinces of Masvingo, Matabeleland North and South provinces which lie mainly in regions four and five (OCHA, 2012:8). Despite Agriculture still being regarded as the backbone of the Zimbabwean economy, the country has been a net recipient of food aid in the last decade. Previous studies on Zimbabwe's food security situation, as conducted by ZimVAC in the years 2000, 2003 and 2006, always indicated that high food

insecurity levels were in the rural areas, however, recent studies by the ZIMVAC reveals an increase in food security vulnerabilities in urban areas as well. This has led to international NGOs also entering the urban areas with food aid programmes. The map below indicates Zimbabwe's food insecurity percentages by districts with urban districts included:

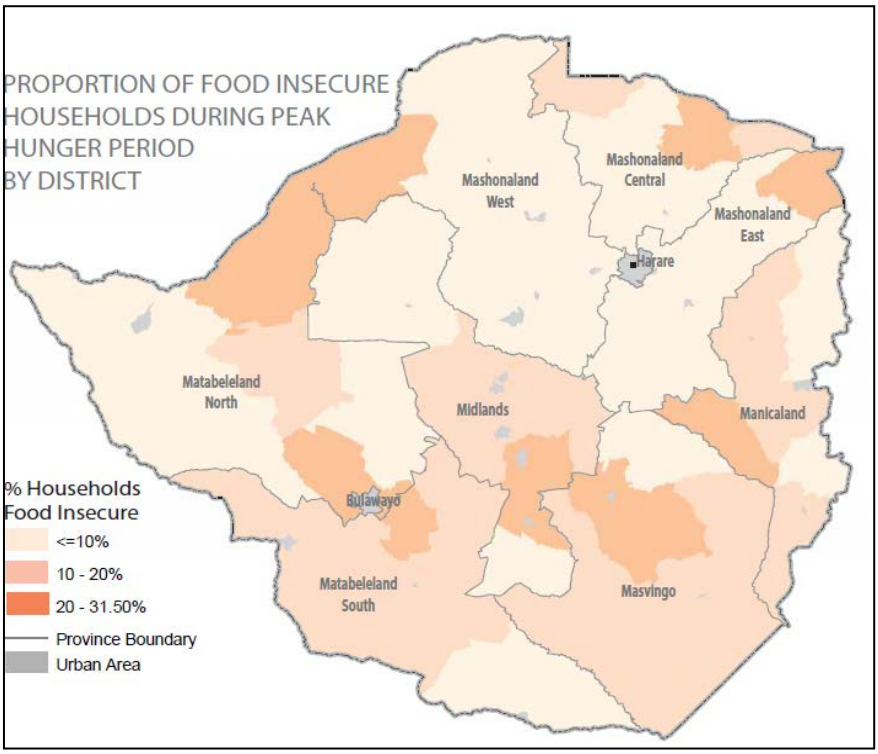


Figure 2.4: Food insecurity in Zimbabwe by province, (OCHA, 2011)

ZimVAC, (2009:5) elaborates:

Food security assessments in urban areas have been too few and far apart, viz; 2003 and 2006. Yet the deterioration of the Zimbabwean economy suggests a rapidly deteriorating food security situation in the urban areas of Zimbabwe. In October 2006, the ZimVAC urban food security assessment estimated 24 percent of the households in the high density and peri-urban settlements of Zimbabwe to be food insecure. The top three best provinces were Mashonaland East (14%), Midlands (17%) and Matabeleland South (20%), and the worst provinces were Bulawayo (35%), Manicaland (33%) and Mashonaland West (28%).

According to Tolossa and Tafesse (2008:66) food security is affected by a multitude of factors, which can be categorised into six: (i) Environment (e.g. availability and quality of natural resources, including water); (ii) demographic (e.g. rapid population growth and the resultant shrinkage of land); (iii) economic (e.g. markets, availability or unavailability of oxen, land size); (iv) technology and infrastructure (e.g. access to roads and health facilities); (v) social (harmful practices, feeding habits, burden on women); and (vi) political/policy (e.g. participation/non-participation in the decision-making process). The current food security situation in Zimbabwe is a cumulative product of a nexus between factors in the last decade. Mudimu (2004:6) grouped the factors into three intersecting factors; factors affecting food availability, accessibility and food utilisation as shown in figure 2.5 below.

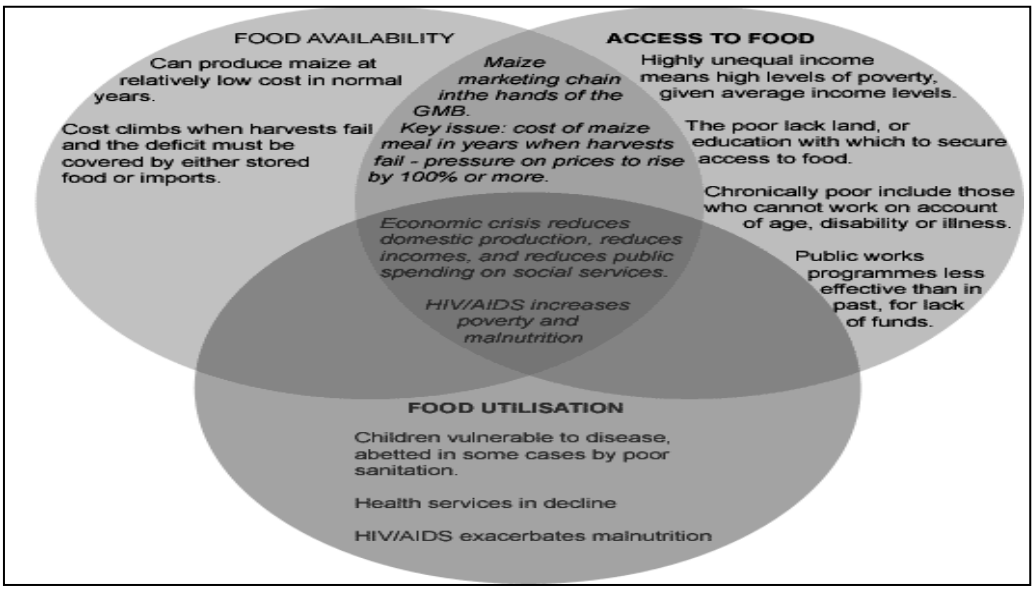


Figure 2.5 Factors influencing household food security (Mudimu 2004:8).

According to *Figure 2.5,* food availability in Zimbabwe mostly relies on the production level of maize (the staple food) at both household and state level. In normal years of sufficient rainfall maize is usually produced at low cost making it easy for households to access their supplies for the season. Most commercially produced maize is stored at the GMB silos for future use and retail market needs. However, in cases of abnormal years, household production levels are low, and access to maize is through purchase from retail markets. The fact that some of the maize is imported in the abnormal years

makes the cost of maize to become very high. Access to maize is then determined by the level of income, making it difficult for the poor whose income levels are very low to access food. With the poor economic situation in the country, it has been very difficult for the state to acquire agricultural inputs and this has crippled domestic food production to its lowest levels, making it even further difficult for the state to provide social services to the communities. Added to these has been the scourge of HIV/AIDs that is continuously eating up the working population, reducing households, and worse, it has resulted in child-headed, old-age-headed, and terminally-ill-headed households. The situation has increased poverty levels because these groups mostly rely on food hand-outs because they are not capable of working to produce their own food.

Since 2004, the above factors have been gradually worsening and reaching a peak in the 2008/9 season (World Bank, 2009:1). The political instability, the protracted socio-economic crisis and effects of climatic change have exponentially increased the number of people who are slipping through the social safety net into extreme poverty (Nhundu & Mushunje, 2010:48). The farmers have over time suffered technological and technical constraints, poor access to agricultural inputs and capital, marketing constraints due to deteriorating infrastructure and inconsistent policies by central government which tend to favour the rich and the connected (Mudimu, 2004:6 and AfricaFocus, 2013:5). The recurrent droughts, poor rainfall variability causing mid-season drought and cyclic floods have diminished the production capacity of small scale farmers, especially in agro regions 4 and 5 (WFP, 2012:3). Given the recurrent droughts, the continued dependence on rain-fed agriculture has been contributing to the high food insecurity in dry communal areas such as Inkosikazi.

2.2.5. Overview of Small Holder Irrigation in Zimbabwe

Since the establishment of the first irrigation scheme 1928, through the colonial period to the post independence era, there has been consistency in advocating for small irrigation as a strategy for achieving food security in Zimbabwe. The post-independence Government has been emphasising small

scale irrigation as a strategy for poverty reduction and economic development in which food security is an integral component. However, there is still a wide gap between policy and practice. According to the Government of Zimbabwe (1997), the potential area which could still be developed according to available potential water resources under formal irrigation (full or partial water control) is estimated to be 240,000ha, of which 90,000ha is under smallholder irrigation. Bjornlund (2004:29) noted that by the end of 2001, only 4800ha, constituting 2% of Zimbabwean agricultural land had been put under irrigation. This low figure has been caused by low investment by the government and private sector in small scale agriculture, and the government's pursuance of developing more expensive models of irrigation. In the Zambezia Magazine, Manzungu (2001) sums up, despite the good intentions, by 1997, 84% of irrigation was under large scale farms, 9% under parastatals and only 7% made up of small scale farms.

FAO (1997b) notes that there are three types of irrigation schemes in Zimbabwe classified according to management and ownership:

a. *Government owned schemes.* These are the schemes which the government assisted in establishing and are managed by the Department of Agricultural Technical and Extension Services (AGRITEX) personnel on behalf of the government. They constituted 32 % of the schemes by 2000.
b. *Farmer managed system.* These are managed by Irrigation Management Committees and farmers. Farmers are involved in the establishment, maintenance and management of the irrigation scheme and constituted 50% of the schemes in 2000. Evaluations by Makombe and Symbatha (2003:18), FAO (1997) and Munamati et al. (2006: 3-5) strengthen that these irrigation schemes tend to perform far much better than the government managed ones as people feel they own the schemes. The AGRITEX officers give technical support to the farmers in the schemes.
c. *Joint ownership.* These are government initiated schemes but have management committees made up of AGRITEX and community representatives. For jointly managed schemes, the farmers and the government share the financial responsibility for the operation and

maintenance. For such schemes the government is usually responsible for the head works, while farmers take responsibility for the infield infrastructure. The government is in a drive to make such schemes to be wholly owned by the community in the long run.

There is general agreement among scholars that most small scale irrigation schemes have managed to increase household food security. However, criticisms on small scale irrigation's effectiveness increases as the goal of research increases in scope on the impact of irrigation on broader issues such as poverty, national food security, and economic development, among others. FAO (1997b) describes some of the success expounded by earlier researches. Studies by Alvord (1933) and Roder (1935) on Nyanyadzi and Mutema irrigation schemes in Manicaland, Zimbabwe, respectively, pointed to an increase in crop yields and improvement in the standards of living of the farmers involved. Researches by Rukuni (1985, 1993); Meinzen et al. (1997); Munamati et al. (2008); Chibisa et al. (1997); Symbatha and Makombe (1999) and Bjornlund (2004), among others, concluded that apart from higher output compared to rain fed farms, most farmers involved had more food supplies and better incomes year round compared to farmers practising rain fed agriculture in the surrounding areas.

FAO (1997a and 1997b) concluded that smallholder irrigation in Zimbabwe has brought the following successes to farmers:

- Smallholder farmers are now able to grow high value crops both for the local and export markets, thus effectively participating in the mainstream economy.
- In areas of very low rainfall, as in Natural Regions IV and V, farmers enjoy the human dignity of producing their own food instead of depending on food handouts from the Department of Social Welfare.
- Irrigation development has made it possible for other rural infrastructure to be developed in areas which could otherwise have remained without roads, telephones, schools and clinics.
- Smallholder irrigators have developed a commercial mentality and now regard farming as a business.

- Crop yields and farmer incomes have gone up manifold.

2.2.6. Constraints Faced by Small Holder Irrigation in Zimbabwe

Despite the success discussed above, the irrigation schemes are riddled with a lot of challenges which greatly reduces their effectiveness in ensuring food security, hence institutions like SADC (1997) have dismissed them as economically unviable and of negligible importance on national and household food security. Bjornlund (2004), FAO (1997) and Chibisa et al. (1997) highlighted some of these challenges affecting small holder irrigation schemes in Zimbabwe. The problems can be grouped into financial constraints, policy related problems, technical issues, governance and management of the schemes, social power relations and environmental challenges.

Irrigation schemes demand high capital outlay in setting, operation and maintenance. The farmers often lack access to credit lines that will enable them to invest into their farming hence their low levels of production and incomes. The situation in Zimbabwe has been exacerbated by the economic decline that has daunted capital accumulation in the last decade. This is also related to the land rights issues in irrigation schemes. Most of the schemes are in communal areas where the farmers have no title to the land hence the land can neither be used as collateral nor be sold by ailing farmers to better farmers. The situation is even made worse by the gender inequality in which men control the land and women have user rights only.

The third set of constraints is on land holding. The above researchers observed that usually farmers are allocated very small pieces of land which makes it difficult to grow beyond subsistence. Most small scale irrigation schemes farmers have between 0.2ha to 0.5ha per farmer which are too small for meaningful production.

Technical issues relate to the design of the irrigation schemes and the ability of the farmers to keep the schemes running. Bjornlund (2004) emphasises on government designing expensive motorised irrigation schemes which are

costly in terms of energy usage (petrol, diesel and electricity) and in maintenance costs. The farmers lack technical knowhow to maintain some of the schemes and lack the heavy equipment that might be needed as in the case of rehabilitating silted dams. With regards to newly resettled A1 farmers, the irrigation systems on their farms were meant for large scale irrigation hence streamlining them has proven to be a challenge. The lack of technical expertise and practice in catchment management systems has further worsened the situation through reducing availability of water for irrigation due to dam siltation.

In terms of policy and institutional support, the level of support still leaves a lot to be desired. The policy emphasis on irrigation by government is often not matched with the resource allocation to the sector. Institutions put in place to assist the farmers in the supply of agricultural inputs and the marketing of the produce usually fail to assist the farmers timeously. There is also a general lack of decentralized irrigation service companies to give back-up service in rural areas.

The farmers are also affected by poor access to input and output market systems. Makombe and Symbatha (2003:6) emphasise that the success of small holder irrigation is dependent upon the marketing potential of agricultural products. The main buyer of grain in Zimbabwe, the Grain Marketing Board (GMB), fails to pay farmers on time whilst middlemen with instant cash heavily underpay the farmers, especially in remote areas. The situation is further worsened by the dilapidated transport and communication structures in areas away from cities, thereby affecting farmers from accessing input and output markets. The Economic Commission for Africa (2006:4) further accentuates that output markets are also affected by food aid which tends to create a depressing effect on local producer prizes, and acts as a disincentive for farmers to produce more.

Productivity is also hampered by management issues. According to Hanatani and Sato (2012:3), it has widely been recognized that the quality of management, rather than the size of the irrigation system and who owns and controls the system, determines the success or failure of the irrigation system.

In the government led ones, the lack of effective control over irrigation practices by farmers and the top down approach by Agritex officers, have resulted in the collapse of many irrigation systems. IFAD (2005:6) posits that where communities have not been properly integrated in the scheme from the inception, the schemes tend to lack sustainability as shown in the diagram below.

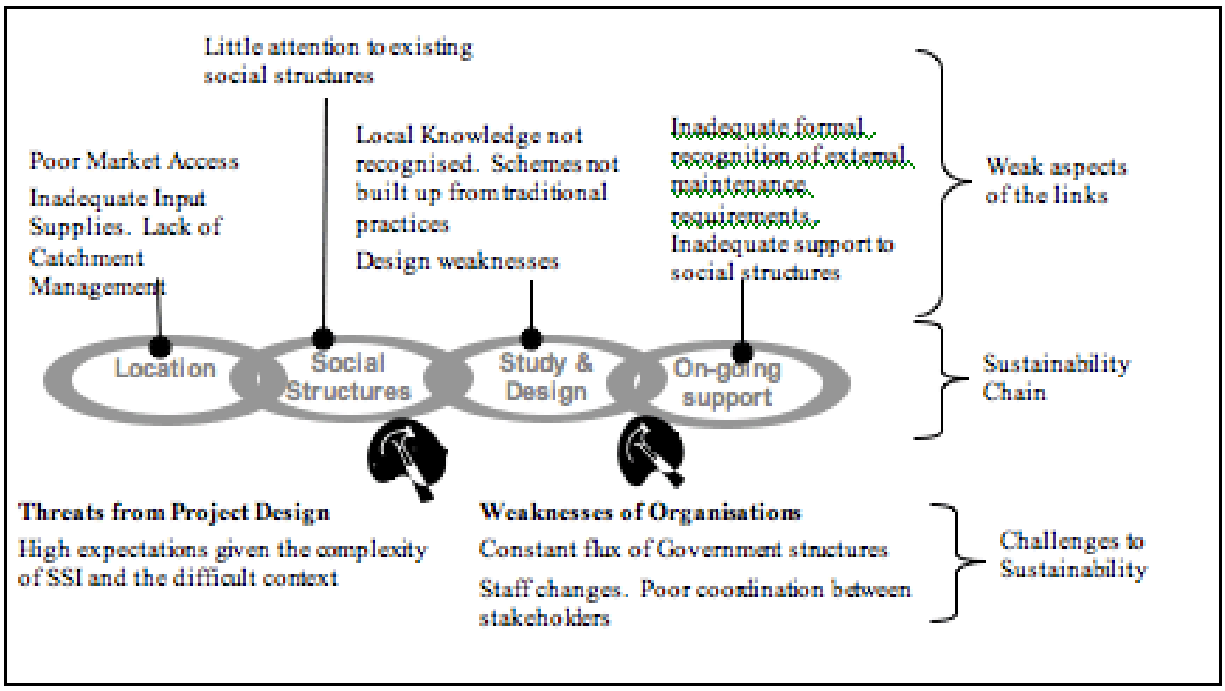


Figure 2.6 Four key aspects of sustainability and common weaknesses in small scale irrigation schemes (IFAD, 2005)

Location of the Scheme – If an irrigation scheme is located in an area that has poor roads it becomes inaccessible. The poor roads will make it difficult to transport the irrigation products to the markets for sale. The farmers will have difficulty in transporting agricultural inputs which will lead to inadequate supplies for their farming operations. It would also lead to poor catchment area management because the irrigation technicians would find it difficult to move around the project when doing maintenance work.

Social Structures – When little attention is given to local and existing social structures, local community leadership might resist any development and

block the smooth implementation of the irrigation project. Community participation from the initial stage of the baseline survey to the final implementation of any project has always been key to their development. If not involved, the communities might lobby politicians to block any development.

Study and Design – Before an irrigation project is established, a feasibility study is carried out to determine the suitability of such a project and all the technicalities that go with it are well assessed and designed to the appropriate standard. If the local community input and knowledge is not recognised, and the scheme is not built up from traditional practices, its design might be weak, and, it may collapse in the short-run, finally becoming a threat to sustainability.

On-going Support – An irrigation scheme must be well supported by all stakeholders. If there is poor coordination among stakeholders, constant interference by government structures, poor recognition of external maintenance requirements, poor recognition of local social structures, and staff changes by the organisations managing the implementation; all these factors might threaten the sustainability of the scheme and lead, finally, to collapse.

3.0. Conclusion

The review of related literature looked at how the definition of what constitutes food security has evolved over time culminating in the widely accepted World Food Summit of 1996. The key concepts and components were looked at in detail. The review also discussed the food security situation in Zimbabwe and the factors that affect food insecurity in the country. The concept of small scale irrigation was explored including the common types and methods used. Contradictions exist on the effectiveness of small scale irrigation as a food security strategy. One group of scholars advocate for the schemes because of their visible benefits whilst others feel it is a wastage of precious resources as the cost will never be recovered. The analysis of the Zimbabwean situation in terms of small scale irrigation for food security was done and the

constraints faced by various irrigation schemes were explored. This chapter provided the conceptualisation of food security and small scale irrigation schemes and the contextual issues which affect them, which are all critical to the investigations conducted in this evaluative research. The next chapter discusses the research methodology.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0. Introduction

This chapter gives an outline of how the research was conducted and the approaches used in doing the research. It also outlines the ethical issues considered, as well as the limitations of the study. The chapter outlines the data collection method used in the research and includes sampling and the method used to select the sample. It further outlines the design plan, administration of the data gathering tools, and an analysis plan of the information gathered. The mixed methods approach was used in collecting the data on evaluating the impact of small scale irrigation on food security. The researcher used a structured household questionnaire and key informant interviews. Detailed discussions on the preferred data analysis method have also been given in this chapter.

3.1. Research Design

A research design can be defined as the strategy, the plan, and the structure of conducting a research project (Carriger, 2000:19). The research design gives an overview of how the study will be structured and should be elucidated as it has very great implications on how the study will be conducted in terms of data collection and analysis. Devaus (2001:27) adds that the function of a research design is to ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible. In other words it is the overall strategy that a researcher chooses to integrate the different components of the study in a coherent and logical way, thereby enabling one to effectively address the research problem (University of California: Global Health Institute, 2012:15). It constitutes the blueprint for the collection, measurement, and analysis of data as determined by the research question. It involves making the major decisions on the sampling frame and techniques: how to collect data, analyse and interpret it; and finally, how to provide an answer to the research question.

As noted by the University of California: Global Health Institute (2012:6), there are many types of research designs that can be used depending on the nature and type of the research question. The research designs can be broadly divided into quantitative and qualitative research. However according to Creswell (1994:31), the inherent weaknesses of methods in quantitative and qualitative inquiry has led to the development of the third approach known as the mixed methods approaches which combines both qualitative and quantitative approaches. This is the approach that was adopted in this research.

3.1.1. Mixed Methods Approach

The rise of the mixed approach came as researchers observed that the strengths and weaknesses inherent in each of the methods could cancel and neutralise biases in them. Clarke (2005:61) acknowledges that the mixed methods approach incorporates both qualitative and quantitative elements in such a way that the information obtained from the approaches complement each other. Clarke, (2005:61) continues to define ***triangulation*** as the combination of methodologies deployed to study the same phenomena. The triangulation of data which is central to this approach is quite important in producing more definitive results. Chaponnière, Marlet, et al. (2005:6) argue that methodological pluralism is essential in irrigation studies as it enables researchers not only to do the traditional quantitative audit type of evaluations, but also utilisation-focused evaluations which promote accountability and learning from the schemes, especially where qualitative data is readily available. Utilisation-focused evaluation (U-FE) aims at providing information for primarily intended users like donors, policy makers, managers, and other stakeholders, leading to capacity building, support action, improvement, learning, and design for future actions (Patton, 1997:23). Patton, (2010:427) elaborates further:

Many options are now available in the feast that has become the field of evaluation. In considering the rich and varied menu of evaluation, utilization-focused evaluation can include any evaluative purpose (formative,

summative, developmental), any kind of data (quantitative, qualitative, mixed), any kind of design (e.g., naturalistic, experimental), and any kind of focus (processes, outcomes, impacts, costs, and cost-benefit, among many possibilities). It is a process for making decisions about these issues in collaboration with an identified group of primary users focusing on their intended uses of evaluation.

Delaure, (2007), Rao & Woolcock, (2003), Cashmore, (2004), and Lee, (2006), believe that a comprehensive representation of irrigation system performance will inevitably lead to a high number of sub-system components to assess, and valuing them quantitatively is difficult, time consuming and costly. All types of available data should consequently be used to inform these sub-system components. As a result Chaponniere, et al., (2005:6) deduce that methodological pluralism is especially relevant in these systems in which the components do not necessarily require quantitative assessment and where qualitative data is often readily available amongst the farmers whose expertise is poorly used by the evaluators.

Creswell (1994:19-20) synthesised propositions from various proponents of this approach and identified three main reasons why it is the most preferable. Firstly, the approach is used in ***sequential procedures*** where results for one method can be used to inform another method (Greene, Caracelli and Graham, 1989:63). In this procedure, the researcher conducts two phases of the project by doing the first method, then using the results of that method to plan for the next one. This may involve beginning with a qualitative method for exploratory purposes and following up with a quantitative method with a large sample so that the researcher can generalize results to a population. Alternatively, the study may begin with a quantitative method in which theories or concepts are tested, to be followed by a qualitative method involving detailed exploration with a few cases or individuals (Creswell, 2003:16). Secondly, the ***transformative procedures*** are used when the researcher uses the theoretical lens perspectives within a design that contains both qualitative and quantitative methods. This lens provides a framework for topics of interest, methods for collecting data, and outcomes or

changes anticipated by the study. Within this lens could be a data collection method that involves a sequential or a concurrent approach (Creswell, 2003:17). The third one, which was used in this study, is the ***Concurrent Procedures***. This is when the researcher utilises both quantitative and qualitative methods simultaneously so as to provide a comprehensive data collection and analysis to the research problem. Qualitative and quantitative data is collected concurrently and an integrated analysis of the results is done. Clarke (2005:59) also notes that the researcher integrates quantitative and qualitative data in order to provide a comprehensive analysis of the research problem, (e.g. survey plus experiment or in-depth interview). The investigator collects both forms of data at the same time during the study and then integrates the information in the interpretation of the overall results. Creswell (2003:18) concludes by saying, *In this design, the researcher nests one form of data within another, larger data collection procedure in order to analyze different questions or levels of units in an organization.*

Advantages of Mixed Methods

The advantages of the mixed approach are summarised according to Clarke (2005:62) below:

1. *Balances efficient data collection and analysis with data that provides context.*
2. *Quantitative data quickly and efficiently captures potentially large amounts of data from large groups of stakeholders.*
3. *Qualitative data provides contextual information and facilitate understanding and interpretation of the quantitative data.*
4. *Because qualitative data is collected from a subset of the stakeholders, costs are mitigated.*

Challenges of the Mixed Approaches

The only main challenge of this approach is to ensure that data collection methods complement and not duplicate each other as this doubles costs.

Why this Study used the Mixed Methods Approach

This study used the concurrent procedures of the mixed methods approach based on ***triangulation***, because it allows for seeking convergence of results and ***expansionism***, adding to the scope and breadth of the study.

3.1.2. Quantitative techniques

Quantitative research is aimed at determining the relationship between one thing (an independent variable) and another (a dependent or outcome variable) in a population. The research emphasises the collection and analysis of numerical data. It concentrates on statistical techniques like measuring the scale, range, frequency, mean, etc. of the phenomena. In other words, it applies statistical or mathematical principles to evaluate evidence collected in the research and presents it in tables and graphs. Kothari (1985:32) acknowledges that quantitative research using statistical methods often begins with the collection of data based on a theory or hypothesis or experiment followed by the application of descriptive or inferential statistical methods. Quantitative research designs are either descriptive (subjects usually measured once) or experimental (subjects measured before and after a treatment). This research utilised the descriptive design.

3.1.3. Descriptive or Survey Research Design

Descriptive research attempts to describe and explain conditions of the present by using many subjects and questionnaires to fully describe a phenomenon. Descriptive research designs help provide answers to the questions of who, what, when, where, and how associated with a particular research problem (Babbie and Earl, 1989:112). Descriptive research is used to obtain information concerning the current status of the phenomena and to describe "what exists" with respect to variables or conditions in a situation. Descriptive research is designed to provide further insight into the research problem by describing the variables of interest and can be used for profiling, defining, segmentation, estimating, predicting, and examining associative relationships (Borg and Gali 1989:17). Khothari (1985:21) expands by saying descriptive research attempts to describe systematically a situation, problem, phenomenon, service or programme, or provides information about, say, living condition of a community, or describes attitudes towards an issue.

In descriptive research, the subject is being observed in a completely natural and unchanged natural environment. The approach yields large amounts of data for detailed analysis which can be used in the formulation of important recommendations. Surveys are a flexible tool, which can produce both qualitative and quantitative information depending on how they are structured and analysed (Stuart & Nicola, 2002:9). Descriptive research relies on observation as a means of collecting data, and attempts to examine situations in order to establish what is normal, and what can be predicted to happen again under similar circumstances.

In this research a household survey was used to collect data while the respondents were in their environment. The respondents of the research were specifically members of the community who have benefited and are still benefiting from the Inkosikazi irrigation project. The population of this research was located in the same geographical area and was easy to locate, as most of them were found in the irrigation fields during the survey. Data was collected by identifying issues from the people directly involved in the irrigation project, identifying further issues from the project documents, observing how the project was actually working and how the people were benefiting from its existence. A questionnaire survey was administered on a face-to-face basis by field assistants to encourage acquisition of detailed information from the respondents. This was done as a cushion on the capability of the respondents to complete a written survey/ questionnaire. The outcome of the survey was to describe the relationship between irrigation and food security.

3.1.4. Qualitative Research

As part of the mixed methods approach, qualitative research was used to augment the findings of the quantitative research. Qualitative research is a form of social inquiry that focuses on the way people interpret and make sense of their experiences and the world in which they live. It seeks to understand the social reality of individuals, groups and cultures. The basis of qualitative research lies in the interpretive approach to social reality

(Holloway, 1997:34). Qualitative research is also described as an unfolding model that occurs in a natural setting that enables the researcher to develop a level of detail from high involvement in the actual experiences (Creswell, 1994:44). Leedy and Ormrod (2001:22) and Williams (2007:48) argue that qualitative research is less structured in description because it formulates and builds new theories, and its purposeful use is for describing, explaining, and interpreting collected data.

Campbell et al. (1963:13) posit that all research ultimately has a qualitative grounding. The various strategies in qualitative research provide for the systematic collection, organization and interpretation of textual material obtained while talking with people or through observation. This research used the phenomenology type of qualitative research. The research design is based on human experience and aims to investigate the meaning of social phenomena as experienced by the people themselves (Malterud, 2001:67).

Qualitative research is multi-method in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret phenomena in terms of the meanings people bring to them. Qualitative research involves the studied use and collection of a variety of empirical materials – case study, personal experience, introspective, life story, interview, observational, historical, interactional and visual texts – that describe routine and problematic moments and meanings in individuals' lives (Denzin, and Lincoln, 2004:2). Qualitative research was thus used in the research to explore issues that might be missed with the household survey. Lieber, (2009:3) observes that qualitative methods take researchers closer to the phenomenon of interest than can be achieved with broader surveys or scales. He proceeds to note that they help to understand peoples' beliefs and theoretical models for how they perceived and organize their life activity and routines in subjectively meaningful ways.

Qualitative methods like exploratory interviews, qualitative pretesting and observations can be used to pinpoint and prioritize the required information (Creswell, 2003:21). The issues of a community's set up, cultural beliefs,

routine practices, and experiences are usually left out in surveys. In a qualitative research, these can then be prioritised by specific questions on the questionnaires to address the issues and give the researcher meaningful understanding of the community he is studying. In the study this was noted and a semi-structured questionnaire was used with key informants together with the data which have been concurrently analysed with the household survey data and has been useful in triangulating data. The research focused on discovering and understanding the experiences, perspectives, and thoughts of participants through various strategies of inquiry such as observations, the questionnaire administered on a face-to-face basis, coupled with structured interviews, to motivate participants to provide detailed information. The interviews were done in the participants' natural settings, attempting to make sense of, or interpret phenomena in terms of the meanings they attach to the impact of irrigation on food security.

3.2. Justification for Choice of Design

The mixed methods approach gives a fusion of the qualitative and quantitative methodologies in the study. The descriptive research has an advantage in that it observes or studies a phenomenon completely in its original and unchanged natural environment. The key informants and members of the community were observed, studied and interviewed within their natural physical, social and economic environment. Harwell, (2012:151) formally defines mixed methods research as the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study. Mixed methods research also is an attempt to legitimate the use of multiple approaches in answering research questions, rather than restricting or constraining researchers' choices. It is an expansive and creative form of research, not a limiting form of research. It is inclusive, pluralistic, and complementary, and it suggests that researchers take an eclectic approach to method selection and the thinking about and conduct of research (Harwell, 2012:152).

Caracelli and Greene (1997:19-20) identified three typical uses of a mixed methods study: (1) testing the agreement of findings obtained from different measuring instruments, (2) clarifying and building on the results of one method with another method, and (3) demonstrating how the results from one method can impact subsequent methods or inferences drawn from the results. Research planning benefits from understanding both qualitative and quantitative sampling and how they compare in terms of generalizability, case selection, focus of information (level of analysis), timing, rigidity of the sampling frame, and the types of data generated (Lieber, 2009:5).

Challenges to integrating these approaches stem from a number of practical design and logistical issues: (a) balancing the relative strengths of each, (b) finding ways to bring relatively incompatible data closer without sacrificing quality, and (c) developing strategies to dynamically integrate these data for efficient and cross-discipline analysis (Lieber, 2009:8).

ACET Inc, (2013:2) summarises this approach as follows:

The advantage of a mixed methods approach is that it balances efficient data collection and analysis with data that provides context. The quantitative data quickly and efficiently captures potentially large amounts of data from large groups of stakeholders. The qualitative data provides the contextual information and facilitates understanding and interpretation of the quantitative data. And, because qualitative data is collected from a subset of the stakeholders, costs are mitigated.

Even though the three approaches, quantitative, qualitative and mixed methods, are often comparable, none of them is the best. The approach that best aligns with the logic model and/or the goals of the evaluation is usually the best approach for that particular evaluation (ACET, 2013:2). This study found that the mixed methods approach was the best one for evaluating the impact of the irrigation project on food security. Quantitative techniques were used in evaluating the agricultural production output of the plots, the increase or decrease in assets and incomes over the years under study, household

food consumption levels, and others, while qualitative techniques were used in explaining and answering some questions on community set up, beliefs, perspectives, and experiences in relation to irrigation benefits. Therefore, the mixed method approach enabled multi-layered analysis to be done in the study in order to obtain holistic information on the community's understanding of irrigation and food security.

3.3. Population and Sampling

3.3.1. Population

A population can be defined as the total number of inhabitants constituting a particular race, class, or group in a specified area. In this research population refers to the inhabitants of Wards 4 and 5 of Inkosikazi. The target population was farmers in the Inkosikazi irrigation scheme, members of the community and selected key informants.

3.3.2. Sampling Frame

The sampling frame incorporated all the farming households in the two wards. Sampling units included key elements of the study and individual households selected from the sampling frame.

3.3.3. The Sample

A sample is a subset of subjects that is representative of the entire population. Kothari, (1985:35) defines a sample a*s a segment of the population selected to represent the population as a whole.* Ideally, the sample should be representative and allow the researcher to make accurate estimates of the thoughts and behaviour of the larger population. The sample must be of sufficient size to warrant statistical analysis. Sampling is done usually because it is impossible to test every single individual in the population. It is also done to save time, money and effort while conducting the research (Castillo, 2009:18). A total of 144 households were directly interviewed through the household survey, out of the total population of 240 irrigation farmers. The sample constituted 60% of the total population. The sample gender distribution consisted of 87 male (60%) of the total sample,

and 57 female (40%). This gender pattern represents the general traditional dominance of men over women. This dominance is traditionally one of the causes of poverty as it gives women no rights to fend for their families, but leaves everything in the hands of men and hence their dependence on men. Forty-eight (48) households were selected from farmers who joined the irrigation in phase one, forty-eight (48) from those who joined in phase two, and finally, forty-eight (48) from those who joined in the last phase. This made it easy to do some comparative analysis between the groups. The comparison was made between the irrigation farmers to determine how their household food security had changed over the years from the time they joined the irrigation project. Additionally, a key informant from the Department of Agriculture, an AGRITEX Officer, was generally interviewed as a person involved in farmer training and monitoring the irrigation through the eye of the government.

Sampling Technique

Dawson, (2002), Kothari, (1985), and Kumar, (2005) concur that the needs of the research project will determine which sample method or technique is most effective. They proceed to divide sampling techniques into two categories, namely probability and non-probability sampling.

1. ***Probability Sample*** **–** in this sample members may be chosen *at random* from the entire population. Its characteristics are:

- *Simple random sample:* every member of the population has a known and equal chance of being selected.
- *Stratified random sample:* the population is divided into mutually exclusive groups such as age groups and random samples are drawn from each group.
- *Cluster(area)sample:* the population is divided into mutually exclusive groups such as blocks, and the researcher draws a sample of the group to interview.

2. ***Non-Probability Sample*** – in this sample the researcher might *select people who are easier* to obtain information from. Its characteristics are:

- *Convenience sample:* the researcher selects the easiest population members from which to obtain information.

- *Judgment sample:* the researcher uses his/her judgement to select population members who are good prospects for accurate information.
- *Quota sample:* The researcher finds and interviews a prescribed number of people in each of several categories.

In this research a multi stage sampling technique has been used. In this sampling strategy, the entire population is divided into naturally-occurring clusters and sub-clusters, from which the researcher randomly selects the sample. The reason for use of purposive sampling is that the researcher purposely chooses persons who, in his judgement, are thought to be relevant to the research topic and are easily available to him (Castillo, 2009:22), and to get 'rich material' from special groups (Patton, 1990:7). In this study, purposive sampling was used in selecting the targets for the research and random sampling in selecting the actual respondents for the household questionnaires. Firstly, an equal allocation of one hundred and twenty (120) households was allocated from each of the two wards. Secondly, an equal allocation of eighty (80) was done according to household farmers who joined the irrigation project in phases 1, 2 and 3 respectively. The eighty (80) for each phase were further divided into five (5) groups of sixteen members. Each of these groups chose a group leader, forming a small group of five members. Random sampling was then used on the leaders' group to select three out of five members. The random selection of three leaders meant that their full group of 16 members would participate in the household survey. The total number of three times sixteen (3x16) member groups is forty-eight (48) for each phase of households in each sample. The three phases of the irrigation implementation project then brought the total number of households who participated in the household survey to 144.

The advantage of using multi-stage sampling is that it is cheap and increases the speed in which the survey can be done. It ensures that selected population units are closer, thus enumeration costs for personal interviews will be reduced, and field work will be simplified. In the study it was ensured that the investigation covered both wards and the opinions of both men and women were been heard. The gender distribution of the final sample

consisted of 87 male (60%) of the total sample, and 57 female (40%). This gender pattern represents the general traditional dominance of men over women. This dominance is traditionally one of the causes of poverty and household food insecurity as it gives women no rights to help man in fending for their families, but leaves everything in the hands of man, and hence greater dependence on whatever little income men get. Sen, (1998:23) advises that women should be particularly targeted for participation in developmental projects as they are the main agency for transformation of the well-being of families.

3.4. Research Instruments

Three methods, namely, review of project documents, interviews and questionnaires were used in the research in assessing small scale irrigation schemes as a food security initiative. The research was done within the framework of the four main dimensions of food security, namely, food availability, accessibility, stability and utilization. The three methods are explained below:

3.4.1. Review of Documents

Review of relevant documents was done to develop an in-depth understanding of the project area. This included both documents in the public domain on food security and irrigation in general, and World Vision project documents on the Inkosikazi irrigation scheme along the project cycle such as the baseline survey, project feasibility study, environmental impact assessment analysis, progress reports, production reports, farmer training, climate changes, and management reports. Overall, the documents review assisted in the development of participatory question guides for discussions and interviews with various categories of respondents who were selected after literature review. The Literature review was a continuous process that was carried out throughout the whole survey process.

3.4.2. Individual Key Informant Interviews

Individual in-depth interviews were conducted with key staff member of World Vision, the irrigation committee chairperson, the ward Agricultural Extension Officer, a local councillor, the headmaster of the local school, one randomly selected community member, and two village heads. The objective of these interviews was to gain more in-depth appreciation of the changes that have been brought by the Inkosikazi irrigation scheme. A semi-structured questionnaire was used to guide the interviews. This qualitative method enabled the researcher to capture in-depth information from the interviewees on their perceptions and ideas on the impact of the Inkosikazi irrigation scheme on food security in the community of Bubi district at large.

3.4.3. Household Survey Questionnaire

Stuart and Nicola, (1986:15) say there are two types of surveys, namely cross-sectional and longitudinal. ***Cross-sectional surveys*** are used to gather information on a population at a single point in time. An example of a cross-sectional survey would be a questionnaire that collects data on peoples' experiences of a particular initiative or event. A cross-sectional survey questionnaire might try to determine the relationship between two factors, like the impact of a programme of activity on the level of benefits claims to the community involved. ***Longitudinal surveys*** gather data over a period of time. This would allow analysis of changes in the population over time and attempt to describe and/or explain them.

This research used the cross-sectional survey in which a questionnaire was administered in the process. A questionnaire is a list of research or survey questions asked to respondents, and designed to extract specific information. It serves four basic purposes, namely to collect the appropriate data, to make data comparable and amenable to analysis, minimize bias in formulating and asking question, and to make questions engaging and varied. The household survey structured questionnaire was the main instrument of the research. A representative sample of households was selected and interviewed using a structured questionnaire. The main target of the questionnaire was the house

head or the person designated to be part of the Inkosikazi irrigation scheme. Stuart & Nicola, (1986:18) identify three types of interview styles and these are structured, semi-structured and unstructured interviews. ***Structured interviews*** follow a set of specific questions, which are systematically developed. This type of interview is used when the researcher wishes to acquire information where the responses are directly comparable. ***Semi-structured interviews*** are a more commonly used interview technique that follows a framework in order to address key themes rather than specific questions. At the same time it allows a certain degree of flexibility for the researcher to respond to the answers of the interviewee and therefore develop the themes and issues as they arise. ***Unstructured interviews*** do not follow any predetermined pattern of questions or themes. The interviewer addresses the issues as they emerge during the interview. This method is useful when the researcher wishes to explore the full breadth of a topic.

Advantages of Interviews

Kothari, (1985:23) lists five advantages of personal interviews as one of the best technique to acquire detailed information from respondents.

- It is very flexible and can be used to collect large amounts of information.
- Trained interviewers can hold the respondent's attention and are available to clarify difficult questions.
- They can guide interviews, explore issues, and probe as the situation requires.
- Personal interview can be used in any type of questionnaire and can be conducted fairly quickly.
- Interviewers can also show actual products, advertisements, packages and observe and record their reactions and behaviour.

Advantages and Disadvantages of Questionnaires

As noted by Haralambos and Holborn (2000:33), there are inherent strengths and weaknesses in the use of questionnaires. The first advantage is that they allow for the collection of large quantities of data in a short period of time.

Secondly, they provide a method to collect the data at a manageable financial cost. Thirdly, data from a questionnaire is easily quantified and manipulated. Fourthly, questionnaire research has the capacity to use larger samples than a more qualitative method such as interviews.

However, the use of questionnaires does have its own weaknesses. This includes researcher biases embedded in the very design of questionnaires especially on coded questions where a range of responses are pre-planned. The other one is that respondents may not give full and accurate replies to questions and this jeopardizes the validity of the data. Furthermore it cannot be assumed that different answers to the same question reflect real differences.

3.5. Data analysis

The entry of data collected from the household survey will be done using general statistics and excel. Data analysis will include verification and frequencies and other statistic methods.

3.6. Pre-test

According to Sudman (1983:56), pretesting is the only way to evaluate in advance whether a questionnaire causes problems for interviewers or respondents. Pretesting of questions is done to avoid phrasings which will be unintelligible to the public and to avoid issues unknown to the man on the street (Katz, 1940:12). Five questionnaires were administered during the pre-test. The questionnaires were then amended by deleting repetitions and clarifying some questions which were vague, dropping irrelevant questions and refining the questionnaire in line with the respondents' understanding. It also assisted the researcher in differentiating which questions to be put to key informants and which to include in the household survey and what data to get from World Vision monitoring processes.

3.7. Gaining Entry

To gain entry to Inkosikazi, the researcher used his relationship with the community, being a former project finance and administration officer and former acting programmes manager in the area. Prior consent was given by

the World Vision Operations Manager, Southern Region. The researcher also used contacts in World Vision to assist in accessing the key contacts and in collecting the data. The researcher used own resources for logistics whilst the personal contacts acted as assistants in the data collection. The irrigation committee assisted in providing the lists of households and identifying the selected households.

3.8. Ethical Considerations

According to Alderson (2010:6) research should, as far as possible, be based on participants' freely volunteered informed consent. This means that the researcher has the responsibility to explain fully and meaningfully what the research is about and how it will be disseminated. The research participants should be made aware of their right to refuse to participate; and understand the extent to which confidentiality will be maintained; be made aware of the potential uses to which the data will be applied; and in some cases be reminded of their right to re-negotiate consent at any part of the conversation (Corti, Day and Backhouse, 2000:29). The researcher sought consent from the Bubi district leadership, the Council, and local community leadership to conduct the research in the study area and with the inkosikazi irrigation beneficiaries in particular. This was to ensure that all protocols, both at political and community levels, within the district structures were observed. With the aid of the World Vision Field Manager for Inkosikazi, the researcher's first point of entry was to approach the District Administrator's (DA) Office. The District Administrator is a political figure appointed to manage the district affairs, and controls the political leadership of the whole Bubi district. The DA then assisted the researcher to meet the councillors of the wards, who, in turn, further assisted the researcher to meet the community leaders, the Chief, the Headman and ward leaders. On approaching community leaders and the local ward councillors the researcher had to explain to them the aims, objectives and the scope of the research, and to solicit their support during the process. The community leaders then helped the researcher in mobilising target audiences on behalf of the researcher and his assistants to enable them to access the irrigation beneficiaries who are the research participants.

The gathered research participants were informed of their right of informed consent and their right of anonymity and confidentiality. The researcher had to fully explain about this educational research and seek their consent before conducting any interviews. All interviewees volunteered the information without any duress or promises of any material gain.

3.9. Limitations and Resolutions

Limitations observed in the mixed research methods are:

1. The loss of depth and flexibility that occurs when qualitative data are quantitized. Driscoll, et al. (2007:25) admits that, in theory, mixed method researchers who quantitize qualitative data need only to avoid focusing on the quantitative dataset to the exclusion of the original qualitative data to avoid this problem, whereas, in practice, analyzing, coding, and integrating unstructured with structured data is a complex and time consuming process. In this research it we found it helpful to return to discrete and original qualitative responses obtained from the questionnaire associated with significant statistical findings rather than to the entire qualitative dataset. In other words we relied entirely on the respondents' responses from the questionnaire interview and any additional clarifications to their responses.
2. Prospective participants had very limited time available to respond to the study. The study employed a flexible and interactive data collection strategy: a questionnaire that combined qualitative and quantitative questions to enable us collect data simultaneously, coupled with face-to-face interviews.
3. Concurrent data collection designs usually preclude follow-up on interesting or confusing responses. This study relied entirely on respondents to augment their survey responses by following-up on any issues, and most respondents made some follow-ups and provided updated responses.
4. The need to collect and analyze qualitative data can force researchers to reduce sample size, which can curtail the kinds of statistical procedures that might reasonably be used. This study employed simple statistical

measures of association only for response categories collected in different phases of the irrigation project. The mixed method design used in the study does not require data transformation, and hence the sample of 60% (144) of the total population (240) has been reasonable to provide accurate information on the impact of the irrigation project on food security of the households involved.

3.10.Conclusion

The chapter presented the research design used in the research and the methodologies of data collection and analysis. The mixed method approach was used which combines the quantitative and qualitative methodologies. The sampling techniques used in the research were also explained. The household survey using a household structured questionnaire and the key informant interviews using a semi-structured questionnaire were discussed in detail. The chapter also looked at the pros and cons of using the selected methodologies. The next chapter focuses on data presentation and analysis of major findings.

CHAPTER 4

DATA PRESENTATION AND ANALYSIS OF MAJOR FINDINGS

4.0. Introduction

This chapter presents the description and findings of the study. According to Best and Kahn (1993:203), data interpretation *"... involves explaining the findings, answering the why questions, attaching significance to particular results, and putting patterns into an analytic framework"*. It is in this vein that this study undertook the following interpretation and discussion to evaluate the results for regularities, patterns, explanations, causal relations, configurations and propositions, extending to their significance and implications. A total of 144 (representing 60%) household respondents were sampled from the 240 Inkosikazi irrigation farmers. The raw household data was triangulated with information gathered from the fieldwork in Wards 4 and 5, and the project monitoring data collected by World Vision in order to determine the impact of the Inkosikazi small scale irrigation scheme on food security.

4.1. Section 1: Household Demographics of Respondents

A total of 144 households were interviewed in the household survey, 48 beneficiaries from each of the three implementation phases, in the years 2005 to 2006, 2007 to 2008, and 2009 to 2010. Each group of these beneficiaries had started cropping using the irrigation project as the implementation steadily progressed in 20ha phases, with each phase absorbing 80 farmers into the project and taking two years to full implementation.

4.2. Age and Gender of Respondents

The target group of the survey were plot holders in the irrigation scheme.

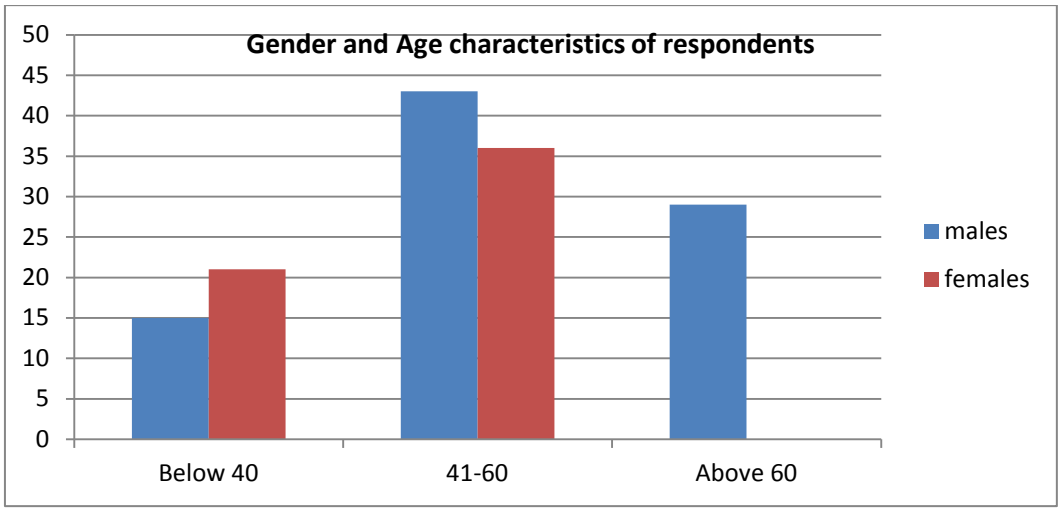


Figure 4.1: The gender and age characteristics of respondents N=144

Men represent the majority of the respondents in the household survey constituting sixty percent (87 respondents), while women are represented by 57 (40%). Of these women, 33 (58%) are divorced, 18 (32%) unmarried, while 6 (10%) are widows. The gender pattern in the sample represents the general dominance of men over women. This is traditionally one of the causes of poverty as it gives women no rights to fend for their families, but leaves everything in the hands and dependence on men.

Most irrigation farmers are in the middle age group (40-60). There are 79 respondents, constituting 55%, while 36 (25%) respondents are below 40 years old. However, 29 (20%) respondents are above 60 years old and all these are men who also own the allocated irrigation plots. This pattern is reflective of the Zimbabwe situation in which men have to continue working to feed their children and grand children.

The average size of a family of the beneficiaries of the Inkosikazi irrigation scheme is five. 108 (75%) of the interviewed households have five or more people, while 36 (25%) have 4 and fewer people. In terms of educational level, 57 (40%) have attended primary education, 65 (45%) have attended up to secondary level, while 22 (15%) have studied up to tertiary education. This high literacy rate is generally normal in Zimbabwe and makes it easier for community training in the Master Farmer courses usually carried out by the

government's AGRITEX wing to community farmers to help them manage their small farming businesses.

4.3. Section 2: Household Asset Characteristics Compared

In Zimbabwe rural community assets and wealth are defined by the number of domestic animals a household owns. The domestic animals can be easily converted into cash through selling them at any given time. The cash obtained from such sales is then used to pay school fees for the children and supplement food. Inkosikazi community is not an exception. The respondents' household assets were also assessed to determine their level of wealth as illustrated in Figure 4.2 below.

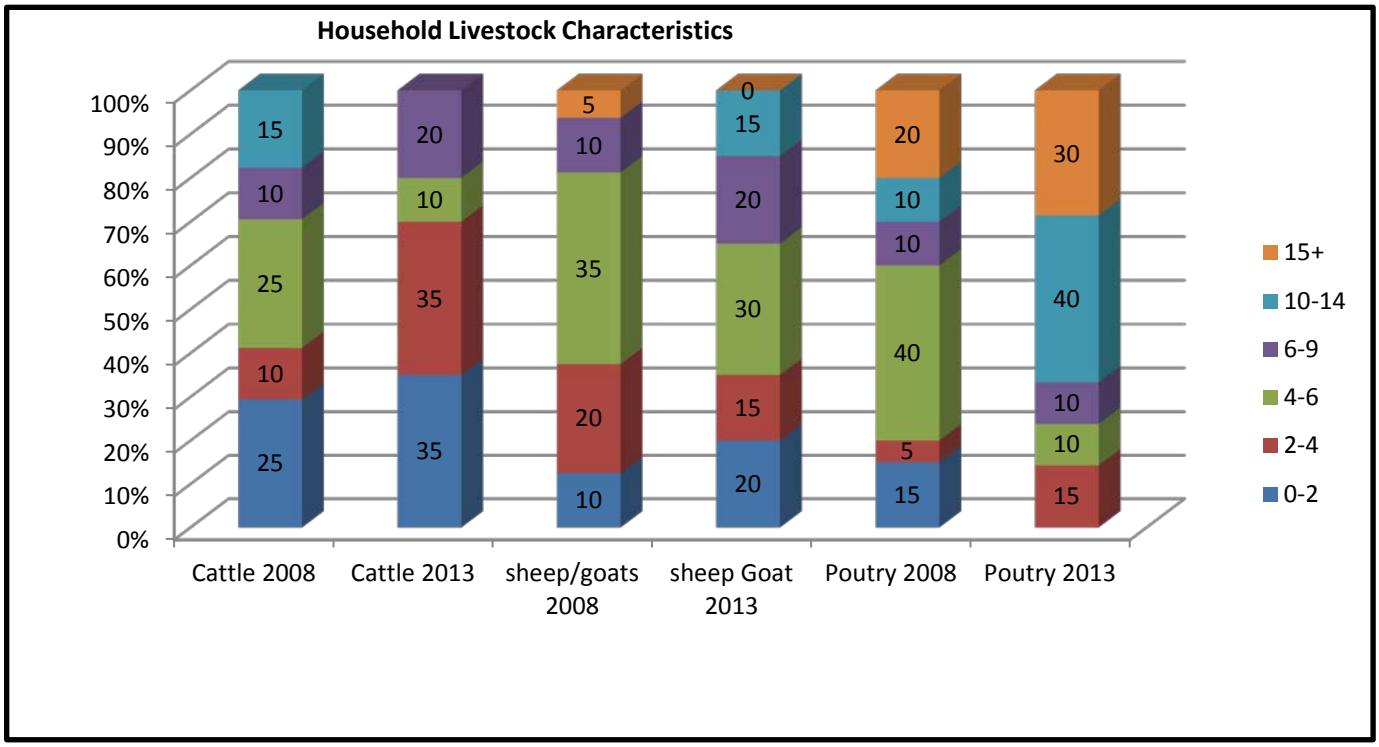


Fig 4.2: Household livestock assets from 2008 (base year) to 2013 (current year)

The most highly regarded livestock in the community is cattle. The table below, Figure 4.3, shows household wealth. All households interviewed have cattle. 108 (75%) of the respondents own more than two beasts in the current year, 2013. 95 (65%) of the respondents own more than 5 goats or sheep in

the current year 2013. All households have chickens with over 100 (70%) owning more than 10 chickens. In 2013 the range of poultry was from as little as 3 chickens to as many as 70 chickens among the households interviewed. Cattle are essential for providing draught power and cash when needed, whilst small livestock and poultry cushion farmers as both serve as food and cash sources in times of droughts which are perennial in the area.

A comparative analysis was done to check whether there has been any difference in livestock holding between those who were in the first phase harvest of the irrigation scheme in the 2005 – 2006 planting season versus those who joined the scheme in the last phase in 2009-2010 planting season. The graphs below analyses these changes in ownership of livestock and productive assets.

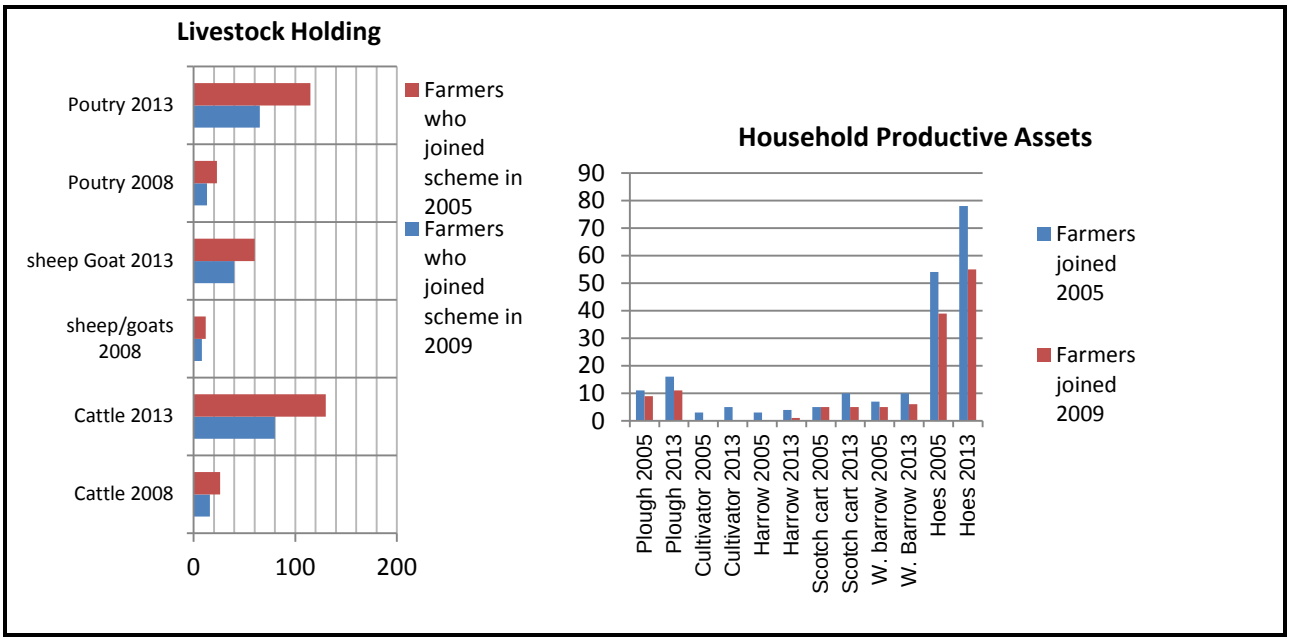


Figure 4.3: Differences in ownership of livestock and productive resources between farmers according to their joining phases

The group that joined in the first phase in 2005-2006 have more livestock (cattle/sheep/goats) and productive assets, but the growth rate of these remained constant over the years for all the groups. The farmers who joined in the first phase own 55% of cattle, 61% of sheep/goats in the current year (2013) compared to the other farmers who jointly own 45% cattle and 39% of

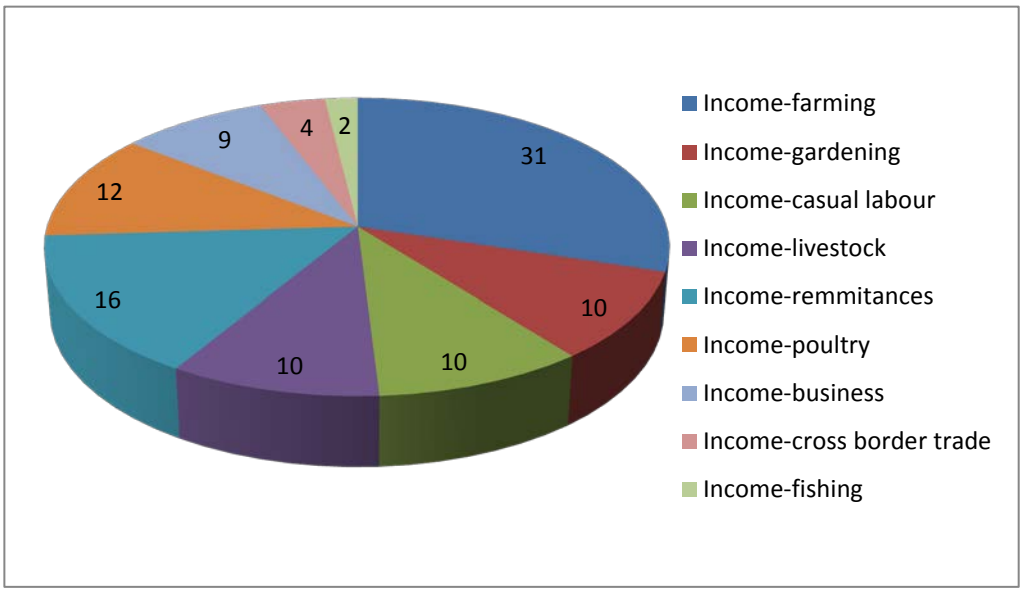
sheep/goats. The growth rate for cattle for both groups remained at 2%, while that of goats/sheep remained at 1%. However, regarding poultry, the group which joined in 2005 gained by a 5% margin whilst the later irrigation farmers lost 5% between 2009 and 2013. This result shows that there was no significant impact of the irrigation scheme on large livestock holding among farmers. For poultry, the later farmers might have been selling to supplement their income and food supplies whereas those who were already practising irrigation were more food secure, hence their accumulation.

The results show that the farmers in the irrigation scheme have more productive assets with noticeable increases in ploughs, scotch carts, harrows and hoes. The graph above shows that the first phase group in the irrigation scheme experienced a 5-15% growth in assets in the period 2005-2012. With the later phase irrigation farmers, there is a marginal growth of assets but with no one having cultivators and harrows over the time. Though the result cannot be conclusive on the contribution of the irrigation scheme to assets, it can be argued that the availability of food in the household frees some income to be spent on productive assets and poultry. Oxfam GB (2012:65) also notices that the 'dollarisation' of the economy has slightly increased the purchasing power of the farmers compared to prior periods.

4.4. Section 3: Household income, expenditure and consumption patterns.

4.4.1. Sources of household income

% Income sources of farmers who joined in 2005-6 planting season



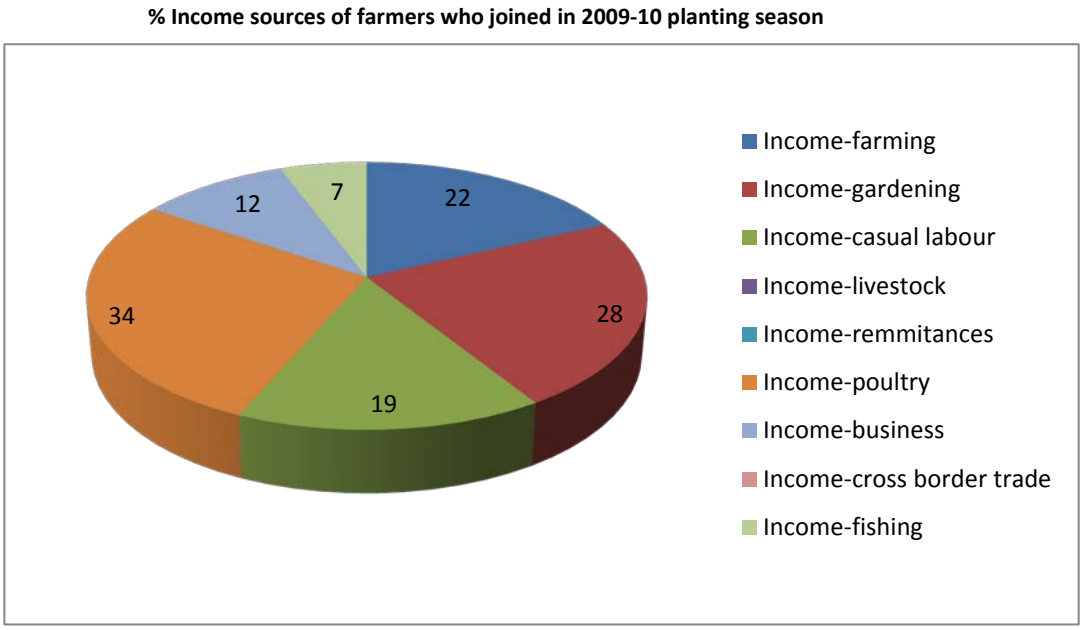


Figure 4.4: A comparative analysis of income sources in the last 12 months

A comparative analysis was done to check the main sources of household income in the last 12 months between households that have been in the irrigation scheme since 2005 and those that joined later in 2009. The households that have been in the irrigation scheme for a longer period have both more diverse income sources and more total income within the income sources than the farmers who joined the irrigation scheme in the last phase. The data in the two diagrams shows that the former group has 31% of its income from crop production compared to the 22% of those who joined later. In contrast the group in the last phase gets its highest income from poultry and gardening and casual labour indicating their growth for diversity.

In terms of total value in each of the income sources, the group that has been in the irrigation longer fares far much better than those who joined the irrigation scheme in the last phase as shown in the table below:

Income Source → / **Income range USD ↓**	*Crop Farming-2005 group*	*Crop Farming-2009 group*	*Gardening 2005 group*	*Gardening 2009 group*	*Livestock 2005 group*	*Livestock 2009 group*	*Poultry 2005 group*	*Poultry - 2009 group*	*Casual labour- 2005 group*	*Casual labour-2009 group*
No income	1	4	30	1	23	48	26	1	42	29
1-25		4	7	2	1		5	1		3
26-50		38	6	4	2		5	3	1	2
51-100	3	2	5	13	6		10	4	1	9
101-200	38				13		1		4	5
201-300	2				2		1	1		
301-500	4				1					
500+										

Table 4.1: A comparison of the income derived in the last 12 months from main sources between farmers who joined the irrigation scheme in 2005 and those who joined in 2009

The above table shows that in terms of crop farming 80% of the 2005 group managed to get above USD100 from their sales where as in the last phase group, all farmers got below USD100 with 80% getting less than USD50 from their crop sales. Whilst there is not much difference in income derived from gardening and poultry between the two groups, there are more people in the last phase group involved in casual labour (70%) compared to the first phase group (30%). Additionally 30% of the first phase group realised high value sales from the sale of livestock compared to 0% in the last phase group.

The above results reflect the positive contribution of the output from the irrigation to the household income. The farmers have sold some surplus from the combined irrigation and dry land outputs unlike their counterparts who find it difficult to have excess to sell from dry land farming only. In order to raise more income for the household, the last phase farmers have been involved in casual work (70%), possibly to supplement the irrigation scheme as well. However, the total income received by the households remains low even for those who have been in the irrigation scheme with the majority (80%) earning total household income below USD500 in the last 12 months. This aligns well with Rukuni's (2002:5) observation after completing some studies on irrigation projects, that although food crops are a major source of income in most areas studied, remittances, livestock sales, and wages from non-farm labour are important income sources.

4.4.2. Household expenditure

This question sought to identify the amount used on recurrent expenditures, and the cost of the household food basket. On the first, the results show that generally all farmers spend less than USD50 per month on expenditures such as soap, grinding mill, energy, transport and repayment of loans and beer. However, interesting expenditure was on telephone (cell phone) costs. 95% of the farmers spend between USD3 and USD15 per month on air time reflecting the increasing importance of communication among farmers. The results also reveal that only 30% of the farmers' income is used for the repayment of loans, which might indicate that the debt burden is less at present in the community.

An analysis was also done on the expenditure of the households in the last 12 months on non-food items such as household assets, education and farming tools and inputs. The results show that the biggest expenditure by farmers is on education, health and farming inputs. The farmers who started practising irrigation in the first two phases spend more money on education, health and farming inputs than those who are not practising irrigation. In terms of education, 60% of the farmers who joined in the last phase spend less than USD50 and the remaining 40% spend less than USD100. In contrast, for the

farmers who have been in the scheme longer, 90% spend more than USD50 with 30% spending between USD200 and USD500 on education. In addition 72 (50%) of the farmers in the early phases of the scheme bought electrical gadgets compared to only 14 (10%) of the farmers who joined the irrigation scheme in the last phase. The slightly higher margin on household expenditure can be attributed to availability of more financial resources in the households involved in the irrigation farming. It can also be a sign of household food security for the farmers in the irrigation scheme as this money could have been spent on food if there were shortages in the household.

On monthly expenditures on food, the food eaten by a household per month was converted into monetary value using the local value of the products. The results show that the farmers in the early phases of the irrigation scheme consume more monetary value in food than those who joined in the last phase. As shown in the graph below, 90% of the respondents already involved in irrigation have a food basket of above USD100 per month, with 40% using above USD200 per month.

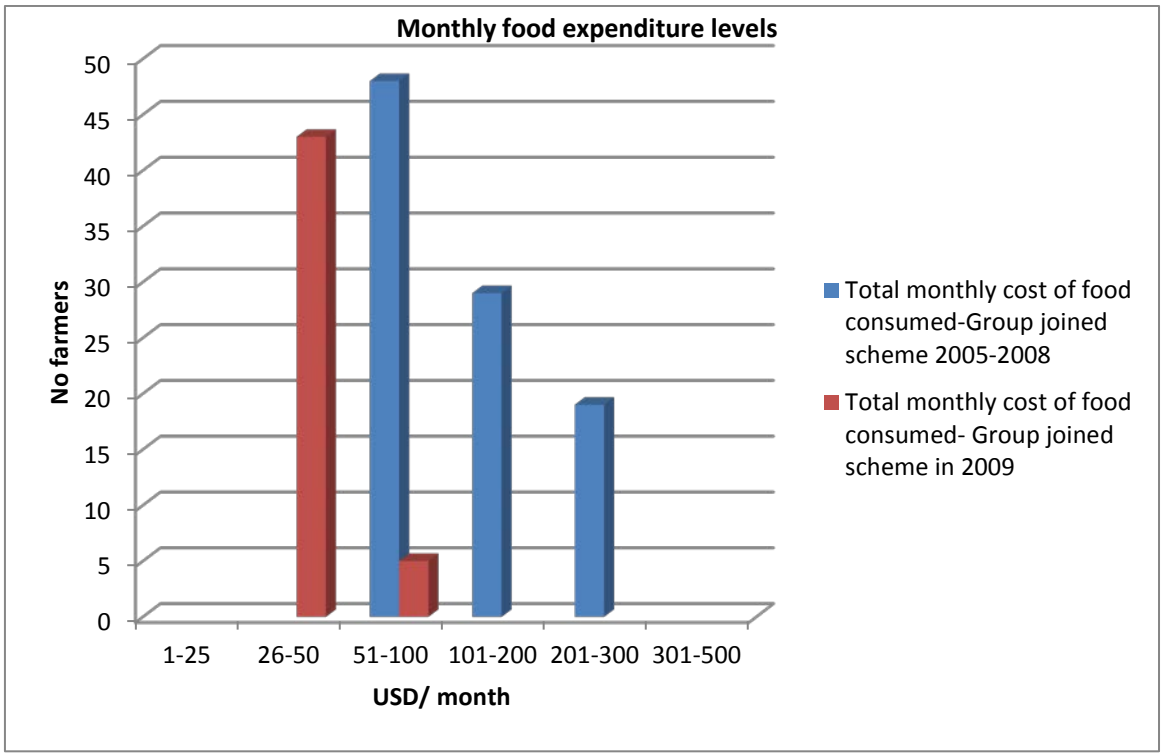


Figure 4.5: Monthly food expenditure of food consumed by households that have been in the irrigation in early phases and those who joined in the last phase

The above results indicate a higher level of food security of farmers who are in the irrigation scheme than those who are not. It shows that the former households consume more food than those who depend on dry land/ rain fed agriculture, hence an indication of the physical availability of food. It also shows that there is noticeable improvement in terms of diversity in the food the households consume. Although cereal remains dominant with all farmers indicating they produce their own cereals, the data shows that the households that have been in the irrigation scheme uses more money to purchase other food items that make diet more diverse. 115 respondents (80%) indicated that they purchase the bulk of the non- cereal items from the local stores.

4.5. Section 4: Household Production Levels

4.5.1. Production patterns of farmers involved in irrigation

The question was aimed at establishing crop yields of maize and wheat in the last two cropping seasons and to ascertain the levels of surplus and the income brought from sales. Data for two farming years was collected. The cropping seasons were the 2010-11 season and the 2011-12 seasons.

Maize Production

The data on yields were collected from the household survey and were triangulated with monitoring data received from World Vision personnel on inputs and outputs from the irrigation. The results show that the average yield from the 0.25ha plots is 800kg (16x50kg). The highest yield was 1300kg (yield rate of 5.2 tonnes/ha) harvested in 2011, whilst the lower quartile was 550-600kg. According to the Zimbabwe Vulnerability Assessment Committee (ZIMVAC), a household needs an average of 10kgs of cereals per person per month. For an average household size of 6 people, this translates into an annual cereal requirement of 720kgs per household.

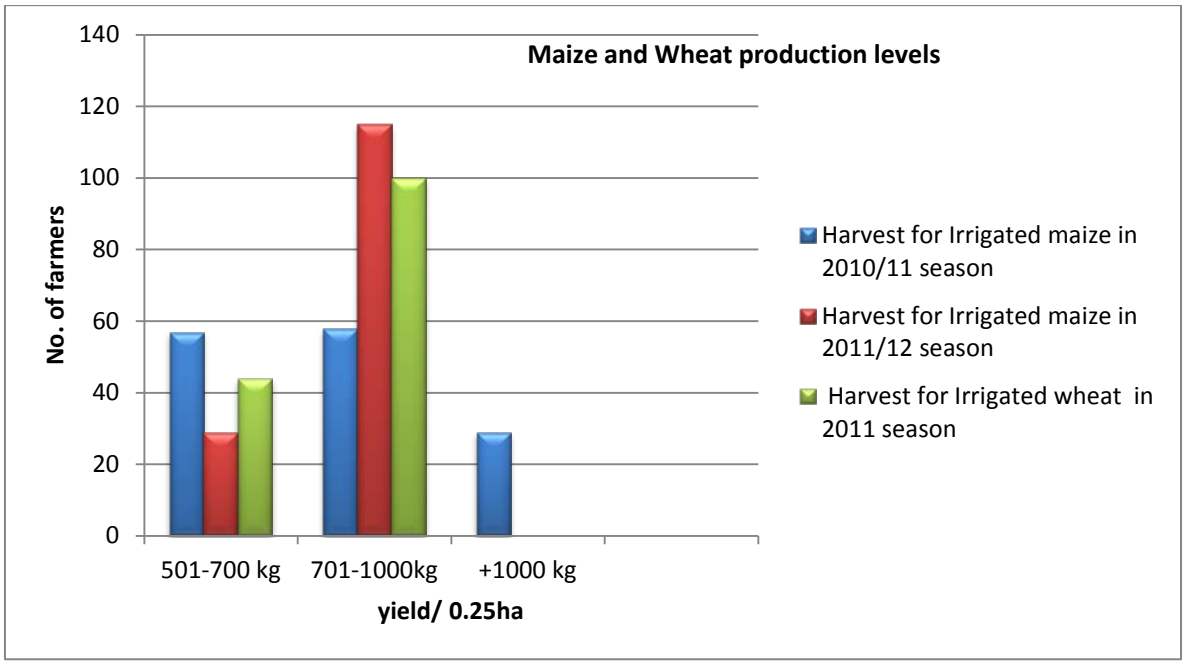


Figure 4.6: The maize and wheat harvests from the 0.25 irrigated plots

Wheat Production

The second crop in the 2011/12 cropping season was wheat with an average of 851kg. As shown in the diagram above, the output of 115 farmers (80%) of those interviewed had an output between 701-1000kgs, whilst only 29 (20%) were below 700kgs. From the monitoring data collected by World Vision (2012) on production, utilisation and sales of each farmer in the scheme, an average of 317kgs per farmer of the output was sold to the Grain Marketing Board.

Statistics	**Quantity harvested (kgs)**	**Quantity sold(kgs)**	**Cash from sales**
Mean	946.39	317.22	65.00
Minimum	525	0	0
Maximum	1800	750	255

Table 4.2: Average yields and sales of wheat in 2011

However, the farmers complained about the marketing of the crop. There was initially a long delay by the Zimbabwe Grain Marketing Board (GMB), where farmers had sold part of their wheat, to pay them. The Inkosikazi irrigation committee engaged with the GMB and the payment delays issue was resolved.

Given the average production of 800kg for maize and 851kg for wheat per farmer in one season, the irrigation scheme has allowed households to produce sufficient cereals to meet their annual cereal requirements, leaving some surplus for sale. Farmers have managed to sell varying quantities to the local and districts markets. The income received, as discussed above, is expended on things like education, other foods and other household necessities. The irrigation farmers are also selling some surplus maize to local community members who are not part of the irrigation scheme. At the local level maize is being sold at USD7/ 20 litre bucket and wheat at USD 12 per 20 litre bucket. This is also helping improve the food security of the other wards in the vicinity.

4.5.2. Comparison of dry land and Irrigation Maize Outputs

In terms of comparison between rain-fed farming and irrigation, an analysis of maize yields have revealed a high output of the cereal from irrigation plots as shown by Figure 4.7 below. Despite the irrigation being very small (0.25ha) compared to land available for rain fed/ dry land agriculture (average 2.1ha), the total output is higher in irrigated land.

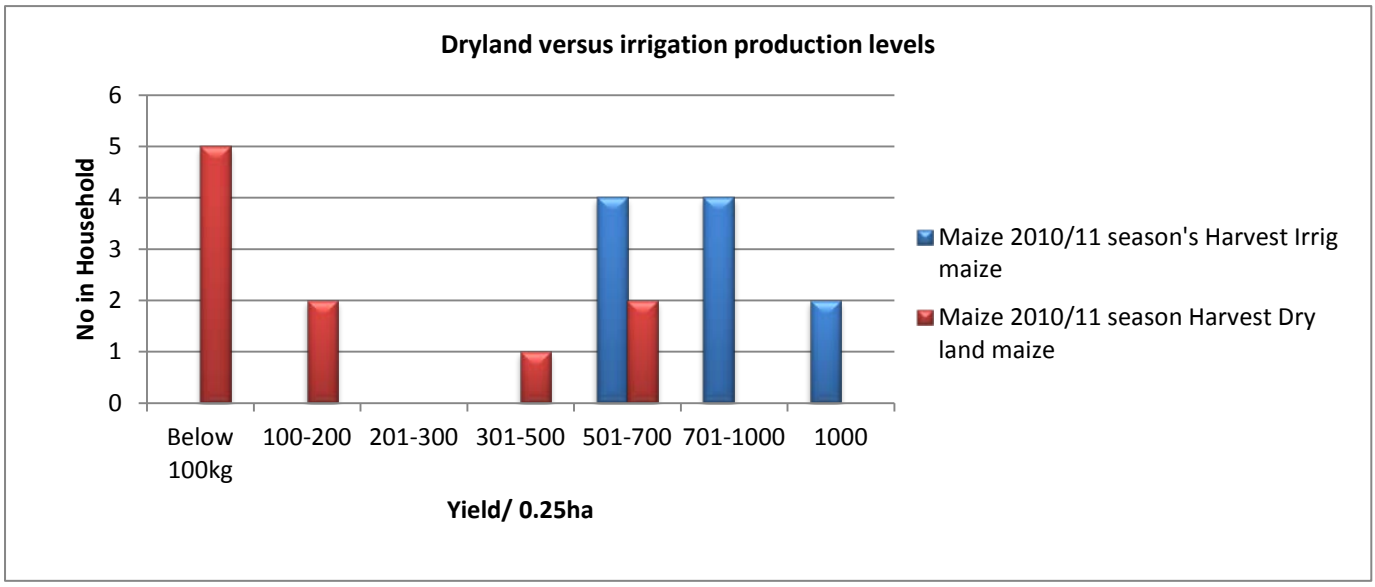


Figure 4.7: A comparative analysis in yield of irrigated land and dry land in 2010/11 season

The above graph shows that the total output from rain fed agriculture was very small with the middle quartile production being below 100kg. Since 70% of the dry land farming output is below 200kg, it can be concluded that the households relying on rain fed agriculture alone are food insecure if measured against the ZIMVAC standard of 720kgs of cereal per household of 6 people per annum. On the other hand, it shows that farmers who practice small scale irrigation are food secure at household level and have some additional income they can use to diversify their food basket, hence their nutrition is improved.

4.6. Section 5: Food Security Status and Challenges

4.6.1. Farmers' definition of food security

The question sought to find the perceptions of farmers on what they define as food security in the area. The responses can be grouped into three categories. The responses are summarised in the figure 4.8 below:

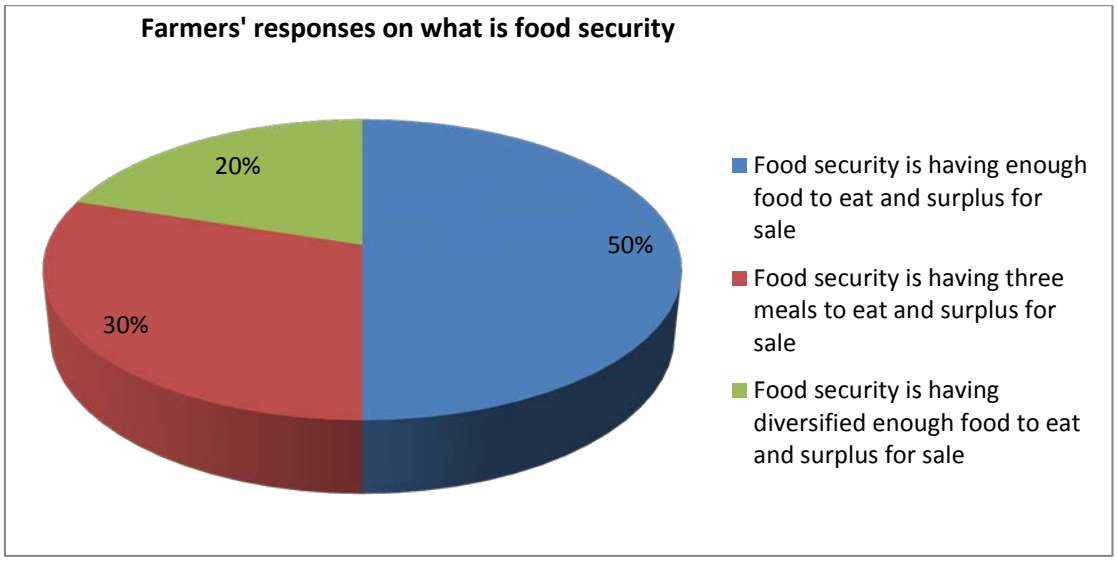


Figure 4.8: Farmer responses on their perceptions of food security.

The definitions by farmers show the different dimensions of food security which include physical availability, accessibility, stability and utilisation. The first two definitions from 130 respondents (90%) focus on the quantity considered to be enough for consumption by the household, whilst 14 (10%), felt that food security should include issues of food diversity which is a pointer to nutrition concerns. The interesting thing is their definition of 'enough' or 'meal', which they say, is food socially acceptable as enough for a person depending on age, sex and size of the person, whereas the World Food Program uses a standard of 2100 kilo calories per day. All the farmers argued that the food security definition should encompass an element of surplus for sale. From earlier analysis, financial resources are paramount in procuring food resources which will enable households in line with the World Food Summit (1996) definition of food security described in chapters 1 and 2 above.

4.6.2. Description of food security situation in the household comparing the Prior Irrigation Period to the Current Status

The question sought to interrogate the status of the food security from 2005 and to the present. The situation in the first phase in 2005 for all farmer groups was not very different. A total of 108 households (75%) of all the

farmers were not meeting their food needs even with external help from NGOs operating in their area. They relied mostly on selling some household assets to generate money for food. The farmers professed that in 2005 they used to travel long distances to find food, some walking as far as 60km. The remaining 36 (25%) could only manage with external help from food aid programmes and other remittances from non-governmental organisations. The situation is further explained in figure 4.9 below.

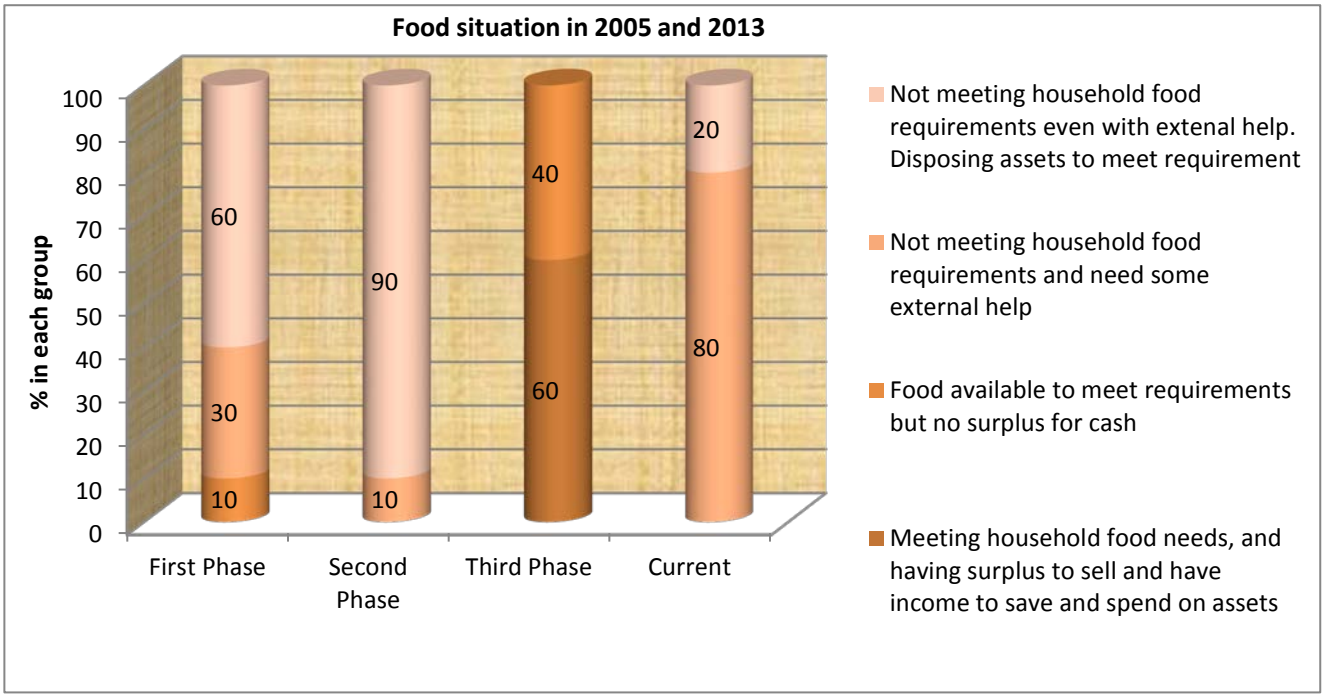


Figure 4.9: A comparative analysis of food situation between farmers who joined the scheme in 2005 from those who joined in later phases and the current status of farmers

By 2013 there has been a shift in the households that have been involved in the irrigation scheme. In 2013, 86 (60%) of the households feel that they are very food secure and able to meet all their food requirements, and they sell surplus to get money for other essentials. The other 58 (40%) can meet all their food requirements in the household but without extra to sell to earn additional income. In contrast the new irrigation farmers have a marginal move from acute food insecurity to transitory food insecurity. 48 (100%) of the

last phase farmers have also managed to stabilise their food requirements though their surplus is still marginal to maximise on sales.

Respondents were also asked a ‘yes or no’ question on whether their households should be defined as food secure or not given the above descriptions, to establish certainty of food security in terms of stability and physical availability. All the farmers who had been in the irrigation scheme from 2005 to 2010 (100% of respondents) indicated that their households were food secure.

The above results on food security situation indicate that at household level, the irrigation scheme has brought food security. However at community level, the horizontal transfers of food are yet to bring community level food security. According to the Bubi District Agritex Office, although people from the surrounding areas are coming to the irrigation scheme to purchase grain from the farmers, community food security is still a long way away. The local AGRITEX officer estimated that the cereal produced by both the irrigation scheme and dry land agriculture in Wards 4 and 5 falls below half of the cereal requirements in the area. He therefore concluded that despite the efforts of the irrigation system there is a deficit of cereals which has always called for external help from NGOs still operating in the area. He pointed out that the irrigation scheme is still too small to cater for the needs of the areas around Inkosikazi which are perennially a drought zone.

4.6.3. Main constraints to crop farming and recommendations

Dry land/ rain fed crop farming

The question (Q6a) sought to identify key impediments in achieving food security in households in the area. All farmers identified erratic rainfall experienced in the area as the key impediment to rain fed agriculture in Wards 4 and 5. The area is greatly affected by recurrent droughts that make it difficult to sustain crops and results in continued poor harvests in the area. According to the Department of Agriculture and the irrigation farmers, the situation is further compounded by poor timely access to agricultural inputs by

the farmers, especially the small grain seeds that are more suitable for the area. Limited knowledge levels on proper farming methods and the impact of HIV/AIDS were also highlighted as impediments to agriculture. 137 (95%) of the irrigation farmers are in favour of an irrigation project as the solution to resolving the drought problem. The respondents acknowledged that the availability and the utilisation of the abundant water in the Inkosikazi dam can counter the negative impacts of climatic change

Irrigation supported farming

The second section of the question (Q6b) sought to understand the problems faced by the farmers already practising small scale agriculture. The responses are reflected in Fig 4.10 below.

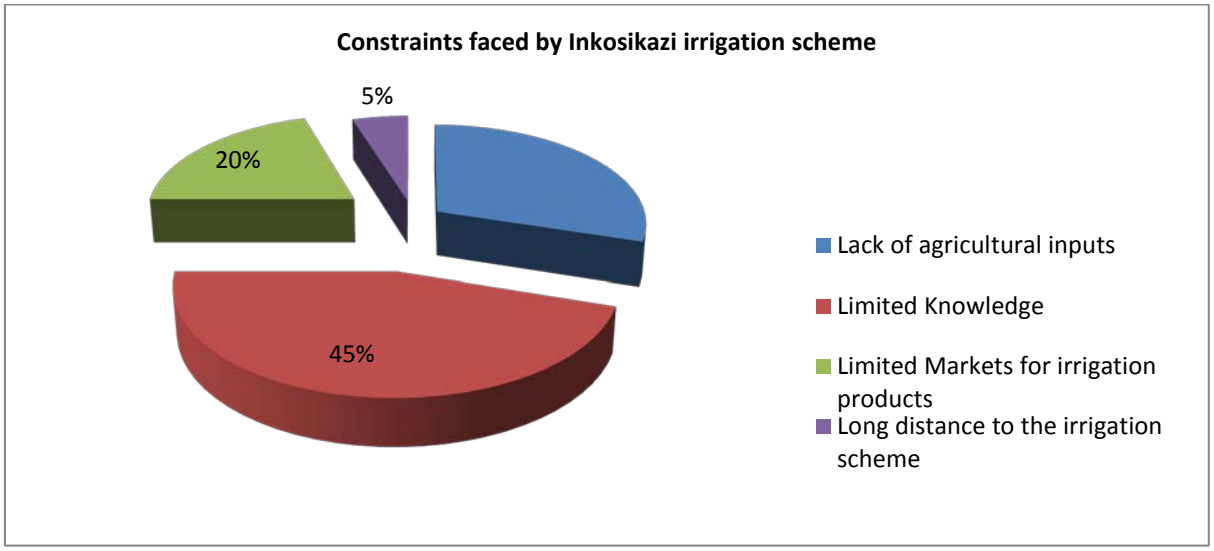


Figure 4.10: The main constraints faced by Inkosikazi irrigation scheme

The farmers identified four main challenges reflected in the diagram above. The main problem highlighted was the limited knowledge levels (45%) whilst 35% highlighted lack of agricultural inputs as one of the major constraints. The challenge of high value markets for the crops, especially wheat, was also stated by 20% of the respondents. 5% highlighted the challenge of travelling long distances to the irrigation scheme.

In order to address these problems, 45% suggested that the efficiency of the irrigation can be improved by training farmers in various issues of agronomy and environmental management. 20% recommended assistance in establishing input and output market linkages which would have a positive impact on production. On inputs support, the farmers bemoaned the lack of assistance in establishing credit lines with input suppliers. World Vision had supported them with input starter packs and the farmers were expected to raise inputs on their own later in the future. The above mentioned problems raised concerns over the sustainability of the scheme in providing food security in the household and community after World Vision left the area. However all the farmers had been able to purchase their own inputs from 2010 up to today.

4.6.4. Recommendations on improving the food security situation

Two questions were asked as to what the farmers think should be done to improve their food security at household level and at community level.

Household level

As shown in Figure 4.11 below, the farmers gave five main responses on how household food security could be further improved. Of the respondents, 50 (35%) proposed for more input support to farmers as a way of improving their household food security situation. The second popular response 43 (30%) was that more capacity building on agronomy and environmental management was of paramount importance in further improving food security.

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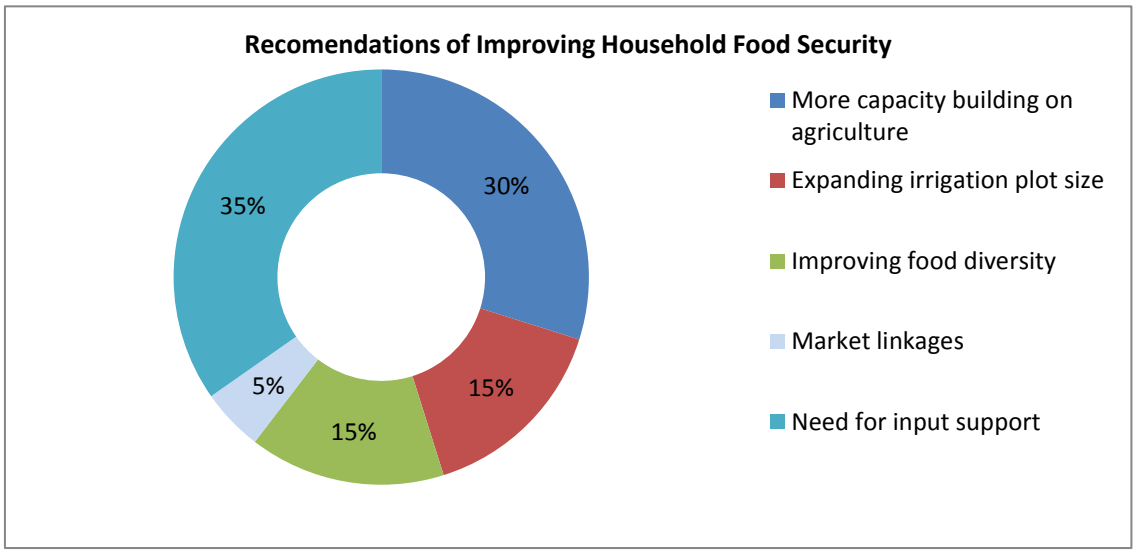

Figure 4.11: Recommendations on how household food security can be improved in Ward 4 and 5 of Inkosikazi

The majority of these respondents in the second response 100 (70%) are farmers who joined the irrigation scheme in the first phase. 22 (15%) of the farmers felt that the plot size is small to do farming as a business and they hence advocated for expansion of plot size per household, if financial resources are to be sourced. Food diversity through market gardening in both irrigation and personal gardens was proposed by 15 (10%) of the respondents, and 7 (5%) people advocated for market linkages with input and high value output markets.

Community food security

The majority of the respondents (95%) felt that the communities of Wards 4 and 5 of Inkosikazi will be more food secure if the current irrigation could be expanded so that more households benefit. Given the current plot size of 0.25, the respondents felt that the current 240 plots cannot meet the food security demands of over 800 households in the two wards and more from the people of the surrounding wards. The issue of size was echoed by key informants such as the AGRITEX officer, local retail traders and the Irrigation Management Committee. They feel the plots are too small to run them as business entities beyond subsistence.

4.7. Which organisation or entity is suited to assist the farmers?

This question was aimed at checking whether the farmers have ideas of getting more assistance as part of sustaining the irrigation scheme. The results show that all the farmers expected Non-Governmental Organisations to continue rendering them support so as to continue with the agriculture. Given the empty promises of support from government through the various departments, the farmers felt that Non-Governmental Organisations usually deliver what they promise. This raises questions on the sustainability issues especially on input supply and expansion in case no NGOs pledge more resources.

4.8. Impact of irrigation on the lives of people in the households

The question sought to capture the impact of the irrigation scheme on the lives of people who are involved in the irrigation scheme. Various responses were given for the question by the 144 respondents. The responses can be grouped and summarised into four main points as shown in the diagram below.

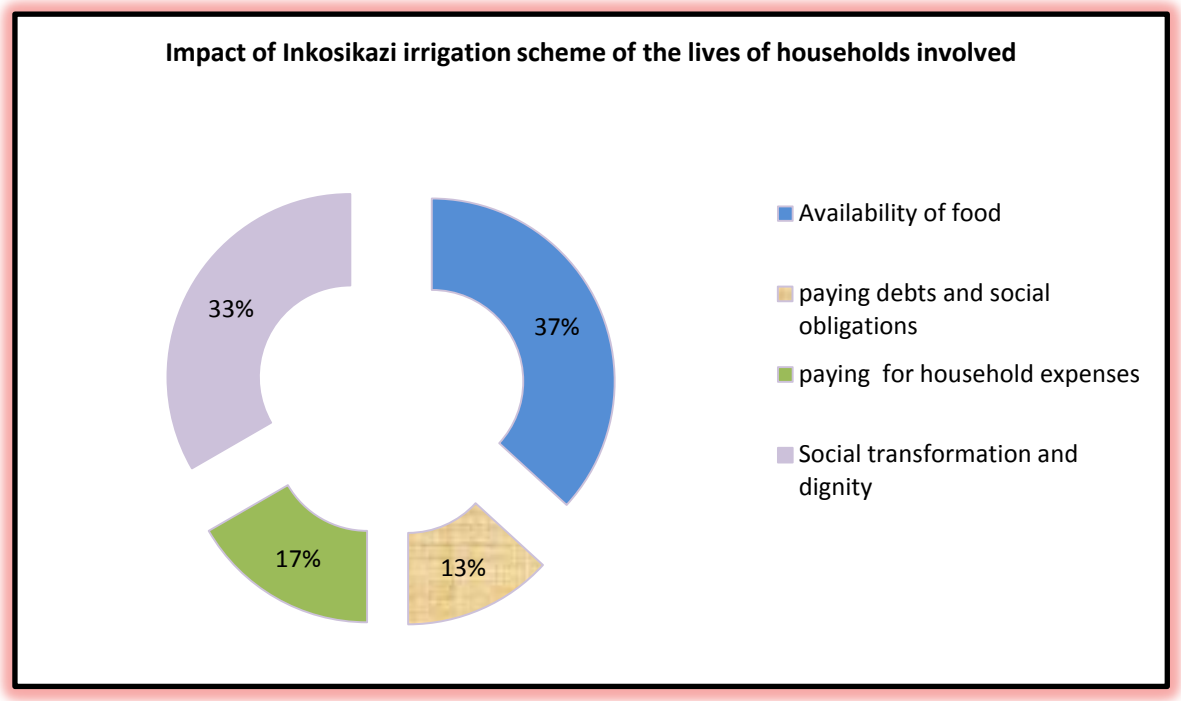

Figure 4.12: The impact of the Inkosikazi irrigation scheme on the lives of households involved in the Scheme

The most popular response from 53 (37% of the responses) was that the irrigation scheme brought in the availability of food in the households. People no longer travel long distances in search of food. The second popular response from 48 (33%) noted that the irrigation scheme has brought social transformation within and between households especially on how they work with and relate to each other. The respondents also felt that they feel dignified, as they can now produce and feed themselves unlike in the past where they lost their dignity scrambling for food from donors and well-wishers. Most hungry Africans produce, acquire and consume food within a rural family/household context (Rukuni, 2002:1).

The irrigation scheme brought some unity of purpose and determination within the community and households as they were involved in all the stages of the project. The impact on some households was that irrigation activities have brought income into the households such that they are able to pay for their debts, community and social obligations, 19 (13% of the respondents), and for their household expenses, especially education for children, food and some assets, 24 (17% of the respondents).

4.9. Lessons learned in the establishment and management of the Inkosikazi irrigation scheme

An open question was asked to key informants and the irrigation management committee on lessons that can be drawn if such a scheme is to be repeated elsewhere. The main lesson identified was that it is important to involve the community from the onset of the project. The community feel that they own the irrigation scheme because they participated in the initial baseline assessment, have worked hard as part of its establishment and are enjoying the fruits of their labour. The second lesson identified was the selection and training of irrigation committee members which they say is essential for the success of the project. The selected members felt respectable, exemplary, and trust-worthy, and have been empowered to remain politically stable. Rukuni (2002:1) points out, "*Moreover, issues of food security smallholder agricultural development can no longer be divorced from issues of democracy, politics and governance."* Thirdly, they feel the support rendered by their traditional leaders and district authorities made the work easier especially regarding the repossession of the land which was gazetted for irrigation. Fourthly, the irrigation committee feels community unity of purpose is also important in the establishment of an irrigation scheme. The process is capital and labour intensive thus demanding a high level of commitment from the future beneficiaries. They have also learned that a coordinated mechanism of buying inputs, and planting and irrigating crops is essential for success and avoidance of conflict. Finally, in the case of conflicts the key informants and irrigation committee underscored the importance of the irrigation constitution and the involvement of local leadership in finding lasting solutions.

In addition, the widows and divorced women who own plots feel empowered as they now earn some income from the plots, and have developed a sense of ownership, against the usual local culture that women must not own land and assets such as cattle. The women are some of the previously vulnerable of the community who were living on food hand-outs from NGOs' food aid programmes and help from the community well-wishers. The women now

own cattle and are able to work and fend for their children and this has increased their state of being empowered and ability to stand on their own. All the 57 (100%) grow vegetables, sugar beans, and tomatoes perennially, but 35 (61%) sell their surplus produce, while 22 (39%) have enough for their household to eat but no extra for sale. However, their diversification leans mostly on farming, gardening, poultry, and casual labour. All the women interviewed feared to take the risk of fishing and cross border trade because there are crocodiles in the dam, and because they cannot leave their children unattended if they join cross border trading. However, in general they all have enough food to feed their children, meaning their household livelihood has changed for the better, when compared to their state before they joined the irrigation project.

4.10. Conclusion

The chapter presented and analysed the data collected during the administration of the mixed methodologies used in the research. The household data from irrigation farmers was collected using a structured questionnaire and interviews. The presentation of data was made in graphs, tables and figures, and explanations of the responses were given. Finally, a summary of the lessons learnt by the community on the establishment of the Inkosikazi irrigation project was presented. The next chapter provides the summary and the conclusions of the research, and further gives recommendations for future study.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0. Introduction

This chapter summarises the whole study. It revisits the objectives of the study and gives a summary of the data analysis done to deduce the major findings. In this chapter, conclusions and recommendations deduced from the findings are outlined. Finally, the chapter gives proposals on possible ways in which the information gathered can be used for future research. The information given can also be used in promoting strategies and policy formulation on irrigation and food security in areas of similar characteristics as those of Wards 4 and 5 of Bubi district, in Zimbabwe.

5.1. Summary of the study

The research has been an evaluative study and was aimed at determining the impact of small scale irrigation project on food security using the case study of the World Vision instituted Inkosikazi small scale irrigation scheme in Wards 4 and 5 of Bubi district, in Zimbabwe.

The objectives of the study were:

a. To assess the impact of the Inkosikazi irrigation scheme on food security in Wards 4 and 5 in the Bubi district.
b. To determine the key factors that promote or hinder the Inkosikazi irrigation scheme as a food security intervention strategy.
c. To assess how the irrigation project has changed the agricultural production, income sources and expenditures, and the lifestyles of the households.
d. To make recommendation about the place of small scale irrigation schemes in local food security intervention strategies in Zimbabwe.

Chapter one presented an introduction of the study, the background to the problem, the setting of the research problem, and the overall structure and layout of the research. Chapter two gave an in depth outline and discussion

of the relevant literature on food security and irrigation. The chapter goes further to elaborate on the complexity of food security, its dimensions and situation. Various concepts of small scale irrigation and its application to food security were explored using the examples of various irrigation schemes in Zimbabwe and Africa in general. An analysis of small scale irrigation, its potential and challenges in Zimbabwe was also done. Chapter three presented the research design used in the research and the methodologies of data collection and analysis. The mixed methods approach was used which combines the quantitative and qualitative methodologies. The sampling techniques and the household survey and key informant interview methods of data collection were discussed in detail. Finally, chapter four presented the results derived from the analysis of the data collected from the household survey, and the review of World Vision monitoring data and other project documents. Chapter five then summarises the key findings of the research, and gives major conclusions and recommendations for future studies.

5.2. Summary of Major Findings

The following is the summary of the major findings:

- The majority of the respondents were male constituting 87 respondents (60%) and 57 (40%) were women. Of the women interviewed 33 (58%) were divorced, and 6 (10%) widowed while 18 (32%) were unmarried. The majority of land holders in the irrigation scheme were middle aged, 79 (55%), whilst 36 (25%) were below 40 years and 29 (20%) above 60 years of age. The average size of household was 6 with 115 households (80%) having 6 or more people. In terms of educational level, 57 (40%) have attended up to primary level, 65 (45%) to secondary and only 22 (15%) have attended to tertiary level.

- In terms of livestock ownership, 108 (75%) own more than 2 heads of cattle, 94 (65%) own more than 5 goats/sheep and 100 (70%) own more than 10 chickens. There is no difference in percentage growth between 2005 to 2013 in cattle and sheep/goats between farmers who joined the irrigation in the first phase and those who joined in the last phase. Cattle ownership grew by 2%, and for goats/sheep by 1% for all the groups over

the years. However for poultry, the first phase farmers experienced an increase of 5% more than the later groups.

- There is a range of 8-25% growth in productive assets such as ploughs, scotch carts, harrows and hoes for the farmers of the first two phases, whilst very marginal increases on assets were recorded among the farmers in the last phase of the irrigation.

- The main sources of income in the area are crop farming, gardening, livestock and poultry sales, remittances, and casual labour, fishing and small business. The irrigation scheme farmers have more income sources than dry land farmers. The first phase irrigating farmers have more income from crop production (31%) compared to the 22% of the last phase farmers. In contrast the last phase group gets its highest income from poultry, (24%), and gardening, (34%).

- In terms of crop farming 77 (80%) of the first and second phase farmers managed to get above USD100 from their sales with an upper limit of USD500, whereas all farmers in the last phase of the irrigation scheme got below USD100 with 38 (80%) getting less than USD50 from their crop sales. All farmers spend less than USD50 per month on expenditures such as soap, grinding mill, energy, transport and repayment of loans and beer. A total of 137 (95%) of respondents spend between USD3 – USD15 on telephone (cell phone) costs.

- One of the main expenditures in the household is on education. Farmers who have been in the irrigation scheme longer spend more on education than those who joined later. Of the first two phases of the irrigation farmers, 86 (90%) spend more than USD50 with 29 (30%) spending between USD200-500 on education. In comparison, 29 (60%) of the farmers in the last phase spend less than USD50 and the remaining 19 (40%) spend less than USD100. In addition 72 (50%) of the farmers in the early phases of the irrigation scheme bought electrical gadgets compared to only 14 (10%) of the farmers who joined irrigation in last phase.

- In terms of consumption, farmers who have been in the irrigation scheme longer consume a higher value food basket in terms of monetary value than those who joined in the last phase. 130 (90%) of the respondents already involved in irrigation have a food basket of above USD100 per month, with 40% using above USD200 per month.

- The average yield of maize from the 0.25ha irrigation plots was 800kg (16x50kg). The highest yield was 1300kg (yield rate of 5.2 tonnes/ha) harvested in 2011, whilst the lower quartile 550-600kg. In the 2011/12 cropping season it was wheat with an average of 851kg. 115 (80%) of the interviewed farmers, had an output between 701-1000kgs, whilst only 29 (20%) were below 700kgs. Comparative analysis of cereal production reveals that irrigation plots produces more than dry land farming. Despite the irrigation being very small (0.25ha) compared to land available for rain fed/ dry land agriculture (average 2.1ha), the total output is higher in irrigated land. Output from rain fed agriculture was very small with the middle quartile producing being below 100kg and 70% of farmers had an annual output below 200kg.

- The definitions of food security by farmers show the different dimensions of food security which include physical availability, accessibility, stability and utilisation. 137 respondents (95%) defined it as having enough food constituting three acceptable meals per day, and having excess for sale. The other 29 (20%) also felt that food security is availability of enough diversified food with surplus for sale. A comparative analysis of the food security situation from 2005 and 2013 of all the irrigation farmers reveal that in 2005 a total of 108 (75%) households of all the farmers were not meeting their food needs even with external help such that they disposed some household assets to generate money for food. In 2013, all the farmers who are in the irrigation scheme described their households as food secure. 58 (40%) of these farmers meet their food needs but without excess for sale whilst the other 86 (60%) said they are meeting the household needs fully and have excess to sell for income. However, given the current plot size of 0.25ha, the respondents felt that the current output from the 240 plots cannot meet the food security demands of over

800 households in the two wards and more from the people of the surrounding wards.

- The key impediments of dry land farming in Wards 4 and 5 of Inkoskazi are the poor rainfall variability due to perennial droughts, and poor timely access to inputs, especially fertilisers and small grain seed. 95% of the farmers recommended irrigation and linkages with input markets as the cure to these problems. The main problems faced by irrigation farmers are limited knowledge levels (45%), lack of agricultural inputs (35%), the challenge of finding high value markets for the crops, especially wheat (20%), and the challenge of travelling long distances to the irrigation scheme (5%). In order to address these problems, 45 % suggested that efficiency of the irrigation can be improved by training of farmers in various issues of agronomy and environmental management. 20% recommended assistance in establishing input and output market linkages which will have a positive impact on production

- On recommendations to improve household food security, 35% proposed more input support to farmers, 30% suggested more capacity building on agronomy and environmental management, 15% suggested expansion of current plot size in the irrigation, 15% were for market linkages and 5% suggested diversification of household food. To improve community food security, 95% suggested expanding the irrigation scheme to include more families. They felt current 60ha of irrigation is not enough for feeding 800 households in the two wards.

- On impact of the irrigation on households, 37% of the responses said that the irrigation scheme brought availability of food into the households; 33% said it brought social transformation within and between households especially on how they work and relate to each other, and they felt dignified to fend for themselves; 13% said the irrigation activities have brought income to the households such that they are able to pay for their debts, and for community and social obligations; and 17% said they are now able to meet their household expenses, especially education for children, food and to increase their assets. As examples of some

responses; Mr Naison Ndlovu exclaimed in amazement: *"The irrigation project established by World Vision here has become a blessing to the community. We are now able to eat green vegetables and tomatoes throughout the year, and some people come from other wards and far places just to buy the vegetables and tomatoes."* Alluding on the same, Mrs Ester Ntini acknowledged that *"The irrigation has increased our household food supply, and we are able to sell some beans, maize grains, and tomatoes to some people coming almost every day from other wards, and to those coming as far as Inyathi* (about 35km away) *who come to order for their vegetable markets.* Mr Luke Tshabangu and Mr Kheyi Mnkandla both noted that *"The irrigation has been one of the greatest miracles to the community; it has brought about income that has been used to purchase some cattle. Most households that were previously without any cattle or chicken, and who were always assisted by the community for food, are now having kraals and their children are going to school."*

- Six lessons learnt during the implementation of the project are that it is important to involve the community from the onset of the project like World Vision did in the Inkosikazi project; the selection and training of exemplary and trustworthy irrigation committee members is essential for the success of the project; the support of traditional leaders and district authorities make irrigation work easy; community unity of purpose is also key in the establishment of an irrigation scheme; a coordinated mechanism of buying inputs, planting and irrigating crops is essential for success and avoidance of conflict over use of water; and the irrigation constitution and involvement of local leadership is essential for finding lasting solutions to possible conflicts. In addition, the women who own plots feel empowered as they now earn some income from the plots, and have developed a sense of ownership, against the usual local culture that women must not own land and assets such as cattle. The women are now able to work and fend for their children and this has increased their state of being empowered and ability to stand on their own.

- All 144 farmers (100%), consisting of 87 males and 57 females, felt the NGOs are better suited to assist farmers than government based on history and performance.

5.3. Conclusive Analysis

In chapter two it was noted that ***food security*** *exists "... when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Household food security is the application of this concept to the family level, with individuals within households as the focus of concern" (FAO2002:6).* The four dimensions of food security were listed as physical availability, economic and physical access, utilization and stability (FAO2008:1). According to the ZIMVAC publications (2002 & 2012) a person needs 10kg/month of cereals, which translates to 720kgs per annum for a household of six. The production level at Inkosikazi shows that the grain which is produced surpasses the needs of the household which means they are food secure. The production data, figure 4.6, and figure 4.7, and correspondence from face to face interviews shows that the irrigation farmers harvests more than three times on a 0.25ha plot than the dry land agriculture on larger pieces of land. The average yield of maize was 800kg (16x50kg). The highest yield was 1600kg (yield rate of 5.2 tonnes/ha) harvested in 2011, whilst the lower quartile 550-600kg. For wheat the average was 851kg with 80% producing between 701-1000kg.

This level of production indicates that the food needed by the irrigation farmer households is physically available in adequate quantities, the households are able to access the food, and to utilise the food, and this continues to stabilise as the years of production increase. This is also elaborated in the figures 2.2 (Toronto Public Health, 2006), 2.5 (Mudimu, 2004), 4.12 (responses to question 4.8, gathered data analysis on impact of irrigation), and table 2.1 (Weingartner, 2000), of the literature review. As pointed out in the literature review, Peters (2011), Ersado (2005), Tolossa and Tafesse (2008), Hussain, et al. (1999), and Barau et al. (1999), all agree that if the irrigation is focused on the household, it improves food security through physical and economic

access. They concur that irrigation increases food production and that it is a powerful factor for providing food security, protection against drought effects, increase prospects of employment and great opportunity for multiple cropping and crop diversification. This is also evidenced by the data represented on figure 4.4 that shows an analysis of income sources, meaning the irrigation farmers have diversified their income sources even though all started from agricultural production. This improvement confirms that irrigation and food security are correlated.

The research study concludes that the World Vision instituted Inkosikazi small scale irrigation scheme has brought food security at household level. The data analysis results show that the households are now food secure and have harvests of more than three times what they were producing on their dry land plots. In the current year 2013, all the irrigation farmers have described their households as food secure. 40% of these farmers meet all their food needs but without excess for sale, whilst 60% said they are meeting the household needs fully and have excess to sell for income.

There is evidence that there is income which is being derived from the irrigation scheme and being used in the household. The income is either derived from selling directly the yields from the irrigation scheme or selling the other crops derived from dry land farming since food needs are met from the irrigation. Irrigation farmers receive income double more than the households who depend solely on rain fed farming. In the last 12 months 115 (80%) of irrigation farmers who joined in the first two phases got more than USD100 from crop sales with 30% getting more than USD300. In contrast in the group that joined in the last phase, all farmers (100%) got below USD100 with 80% getting below USD50 in the last 12 months. The yields from dry land farming complement income from irrigation and there is more potential to increase it if crops doing well in the area, such as groundnuts, are encouraged. There are more income sources and disposable income in households of irrigation farmers compared to those who are not. The major expenditure in the area is on education. The farmers spend more money on education (school fees, materials and uniforms) compared to those who are not in irrigation. Of the

farmers practising irrigation, 130 (90%) spend more than USD50 with 30% spending between USD200-500 on education.

In terms of expenditure of money on staple food, all farmers in the irrigation indicated that they are eating from their own production realized from the irrigation scheme combined with dry-land farming, which is a sign of food security. As a result of increased agricultural production crop sales became very significant components of household income.

In terms of consumption, farmers in the irrigation scheme consume a higher value than those that are not in the scheme. This is an indication of both quantity and diversity of food consumed in the household. Of the interviewed irrigation farmers, 130 (90%) of the respondents have a food basket of above USD100 per month, with 40% using above USD200 per month. This indicates that the irrigation farmer households are food secure while those who are not in the irrigation scheme have very high food insecurity and need external support to meet food needs. Small scale irrigation is an appropriate strategy for food security for areas in dry regions such as Ward 4 and 5 of Inkosikazi. A total of 137 people (95%) identified erratic rainfall as the chief cause of food insecurity and advocated for irrigation as the chief solution to their problem.

Ownership of plots in the small scale irrigation scheme is dominated by middle aged people, 60% men, and 50% women, whilst ownership of youths especially below 30 years is very low. Participation of women in the irrigation scheme is commendable at 57% of the total beneficiaries of the irrigation scheme. However, in married relationships the land is owned by men and women only have user rights which give men control of the food production process. There is a mixture of women who own land, being divorced, unmarried, or widowed. Production patterns show no difference between men and women-owned plots.

Even though the Inkosikazi small scale irrigation scheme brought household food security to the irrigation farmer families, the same cannot be said of Community food security. The community of Wards 4 and 5 are still food insecure, and in need of external food assistance despite the existence of the irrigation scheme. All respondents (100%) noted that they were severely food

insecure before they joined the irrigation scheme. The department of AGRITEX estimates that the current production levels (dry land and irrigation) are failing to reach 50% of the cereal needs in the community till the next harvest. The production from the 0.25ha plots by the 240 farmers has not produced any significant change in the 800 household communities of Wards 4 and 5. However there is potential for cumulative benefits of the irrigation scheme over time given the current production levels.

The Inkosikazi irrigation farmers are faced with different constraints, some of which are already stated in the literature review. The four main challenges faced by the irrigation farmers, as indicated in figure 4.10, are limited knowledge levels (45%), lack of agricultural inputs (35%), the challenge of finding high value markets for the crops especially wheat (20%) and the challenge of travelling long distances to the irrigation scheme (5%). In order to address these problems, 45 % suggested that efficiency of the irrigation can be improved by training farmers in various issues of agronomy and environmental management. 20% recommended assistance in establishing input and output market linkages which would have a positive impact on production. These challenges have been highlighted by Bjornlund (2004), FAO (1997), and Chibisa et al. (1997) as affecting small holder irrigation schemes in Zimbabwe. These researchers also list some irrigation challenges such as technical issues, governance and management, catchment area management, policy related and financial constraints. Face-to-face interviews revealed that World Vision, the AGRITEX department and the Irrigation Management Committee are handling these at the moment. This has raised concerns over the sustainability of the scheme in providing food security in the households and community after World Vision leaves the area. This was noted by the IWMI (2005) as stated in the literature review that most irrigation projects that failed had failed because of poor management and maintenance by local governments after the NGOs who established them left. However, all the farmers have been able to purchase their own inputs from 2010 to today.

The size of the plots (0.25ha each) in the study area is consistent with the views of FAO (1997), Smout and Shaw (1994), Van’t Hof (2001), Shaw (1999), and Kedir and Alamireuw (2006) in the literature review. They all

concur that the plots for small scale irrigation plots are less than 10ha, although there is no definite size agreed upon, because these vary from place to place depending upon the irrigation project. Success of small scale irrigation depends on a nexus of a number of factors. These include proper selection and training of committee members, community ownership of processes, unity of purpose, clear roles and support of community and district leaders, and presence of a functional constitution to guide operations and conflict resolution.

5.4. Recommendations

The Inkosikazi small scale irrigation scheme shows evidence of meeting household food needs. The following set of recommendations should be given high attention:

a. Even though 0.25ha is effective for subsistence farming, expanding the plots to 0.5ha would bring more household income and help improve livelihoods for more community members as more production may bring more sales.

b. Government must address the food insecurity problem of the community by working together with NGOs by helping the community with inputs and training on small grains that are drought resistant. The two stakeholders can also find possible ways to expand the land under irrigation so as to increase more plots and incorporate more community members.

c. Attention should be put on other livelihood activities that seems to be doing well as part of food and income diversification. This includes market gardening, small businesses and poultry. This will go a long way in supplementing household income and boosting local economy and food security.

d. Introduce the production of high value crops in the cropping cycle and explore value addition options. FAO, (1997) confirms that smallholder irrigators have developed a commercial mentality and now regard farming as a business.

e. Building capacity of farmers on market research and promotion of input and output markets, as well as that of farmer representatives on advocacy and lobbying for better roads, transport, electricity and other essential services that help improve the food security goal.
f. Integrate environmental and catchment management issues in agricultural planning, not only in the target area but also the areas above and below the dam. This gives a long term guarantee of availability of water for irrigation.
g. Use the irrigation scheme as an entrance for tackling other pertinent developmental issues such as HIV/AIDS and other health related problems, water and sanitation, gender, peace and reconciliation, social transformation initiatives, advocating for change.

h. An evaluation of the project should be done every five years of irrigation to monitor on sustainability and long term impact of the project.

5.5. Limitations encountered during the study

Wards 4 and 5 communities of Inkosikazi constitute a small group of the Bubi district population. The data gathered may not represent the whole district, or Zimbabwe as a whole. Food security is a complex subject that needs more time to study. It also needs a wider coverage for the results to be meaningful. It has many influences that sometimes cannot be measured or quantified. More in-depth studies of a larger sample remains important in further understanding the issue of the impact of irrigation of food security. Finally, with the increasing incidence of global warming and prospects of advancing desertification that tend to limit global water availability, further studies are important on sustainability of irrigation development as a way to improve food security.

5.6. Implications for future research

The scope of the study relates only to the Inkosikazi irrigation project, in the Bubi district, and cannot bear the same reality to all small scale irrigation projects in Zimbabwe. However, the data gathered in the study can be recommended for use as a step towards a more detailed study on the long

term impacts of small scale irrigation on food security at any community level. It can also be used as entry to more in-depth research into the economic and political variables that impact the development in the Inkosikazi area. Finally, the research can also be used as an entry point for more complex and technical research that measure the general effectiveness and efficiency of the irrigation schemes in uplifting the standards of living of the communities.

Key Terms

Small scale irrigation, Inkosikazi irrigation project, irrigation and food security, irrigation instituted by World Vision, Bubi district, Inkosikazi irrigation farmers, Mixed Research Methods, Agricultural Production, community wealth, Zimbabwe land reform.

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Appendix 1: Research Questionnaire

Household Survey: Inkosikazi Food Security Research

a- Date (day/month) |____| |____| / |____| |____| b. Province _____

c- District _____ d- Ward number|____| |____|

e- City/village name: _____

f-Enumerator names : _____ |____| |____| g.- Respondent name:_____

h. If not head of household, **r**elation of the respondent to the head of household (wife, mother-in-law, brother etc.):_____

Signature enumerator: _____ Signature team leader: _____

Beneficiary/ non beneficiary _____ (1= beneficiary 2 = non beneficiary)

Consent: We are conducting a survey on the impact of the Inkosikazi irrigation scheme on food security. We would like to ask you some questions about your family. The survey usually takes 40 minutes to complete.

Any information that you provide will be kept strictly confidential and will not be shown to other people. This is voluntary and you can choose not to answer any or all of the questions if you want. However, we hope that you will participate since your views are important. Do you have any questions? May we begin now?

Section 1: Household demographics

HOUSEHOLD COMPOSITION AND SCHOOL ATTENDENCE			
1.1	What is the gender of the **head of household**? *(choose one option)*	**1**= Male , **2** = Female	|_____|
1.2	**How old** is the head of household? *(write number)*		|_____| years
1.3	What is the **marital status** of the household head? *(choose one option)*	1 = married 2 = divorced, 3 = widowed , 4 = separated 5 = unmarried	|_____|
1.4	What is the **highest educational level** of the household head? *(choose one option from below)*		|_____|
1= never attended school , 2= primary school only (grade 1-5), 3= secondary school (grade 6-10), 4= college and beyond, 99= not applicable			
1.5	Who in the household owns the plot in the irrigation scheme? *(choose one option)*	1= nobody, 2=only head of household 3= Relative	|_____|
1.6	**Currently, how many persons** are living and eating in this household (excluding guests/)? *(write number)*		|_____| persons

How many children and adults are currently living in the household (excluding IDPs)?		**Male**	**Female**			**Male**	**Female**
1.7	Children < 5 years	|___|	|___|	1.8	Children 5-9 years	|___|	|___|
1.9	Children/Adolescents 10-17 years	|___|	|___|	1.10	Adults 18-60 years	|___|	|___|
1.11	Elderly (>60 years)	|___|	|___|				

Section 2 - Household Assets

Livestock		Cattle	Sheep/goats	Horses	Donkeys	Pigs	Poultry
Quantity	2005						
	Present						

Agricultural Equipment:		-tractor	-plough	cultivator	-harrow	Scotch cart	-wheel barrow	-hoe
Quantity	2005							
	Present							

Land Ownership & Use	2005	Present	
Total Land owned (units)			Acres
Does some of your land have irrigation infrastructure			yes/no
Land under irrigation			Acres
Total land used for vegetable gardening			

	2005	present
Housing Infrastructure		
Roofing Material: (1) Zinc; (2) Asbestos; (3)		
Walling Material: 1 – Mud, 2 – Bricks, 3 –		
Flooring Material: 1 – Cement, 2 – Bricks, 3		
Domestic water source (1) tap water; (2)		
Total Number of rooms		
Sanitation (1) Blair toilet; (2) flash; (3) bush;		
Do you have Electricity: (1) Yes; (2) No		
Do you have access to transport of any		
Car		
Bicycle		
Public transport		
Cart		

Other (specify)		

Section 3 – Household Income, expenditure and consumption patterns

Income Source	Farming (cereals)	Vegetable Gardening & sales	Livestock rearing	Poultry keeping & sales	Fishing	Pension	Remittance	Formal Employment	Business	Casual employment	Income generating projects	Cross border trading	other (specify)
Tick each applicable													
Income from this source in last month													
Income from this source in the last year													

In the last month (4 weeks) how much have you spent on the following items:	
Item	**Expenditure (USD)**
Soap/ Washing powder	
Maize Grinding	
Firewood	
Paraffin	
Transport (public)	
Candles	
Telephone Bill	
Rent	
Loan Repayments	

In the last year (12 months) how much have you spent on the following items:	
Item	**Expenditure (USD)**
Electrical Equipment (TV, Radio, DVD's)	
Pots and kitchen utensils	
Clothing	
Health Costs	
School Fees & education	
Household Furniture (bed, mattress, sofas)	
Tax, water, rates or levies	
Farming tools	
Fertiliser	

Beer (or other alcohol)	

Seed	
Savings contributions	

What are the main foods eaten in your household?

Food type	How much on average is consumed in a month (or how much was consumed in the last month)	Unit cost of this item	Total monthly cost (to be calculated by enumerator)	Where it is most commonly obtained 1=grow on my own 2= buy from local shop 3= barter trade 4= food for work 5= other (specify)	Time of year when it is least available 1=Jan-March 2=April-June 3=July-Sep 4=Oct-Dec	Time of year when it is most available 1=Jan-March 2=April-June 3=July-Sep 4=Oct-Dec	Main reason for fluctuations in availability
Maize Meal							
Cooking Oil							
Sugar							
Beef							
Dried Fish							
Fresh Fish							
Powder Milk							
Milk							
Margarine							
Eggs							
Bread							
Peanut Butter							
Rice							
Flour							
Soya/ Chunks							
Chicken							

Section 4 – Household Production Patterns

Crops grown and harvested for past and current cropping cycles

Ensure respondent is someone knowledgeable about HH farming:

In the section below, record all crops grown for each crop grown record total seed used, area planted, fertilizer used and the expected harvest.

	Irrigation Plot, Beneficiary Households															
	Planting season **1=2007/08** **2=2008/09** **3=2009/10** **4=2010/11** **5=2011/12**	**Number?** **Crop (***see codes below)*	**B1. What was the total quantity of seed planted to this crop** *(see codes below)*		**B2. Total area planted to this crop** Acres/ hectares		**B3. Total basal fertiliser applied on this crop** *(see codes below)*		**B4. Total top dressing applied on this crop** *(see codes below)*		**B5. Quantity harvested** *(threshed or shelled)*		**B6. Quantity sold**		**B7. Cash realised from sales** *(see codes below)*	
			Quantity	Units	Area	Units	Quantity	Units	Quantity	Units	Quantity	Units	Quantity	Units	Amount	Currency
a)																
b)																
c)																
d)																

For Beneficiary and Non Beneficiary Households for Dry Land Farming																
	Planting season **1=2007/08** **2=2008/09** **3=2009/10** **4=2010/11** **5=2011/12**	**Crop (***see codes below)*	**C1. What was the total quantity of seed planted to this crop**		**C2. Total area planted to this crop** Acres/ hectares		**C3. Total basal fertilizer applied to this crop**		**C4. Total top dressing fertilizer applied to this crop**		**C5. Quantity harvested** *(threshed or shelled)*		**B6. Quantity sold**		**B7. Cash realised from sales** *(see codes below)*	
			Quantity	Units	Area	Units	Quantity	Units	Amount	Currency	Quantity	Units	Quantity	Units	Amount	Currency
f)																
g)																
h)																
i)																
J)																
k)																
l)																
m)																
n)																
o)																
p)																
q)																
r)																
s)																
t)																

	Codes for Crops 1 = maize,2 = sorghum.3 = millet,4 = Rapoko,5= groundnuts,6 = sugar beans,7 = cowpeas 8. wheat	**Codes for Units** 1 = kgs, 2 = small cup 300ml, 3 = large cup>300ml 4 = 50kg bag, 5= 90kg bag, 6 = 20 lt tin,	**Codes for currency** 1= USD, 2= Rands, 3= pounds, 4= other

	8 = Other, specify	7 = 5 lt tin 8 = Other, specify		(specify)

Section 5 – Food Security Status and Challenges

Q5. Please select the phrase that best describes your household food situation from the statements below

	2005/2009	present
Doing very well and managing to meet all household food requirements and household expenses and having excess food and money to save, sell and spend on household assets		
Doing ok and just managing to meet household food and household expenses with no extra food to sell or save or money to buy assets		
Not quite managing to meet all household food requirements and expenses and requiring help from friends and relatives		
Not meeting household food requirements and expenses at all even with help from others and having to sell assets on a regular basis		

Codes: 1=doing very well, 2= doing well, 3=not quite well, 4= not meeting requirements

Q6. What are the main problems/ constraints that you experience with:

a) Rainfed agriculture_____

How best can these problems be overcome_____

b) Irrigated agriculture_____

How best can these problems be overcome_____

c) Getting enough food for you and your family_____

d) How best can these problems be overcome_____

Q7. Who or which organisations or entities are best suited to helping your household/ community to achieve long term food security. 1=local government 2=NGO's 3=??

_____

Q8. Where do you market and sell your excess agricultural produce_____

1=local shops/market 2=to neighbours 3=nearest town 4=other 5=do not have any excess

Q9. What is the main item that you spend the money earned from agricultural sales on

1=food 2=school fees 3=health care 4=other (specify_____)

_____

Q10. In your view what would you define as food security?

_____

Q11. What more would need to be done to ensure food security in your household?

_____

Q12. What more would need to be done to ensure food security in your community?

_____

Q13. For those with irrigation (i.e. beneficiary households)

Please describe in a few words what have been the main impacts of having irrigation on your life and that of your household.

_____

_____

Q14. Would you describe your household as being food secure? Y N (circle)

At this point I would like to thank you for your time and the information you have provided. I would also like to remind you that this questionnaire is for information purposes only and does not mean that you will receive any benefits from the implementers of this questionnaire.

Appendix 2: Key Informants Questions

1. Has the implemented irrigation scheme helped improve the well-being of the households of the irrigation farmers? (Y=Yes; N=No, D=don't know)

2. What can you comment about the irrigation as a source of food in the area?

I would like to take this opportunity to thank you for the short time for answering these questions.

_____