Productive Water Technologies to enhance resilience for smallholder farming households in Chiredzi and Mberengwa

Baseline Assessment Report

October 2020

Acknowledgements

The success of the Productive Water technologies to enhance resilience for smallholder farming households Baseline was due to the collaborative efforts of many individuals. We are thankful to the farmers, for their enthusiasm and collaboration in providing information during fieldwork. We are grateful to Latter Day Saints Charities (LDSC), the Enhancing Community Resilience and Sustainability (ECRAS) and Enhancing Community Resilience and Inclusive Market Systems (ECRIMS) projects for providing financial support and logistics, respectively. We are also thankful to the research assistants from Chiredzi and Mberengwa for providing constructive and very useful comments that improved the survey tool as well as collecting the data. Thanks also goes to and the project team, the study would not have been possible without their high level of professional technical support in study designing, developing tools, conducting training, data analysis and putting together the report. The assessment was not going to be a success especially in the operational context of COVID-19 pandemic.

Introduction

Overview of the LDSC project

Background

CARE International in Zimbabwe is implementing the *Productive Water Technologies to enhance Resilience for Smallholder Farming Households* initiative, within two existing CARE resilience building projects. The LDSC-funded intervention will complement the software components of two ongoing CARE projects funded by the Zimbabwe Resilience Building Fund (ZRBF), which is managed by the United Nations Development Programme (UNDP). The two CARE projects, *Enhancing Community Resilience and Sustainability (ECRAS)* running from July 2016 to March 2021, and *Enhancing Community Resilience and Inclusive Market Systems (ECRIMS)* running from September 2017 to October 2020, are being implemented in **Chiredzi** (and Mwenezi) and **Mberengwa** (and Zvishavane) districts respectively.

The current projects mainly focus on software (training, capacity-building, etc.), with limited establishment of water infrastructure. Specifically, the new initiative will support year-round access to productive water for smallholder farming households in Chiredzi and Mberengwa districts through the **establishment/construction and rehabilitation of water infrastructure and related production assets**. Year-round water access will address challenges relating to livestock and crop production, thus helping improve food and nutrition security for smallholder farming households, including those headed by women and youth. Some of the water points also will provide safe drinking water. In each of the two districts (Mberengwa and Chiredzi), the proposed project interventions will be layered on and integrated with the two ongoing CARE projects to enhance resilience and sustainability. Both ECRAS and ECRIMS aim to increase community capacities to sustain development gains and achieve improved well-being in the face of shocks and stresses. The projects, which enhance household and community resilience, seek to achieve five outcomes: Household and community capacities and assets are strengthened to deal with economic and climate-related shocks and stresses;

- Economic and climate-related drivers of risk are reduced in targeted communities;
- Leaders and service providers create an enabling environment for resilient livelihoods;
- Relevant value chains are profitable and able to withstand shocks and stresses; and
- Market ecosystems have improved responsiveness to the needs of at-risk communities.

Goal of the project

The **goa**l of the LDSC-funded intervention is to ensure that targeted smallholder farming households are food- secure.

The project aims to achieve the following **specific objectives** in support of the overall goal:

1. **2,140 smallholder farming households** will have access to adequate, multi-purpose, year-round water sources. This will be done through: weir construction; installation of solar-pumping systems on high-yielding boreholes; irrigation system rehabilitation; and establishment of community and household water harvesting structures.
2. **640 smallholder farmers** will produce food and cash crops under irrigation. This will be accomplished through the installation of irrigated "nutrition gardens" that are each 5 x 1 hectares in size.
3. **1,700 households** will have uninterrupted access to drinking water for both people and livestock within acceptable distances. This will be accomplished in part through the construction of

livestock drinking troughs to ensure that the animals do not contaminate community water supplies.

A total of **2,140 youth, female and male smallholder farmers** will **directly benefit,** with **9,415 household members also benefiting** from the food produced and income earned through the sale of cash crops. Other community members will benefit from increased local availability of vegetables, beans and other crops at more competitive prices due to the increased water supply. A total of **3,080 individuals will have access to safe drinking water** within acceptable distances, while **15,300 livestock** (cattle, goats and sheep) will benefit from reduced trekking distances to watering points.

Executive Summary

This report presents Baseline Assessment of the Latter-Day Saints Charities Productive water technologies to enhance resilience for smallholder farming households project being implemented in Chiredzi and Mberengwa Districts where two ZRBF -UNDP projects are being implemented under ECRAS and ECRIMS. It is drawn from an empirical study conducted in the two districts in July- August 2020. The project aims to complement existing ECRAS and ECRIMS activities through the facilitation of year-round access to multi-purpose reliable and sustainable water sources. To address the objectives, the requisite data and information were gathered using a mixed methods approach comprising both qualitative and quantitative methods. A questionnaire comprising mostly closed-ended questions was the main data collection instrument, while Focus Group Discussions with the water point committees and irrigation committees were complementary approaches. To better understand the results, survey data were disaggregated by sex and age category, district and intervention type.

The results of the study showed that in both districts, the middle-aged category dominated the highest proportion of participants targeted by the interventions (70% for Chiredzi and 57% for Mberengwa) followed by youths where in Chiredzi they constituted 25% and in Mberengwa 26% while the old aged constituted 5% and 18% for Chiredzi and Mberengwa samples respectively. In terms of marital status and participation in interventions, single respondents constituted 5% of the interviewed households and they participated mainly in the solar borehole, water harvesting and small weir and dam intervention which is extremely far less than the way the married living together participates in interventions. The findings also indicated that overall a household had an average of two (2) able bodied male and female members. The average household sizes for the two districts was seven (7). Forty-three percent of the households interviewed were participants from the ZRBF with 27% of them being model households in the resilience building programme. For both Chiredzi and Mberengwa the trend was similar to the overall sample with 42% and 43% for Chiredzi and Mberengwa respectively. A highest proportion of the ZRBF beneficiaries indicated that they were participating in the irrigation scheme rehabilitation intervention with 31% indicating that they are model households. The findings indicate that the interviewed households had received some capacity building from the resilience building projects hence their high participation in productive crop production in irrigation.

From the survey the major source of water for productive use was surface water with a proportion of 46% with Mberengwa having a proportion of 55% compared to Chiredzi where 21% of respondents acknowledged relying on surface water for productive use. This is likely due to that Chiredzi has a flat terrain and relies mostly on underground water with 24% of the respondents acknowledging access to water for productive use in Chiredzi from protected wells. For the households that acknowledged access to water for productive use from surface water the highest proportion were households participating in the irrigation scheme where 80% acknowledged surface water. The results were consistent with Focus groups discussions held in Chiredzi where, more than 60% of the participants depended on boreholes to water their livestock's and some solely on deep wells. In terms of domestic water access, bush pump boreholes were the most used with a proportion of 53% compared to surface water and unprotected wells which had a proportion of 13%. Mberengwa had the highest proportion of respondents who acknowledged having access to water for domestic use from tube (55%) compared to Chiredzi were 48% acknowledged having access to water for domestic use from borehole. In Chiredzi the results indicate that a slightly higher proportion of the interviewed farmers (25%) are accessing water for domestic use from

unprotected wells. A significantly high proportion of farmers interviewed in Chiredzi (17%) indicated that their source of water for domestic use was protected wells compared to Mberengwa which had only 3%.

Location of water source has strong bearing on communities' access to productive and domestic water needs. From the baseline survey 46% of respondents indicated that they travel for more than 1km and above (54% Mberengwa 20% Chiredzi). For those who travel for the furthest water harvesting participants had the highest proportion of 50% followed by irrigation participants who had a proportion of 46%. Female headed households had the higher proportion of those who noted that they travel the furthest distance to reach the source of water for domestic use with a proportion of 48% compared to 44% for the male headed households.

In terms of dryland crop production 89% of the interviewed farmers indicated that they are involved in dryland crop production, 96% being in Chiredzi and 86% in Mberengwa. By crop type, maize was the most produced crop despite its susceptibility to harsh drought conditions. About 85% of the households indicated that they were producing maize. Mberengwa had the highest production with an average of 244kg (86%). Sorghum was the second most produced crop, with about 51% of the households citing production. The highest proportion was by Chiredzi farmers with 78% of the respondents and average production of 216kg. High proportion of households producing maize increases the risk of crop failure given the susceptibility of maize to high temperatures. There is thus an opportunity to aggressively promote small grains production to avert this risk, integrating this into smallholder farmer diversified livelihoods.

To establish prospects of farmer dryland crop production, the study sought to understand the market dynamics by looking at the proportion who sold surplus and who they sold their produce to. Overall, 15% of the respondents indicated that they sale their dryland crops. Chiredzi had the highest proportion of farmers indicating that they sale their dryland crop produce (42%) compared to 7% reported in Mberengwa. The farmers who indicated that they sell were mostly those targeted by the irrigation scheme intervention with a proportion of 29%. This is due to the nature of production which is largely large-scale group production hence ease of market access. By sex, male respondents recorded a relatively higher proportion of those who are selling dryland crop produce with 19% compared to 13% for their female counterparts. Domestic markets/local markets were the most used for trade according to the interviewed farmers.

Agricultural production systems in the drylands are facing numerous challenges that threaten their resilience and future sustainability. From the findings the major challenge was drought as reported by 83% of the respondents. Below average rainfall has been received and infrequent rains in the last couple of years. Lack of inputs like seed and pesticides was another challenge faced by 49% of the interviewed farmers and crop pests. Amongst the challenges water shortages or system breakdowns for irrigation was noted by 18% of the respondents. Focus groups discussion with Irrigation scheme beneficiaries revealed other challenges such as high electricity charges, dilapidated canals which resulted in water losses

From the overall sample 79% of interviewed farmers indicated that they are involved in gardening and Chiredzi had a highest proportion of 90% compared to Mberengwa which had 76% who confirmed they are engaged in gardening activities. Farmers involved in the small weir, solar borehole and water harvesting interventions noted that they were involved in gardening with those from water harvesting and small weir recording 79%. The farmers in the middle-aged category were the ones with the highest proportion of participants in gardening activities with 81%. Most plots (47%) for the interviewed farmers

were located at homestead plots and Chiredzi recording 62% of farmers having plots at homesteads whilst Mberengwa 43% of the farmers had plots at homesteads.

The survey further revealed that majority of the crop proceeds is being used to purchase groceries and payment of school fees as shown in figure 2 above with 72% and 66% respectively. Veterinary levies, savings and village savings and lending followed with 28% whilst livestock purchases and crop production inputs was the other dominant use with 23%. 19% of the interviewed farmers indicated that they use their proceeds for purchase of farm implements. In terms of nutrition gardening or horticultural crop production, 90% of the interviewed farmers were growing tomatoes and 99% were growing leafy vegetables. Onion was the third most grown crop as reported by 60% of the households in Chiredzi (81%) and Mberengwa 54%. Nevertheless, there is low production of other nutritional crops such as carrots, sugar beans and Irish potatoes in both districts. This was mainly due to lack of seeds for the crops as, limited access to output markets and lack of knowledge on production. Tomato production was generally high in Mberengwa with an average of 416kg whilst 96kg was the average in Chiredzi (overall 257kg).

The assessment inquired on the average amount realized from garden crop production per month over the last 3 years. The amounts were captured in various currencies and converted to US dollars by the enumerators during field data collection. The overall average monthly income was $44.34 for the whole sample, with Mberengwa having the highest average monthly income of $56.57 compared to Chiredzi which had an average of $32.12. This means that for Mberengwa, garden production is a significant livelihood activity at household level compared to Chiredzi. Layering production of garden crops should be encouraged in-order to smoothen income at household level in line with absorptive and adaptive capacities for resilience building.

Cattle in Zimbabwe represents wealth of households and represents household ability to produce food as they are source of income through sales, draught power to work in the fields, paying lobola, traditional functions and transport of goods as well. Generally, cattle ownership is high amongst the targeted beneficiaries with 71% the Chiredzi (73.4%) and Mberengwa (69.9%) beneficiaries owning cattle (table 17). Ownership was higher amongst the solar borehole (80.6%), male (77%) and old aged (82.4%) beneficiaries when compared to other classes within their categories. It should be noted that despite being lower than that on men, ownership of cattle by women is significantly higher at 66% indicating greater control over productive livestock previously owned by men. In terms of poultry ownership, every household had some type of poultry including indigenous chickens, Broilers/layers, turkeys, guinea fowl and pigeons. From the overall sample an average of 12 indigenous chickens were owned by farmers across both districts. Mberengwa had the farmers with an average ownership of 13 indigenous chickens which was slightly higher than for Chiredzi which had an average of 11. The report also shows that goats were one class of livestock which was commonly being reared in the two districts with an average ownership of five (5). Goats in Zimbabwe are regarded as important livestock as they save token of appreciation and source of protein as well as their adaptability to climate vagaries such as drought.

Findings from the study highlighted that most households derive their income from agriculture, it accounted for 34% for casual agriculture labor whilst vegetable and fruit sales contributed 28% for the overall sample. Remittances alone contributed a substantial share of 21% as well as casual non-agriculture labor and petty trading which contributed 20% and constitute an important source of income for most households interviewed. Respondents were asked cite their most important sources of income. Overall,

vegetable sales and casual agricultural labour had the highest proportions of 16% respectively, whilst 12% reported casual non-agricultural labour and 11% reported remittances.

Understanding of financial inclusion by district, targeted intervention, sex and age categories is of relevance with regards to spatial and differential targeting and programming. The majority (82%) of interviewed households indicated that they were not part of any Village, savings and lending and only 18% were part of VS and L members. The survey followed up on the reasons for not participating in VS&L. The major reasons for not participating in VS&L were lack of money for contribution (41%) and lack of surplus from production activities (36%). Other reasons include lack of interests and lack of knowledge. Fifteen percent of the overall sample acknowledged that they have life assurance, Mberengwa having the highest proportion of 18% compared to Chiredzi which only had 4% of respondents acknowledging having the life assurance. Whilst farmers investment in life assurance remains low even across the mainstream ECRAS and ECRIMS projects, life assurance remains a viable social safety net as it reduces possibilities of cash, livestock or asset disposal in the event of death of a family member. Efforts should be made to strengthen linkages with life assurance service providers and layer the intervention on VS&L.

In terms of asset ownership, the study revealed that the most commonly owned asset was the hoe (average of 5 per household), followed by the plough with average ownership of 1 per household. No significant differences were observed across all the other categories. The interviewed respondents have access to communication assets (atleast 1 cellphone) across districts, targeted interventions, sex and age category. Similarly, there was average ownership of one (1) solar panel across similar categories.

Access to information is important for household decision making. The survey showed that at least 50% of responses acknowledged that they were accessing information on their regular livelihood needs. A higher proportion of Chiredzi respondents generally had access to information compared to Mberengwa. The most cited information types were on crop and livestock diseases, weather forecasts, input prices, floods and water management (all +60%). Communities showed that they had utilized information they received from their respective sources in the last 12 months. Information on weather forecast (96%) was the most utilised. This is attributed to the Seasonal Participatory Scenario Planning sessions held annually in both Chiredzi and Mberengwa districts. The major sources of information were from friends, radios, other farmers and government extension workers. The source of information depended on the type of information. Respondents showed that they were aware of the market situation regarding price of commodities, demand and inputs prices was largely shared with family and friends with a proportion of 35% for commodity prices, commodities on demand with a proportion of 40%.

The Household Food Consumption Score (FCS) was used in this study as a measure of dietary diversity, food frequency and the relative nutritional importance of the food consumed. This forms the basis for the Average Food based Coping Strategy Index score (FCS) for households in targeted communities. The respondents were asked about frequency of consumption of 10 food groups (in days) over a recall period of the past 7 days. The average FCS was 40.56 which indicates reasonable access to all 10 food groups by households. Chiredzi households have a higher score (42.06) when comparing male and female households. The scores were further categorized using the ZRBF Indicator Reference Guide, i.e poor, borderline and acceptable food consumption. On average 58% of the sampled households have an acceptable food consumption score. About 37% % fall within the border line whilst only 6 % have poor food consumption. More households in Chiredzi fall within the acceptable category (66%) compared to the 55% in Mberengwa. An analysis of the intervention categories showed that a higher proportion of the

households targeted by solar boreholes and gardens had acceptable food consumption of 70.5% whilst those targeted by water harvesting had largely borderline consumption.

Household Dietary Diversity Score is a measure of household food access (food consumption) that reflects household access to a variety of foods defined by the number of unique foods consumed by household members over a given period. The assessment sought to provide an estimation of the quality of the diet of households in the 2 operational districts of Chiredzi and Mberengwa by looking at 7 food groups which are: Cereals, roots and tubers, pulses and legumes, vegetables, fruits, meat, fish and eggs, milk and milk products and oils and fats. The average dietary diversity score is 4.62 for households who participated in the questionnaire survey. This indicates that households have reasonable access to at least 5 food groups which is important for their absorptive capacity to shocks and stresses. Programming should thus seek to improve access and utilization of protein and vitamin rich foods which households have limited access to.

In terms of governance it emerged that committees worked with a number of key stakeholders such as DDF, the MoHCC, the RDCs through councilors, community leaders and AGRITEX. Water point committees generally had knowledge on water point roles and duties. Some of duties mentioned included: spearheading maintenance of the borehole in times of break through partnering with pump minders. In terms of membership constitution, there were more female members (75% female: 25% male) in water point committees because women are the principal users of a water system and as such, they are the first to recognize problems at water points. On the contrary, irrigation scheme committees were largely constituted by men (80%). Despite women being 57% of the total irrigation scheme targeted beneficiaries in Chiredzi and Mberengwa they were not in control of key decision making for their production. Traditionally men have always held positions of influence in key asset management.

Despite the community's knowledge of the COVID 19 pandemic, the communities were reluctant to take any mitigatory measures such as wearing of masks when attending public meetings and washing of hands. About 33% of the interviewed WPC indicated that they had put in place a measure to ensure that people practice social distancing and appointed a member of the committee who ensures people do not crowd at the water source. The committees indicated that they were VHW who were trained on COVID 19 and were ensuring that knowledge on the COVID pandemic is imparted to everyone. A number of participants in the committees also indicated that they were receiving awareness messages on COVID 19 in vernacular from ZRBF.

The study concludes that generally all age groups, that is the youth who are aged 18-35, middle aged 36-65 and the old aged above 65 were targeted by the project. These were also active participants in the ZRBF projects. The households generally had reasonable access to productive water. Dryland crop production was found to be a dominant livelihood activity contributing towards household food security with a significant proportion of farmers are involved in garden activities which is indicative of commitment by households towards their food, nutrition and income security. Financial inclusion was concluded to be low amongst the targeted Chiredzi and Mberengwa households and only 18% were in VS&L. An analysis of the management committees who are the bearers of governance of assets showed that committees were aware of their roles and responsibilities. They were also allowing for participation of women as 75% of WPCs were women. Despite this, committees were weak in enforcing the collection of revolving funds, hence do not have resources to meet their operation and maintenance obligations.

Key recommendations were on improving house hold access to water for domestic and productive use which will strengthen their resilience and sustainability. Establishment of water harvesting structures,

rehabilitation of irrigation schemes and solarization of boreholes will thus increase productivity for smallholder farmers. Improving income and increasing the number of income streams that smallholder farmers have. Any interventions should seek to build on already existing knowledge and familiarity in exploring potential opportunities for farmers with access to all year-round water. Improving irrigation infrastructure through rehabilitation and upgrading of existing pumps. Irrigation can enable smallholders to engage in year-round production, increase yield and improve food and nutrition security. From the study it was noted that production was generally low.

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List of Acronyms

AGRITEX	Department of Agricultural, Technical and Extension Services
ECRAS	Enhancing Community Resilience and Sustainability
ECRIMS	Enhancing Community Resilience and Inclusive Market Systems
DDF	District Development Fund
FGDs	Focus Group Discussions
GoZ	Government of Zimbabwe
LDSC	Latter Day Saints Charities
MoHCC	Ministry of Health and Child Care
RDC	Rural District Council
SPSS	Statistical Package for the Social Sciences
VS&L	Village Savings and Lending
WASH	Water Sanitation and Hygiene
ZRBF	Zimbabwe Resilience Building Fund

Baseline objectives

The purpose of the baseline survey was to:

- Learn about the general farming livelihood by looking at production trends, social safety nets, assets and livestock ownership, access to information and food consumption for the targeted population.
- To understand the water and production challenges and opportunities within the targeted irrigation schemes and community at large so as to better guide our intervention.
- To have an understanding on the governance for managing irrigation scheme facilities and water points and identify challenges and opportunities as well informing programming.
- To assess the accessible water sources for farming, livestock rearing and personal consumption for targeted smallholder farming households.

Assessment methodology

Study Design

The baseline was conducted through a quantitative household survey. qualitative approaches were also employed through the use of focus group discussions to gather some in-depth information especially on governance for managing irrigation scheme facilities and water points. In this case, probability and non-probability sampling methods were used although the survey was predominantly probability.

Study population and Sample

The study population was derived from Irrigation Scheme Rehabilitation, Small weir dam, Solar borehole/nutrition garden and Water harvesting structures beneficiaries from Chiredzi and Mberengwa operational wards for the LDSC interventions. The baseline study used 10% sample which is statistically representative for the generalization of findings. A total of 348 households were sampled and there was 100% response rate.

Sampling procedure

Modified systematic random sampling technique was used for sample selection which is widely used as a probability sampling method. The rationale for choosing this technique was its simplicity and it also gave assurance that the population is evenly sampled. A sample size of 348 households (HH)/ smallholder farmers were selected for the baseline. The sample was disaggregated as indicated in fig 1 below for both Districts. In total, this represented 10% of the targeted households for all the four interventions.

Table 1: Sample disaggregation by District

Intervention	District		Total
	Chiredzi	Mberengwa	
Irrigation Scheme Rehabilitation	20	15	**35**
Small Weir/ Nutrition Garden	0	39	**39**
Solar Borehole/ Nutrition garden	47	82	**129**
Water harvesting	12	133	**145**
Total	**79**	**269**	**348**

Study timelines and the data collection process

The baseline was conducted soon after completion identification of sites. The process involved designing of the baseline protocol, data collection tools, training the enumerators, field data collection, data entry, data cleaning, and reporting writing. The study was conducted between 14 August 2020 and 17

September 2020. Data collection was done by enumerators under the supervision of the project M&E Team. The enumerators were trained on the baseline survey tool and were deployed to selected project sites. The questions were administered in vernacular Shona language. Seven (7) qualitative focus group discussions with water point committees and the irrigation committee were conducted in both Chiredzi and Mberengwa District with an average of seven committee members for both. Data collection was done electronically using tablets and collected information on:

- Demographic information (sex, age category, household head marital status, farmer level of education, etc.)
- Households access to water for domestic and productive use by project intervention
- Sources of water for domestic and productive use by project intervention
- Household/farmer dryland crop production by project intervention
- Social safety nets
- Socio-economic status (household assets, income etc.) by project intervention
- Household food security status by project intervention

Secondary data document review

A review of relevant documents from various sources was done prior to commencement of primary data collection to obtain an understanding of the context so as to inform the work, in particular, to develop relevant primary data collection tools. Some of the documents used in the review process include the ZRBF high frequency monitoring, vulnerability assessment reports, among others.

Data Quality Assurance

i. An intense training of data collectors (enumeration team) was conducted to ensure everyone was equipped with the right skills, understand the project objectives, and the tools.
ii. A pre-test of the tools.
iii. Data collection tools were linked to the project objectives and project indicators. In this vein, the idea was to have a tool that capture essential information only, and of the right size (length) to manage interviewee and interviewer fatigue hence detailed responses were elicited from the participants.
iv. End of day debriefing sessions were conducted to review each day's data collection process and challenges.
v. Use of kobo platform to collect data, under which data validation controls were inputted in the designing of the form so as to minimize errors.

Data analysis plan

Quantitative data was cleaned and exported to Statistical Package for Social Sciences (SPSS) for an in-depth statistical analysis. A data analysis plan was developed and used in the data analysis phase. The data was presented in the form of frequent tables, descriptive statistics, graphs and charts.

Plans for use of data: All of the data gathered, and the reports generated in conjunction with LDSC, will be presented to different stakeholders, including the beneficiaries, financiers, implementers and government. Different methods of disseminating the results will be employed taking into consideration the different needs of data users.

Ethical Considerations

The following ethical issues were adhered to during data collection:

i. Confidentiality
ii. Beneficence

iii. Respect for diversity of views
iv. Transparency and accountability through clearly explaining the baseline process to all stakeholders.
v. Voluntary participation based on consent – interviews were conducted upon consent of the respondent.
vi. Do no harm approach (either emotional or physical)

Study Findings

Demographics

The results of the study showed that majority of the interviewed sample for Chiredzi (25%) are households benefitting from the irrigation scheme, 60% solar borehole and garden and 15% were households benefitting from the water harvesting structures (table 2). For Mberengwa the highest proportion of the households interviewed (49%) are beneficiaries from the water harvesting structures, 31% are the beneficiaries from the solar borehole intervention, 15% are from the irrigation scheme rehabilitation whilst 6% of the interviewed are from the small weir and garden. In both districts, the middle-aged category dominated the highest proportion of participants in the interventions (70% for Chiredzi and 57% for Mberengwa) followed by youths where in Chiredzi they constituted 25% and in Mberengwa 26%) while the old aged constituted 5% and 18% for Chiredzi and Mberengwa samples respectively (table 2). This is mainly because the middle aged and the youths are the most age categories that have a positive impact for labor productivity and capital formation whilst the elderly which are regarded as the dependents contributed a small proportion as shown on the table above. However, the youth participation in the

intervention is lower than the middle aged because in the communities of implementation youths do not have access to land and resources as compared to the middle aged.

Table 2: Sex, Age and Intervention Characteristics (%)

District	Overall Sample	Intervention				Sex		Age Category		
		Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole& garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Chiredzi	23	25.3	0.0	59.5	15.2	55.7	44.3	25.3	69.6	5.1
Mberengwa	77	5.6	14.5	30.5	49.4	58.0	42.0	25.7	56.9	17.5
n	**348**	**35**	**39**	**129**	**145**	**200**	**148**	**89**	**208**	**51**

The overall sample showed that 72% of the interviewed households are married and living together and the trend was the same for both Chiredzi and Mberengwa with 75% and 71% respectively (table 3). For married living together 63% of them were females and 83% were males. The married and living together had a high proportion in participating in all the interventions with 74% participating in irrigation scheme rehabilitation, 64% participating in small weir and 72% in both Water harvesting and solar borehole garden. This is mainly due to that the communities the married and living together focus on interventions that are related to their livelihoods and they are usually not mobile and have no migratory tendencies as compared to the single or married living apart. The research also revealed that the widowed constituted 13% of the interviewed households and they also participated in all the interventions with 23% of them participating in irrigation scheme and the highest proportion of widowed was found to be female respondents (18%) compared to widowed males who constituted 6%. The highest proportion of widowed was found to be on the old aged category (22%) followed by middle aged (15%). single respondents constituted 5% of the interviewed households and they participated mainly in the solar borehole, water harvesting and small weir and dam intervention which is extremely far less than the way the married living together participates in interventions.

Table 3: Farmer marital status (%)

Marital status	Overall Sample	District		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole &Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Divorced	1.1	2.5	.7	0.0	0.0	.8	2.1	1.5	.7	1.1	1.4	0.0
Married living apart	7.5	2.5	8.9	2.9	17.9	8.5	4.8	12.0	1.4	10.1	7.7	2.0
Married living together	71.6	74.7	70.6	74.3	64.1	72.1	72.4	63.0	83.1	69.7	72.1	72.5
Separated	1.7	0.0	2.2	0.0	2.6	0.0	3.4	1.5	2.0	1.1	2.4	0.0
Single	5.2	6.3	4.8	0.0	2.6	8.5	4.1	4.0	6.8	14.6	1.4	3.9
Widowed	12.9	13.9	12.6	22.9	12.8	10.1	13.1	18.0	6.1	3.4	14.9	21.6
N	**348**	**79**	**269**	**35**	**39**	**129**	**145**	**200**	**148**	**89**	**208**	**51**

The results from the survey indicates that the highest proportion of the households interviewed from the overall sample had some secondary (29%) followed by 24% who indicated that they had some primary education with only 1% indicating that they had completed some tertiary education (table 4). Respondents who indicated that they have completed tertiary education were not participating in any interventions as compared to the respondents who highlighted that they have either some secondary or some primary education. The males constituted a bigger proportion of those who have completed tertiary education (2%) as compared to women. The highest proportion of females (31%) indicated that that they had some secondary education. For the old aged the findings indicated that 35% of the interviewed had

some primary education whilst 31% indicated that they have some secondary education from the middle-aged category. A higher proportion (24%) of the old aged also indicated that they have some non- formal education. The results indicate that the respondents had some level of education they had acquired informally and formally which entails that from the resilience building projects running in their communities they can get some capacity building that will enhance their resilience without any challenges.

Table 4: Farmer Education level reached (%)

Education Level Reached	Overall Sample	District		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Some Primary	24.4	45.6	18.2	28.6	17.9	34.1	16.6	23.5	25.7	19.1	24.0	35.3
Completed primary	16.1	10.1	17.8	20.0	20.5	14.0	15.9	16.0	16.2	15.7	16.3	15.7
Some Secondary	29.3	16.5	33.1	20.0	23.1	24.8	37.2	30.5	27.7	33.7	30.8	15.7
Completed Secondary	19.0	7.6	22.3	20.0	25.6	14.0	21.4	18.0	20.3	24.7	19.2	7.8
Some Tertiary	.9	1.3	.7	2.9	0.0	.8	.7	.5	1.4	2.2	.5	0.0
Completed Tertiary	1.4	1.3	1.5	0.0	0.0	.8	2.8	1.0	2.0	2.2	1.0	2.0
Non formal	8.9	17.7	6.3	8.6	12.8	11.6	5.5	10.5	6.8	2.2	8.2	23.5
N	**348**	**79**	**269**	**35**	**39**	**129**	**145**	**200**	**148**	**89**	**208**	**51**

The average household size for the overall sample from the study was found to be seven (7) and trend was uniform for both Chiredzi and Mberengwa (table 5). The findings also indicated the overall sample had an average of two (2) able bodied male and female members from the interviewed households and the trend was uniform in both district which indicates that there is availability of labor for production in all the interventions.

Table 5: Mean Household size and able-bodied household members

Variable	Overall Sample	District Name		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole& Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Household Size	7.2	7.8	6.6	6.5	7.0	6.5	7.2	6.6	7.3	5.9	7.2	7.3
Able Bodied Male	1.8	2.1	1.6	1.8	1.4	1.7	1.9	1.6	2.0	1.6	1.8	1.7
Able Bodied Female	1.9	2.1	1.7	2.0	1.8	1.7	1.9	1.9	1.8	1.5	2.0	1.8

The survey also sought to find out if the targeted households were also participants in the ZRBF- resilience building projects and the results indicated that 43% of the households interviewed were participants with 27% of them being model households in the resilience building programme. For both Chiredzi and Mberengwa the trend was similar to the overall sample with 42% and 43% for Chiredzi and Mberengwa respectively. A highest proportion of the ZRBF beneficiaries indicated that they were participating in the irrigation scheme rehabilitation intervention with 31% indicating that they are model households. The findings indicate that the interviewed households had received capacity building from the resilience building projects. The research also revealed that 47% of the ZRBF beneficiary households were male headed with 41% being female headed. About 74% of the ZRBF beneficiaries showed that they are participating in the irrigation scheme intervention indicating previous implementation of resilience building activities by ZRBF partners in the districts.

Table 6: Farmer Participation in ZRBF Activities (%)

Variable	Overall Sample	District Name		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole& Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
ZRBF Beneficiary Household	43	41.8	43.9	74.3	43.6	34.9	43.4	40.5	47.3	27.0	47.6	54.9
ZRBF Model Household	27	27.8	26.8	31.4	33.3	25.6	25.5	24.5	30.4	19.1	28.4	35.3
N	**348**	**79**	**269**	**35**	**39**	**129**	**145**	**200**	**148**	**89**	**208**	**51**

Household access to water source and sanitation

Chiredzi and Mberengwa districts characterized by low annual rainfall and high temperatures experiences prolonged mid-season dry spells which results in far lower water tables and adversely affecting crop, livestock productivity and negatively affecting access to safe drinking water for communities. Data collected from the baseline survey showed that 73% had access to productive water for the overall sample and Chiredzi having the highest proportion who acknowledged they have access to water for productive use with a proportion of 90% (table 7). The participants for irrigation scheme had the highest proportion of those who acknowledged they have access for productive use with 86% compared to solar borehole participants with 79% who acknowledged access to water for productive use. Irrigation schemes by their nature have access to water given the large scale of production. Female headed households had a higher proportion of respondents (75%) who acknowledged they have access to water for productive use compared to their male counterparts (72.3%). By age category, the old aged reported higher access to productive water (77%), relative to the middle aged and youth.

Table 7: Farmer productive water access (%)

Productive Water source Variable	Overall Sample	District Name		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Productive water access	73	89.9	69.1	85.7	66.7	79.1	68.3	75.0	72.3	70.8	74.5	76.5
N	**348**	**79**	**269**	**35**	**39**	**129**	**145**	**200**	**148**	**89**	**208**	**51**
Productive water source												
Piped into yard/plot	0.39	0.0	.5	0.0	0.0	0.0	1.0	.7	0.0	1.6	0.0	0.0
Protected spring	0.8	0.0	1.1	0.0	0.0	0.0	2.0	1.3	0.0	1.6	.6	0.0
Protected well	7.4	23.9	1.1	3.3	0.0	14.7	3.0	6.0	9.3	7.9	9.0	0.0
Sand abstraction	1.6	1.4	1.6	3.3	0.0	2.0	1.0	2.0	.9	1.6	1.9	0.0
Surface water eg river, dam, canal)	45.9	21.1	55.4	80.0	50.0	34.3	46.5	46.0	45.8	47.6	44.5	48.7
Tanker truck	0.4	0.0	.5	0.0	0.0	1.0	0.0	.7	0.0	1.6	0.0	0.0
Tube well/borehole	28.4	28.2	28.5	0.0	26.9	33.3	32.3	24.7	33.6	23.8	29.7	30.8
Unprotected spring	4.7	1.4	5.9	3.3	19.2	3.9	2.0	7.3	.9	3.2	4.5	7.7
Unprotected well	10.5	23.9	5.4	10.0	3.8	10.8	12.1	11.3	9.3	11.1	9.7	12.8
Distance to productive water source (Km)	2.05	2.31	1.80	1.73	1.45	2.36	1.69	2.22	1.53	2.97	1.50	1.99

The major source of water for productive use with the highest proportion was surface water with a proportion of 46% with Mberengwa having the highest proportion of 55% compared to Chiredzi where 21% of respondents acknowledged relying on surface water for productive use. This is likely due to that Chiredzi has a flat terrain and relies mostly on underground water with 24% of the respondents acknowledging access to water for productive use in Chiredzi from protected well. For the households that acknowledged access to water for productive use from surface water the highest proportion were households participating in the irrigation scheme where 80% acknowledged surface water followed by 50% for small weir participants and 47% for water harvesting structures participants. 46% of both male and female acknowledged that they rely on surface water for productive use. Deep wells especially in Chiredzi are perennial and from the Focus group discussions conducted, the participants noted that during the dry period from August to October the water sources cannot support gardens and drinking for livestock. For the boreholes production during the dry period is affected by the manual labour involved in pumping the boreholes, farmers tend to concentrate on a small portion as there is need to water crops often. The average distance travelled to access productive water from both districts was 2km with Chiredzi district farmers travelling more than 2km while farmers in Mberengwa district were traveling nearly 2km. The average distance travelled to access productive water from both districts was 2km with Chiredzi district farmers travelling more than 2km while farmers in Mberengwa district were traveling nearly 2km.

Farmer Household Domestic Water access

The survey solicited information on domestic water sources from both districts and data collected revealed that tube well/ borehole from the overall sample had the highest proportion (53%) compared to surface water and unprotected wells which had a proportion of 13% (table 8). Mberengwa had the highest proportion of respondents who acknowledged having access to water for domestic use from tube well/ borehole with 55% compared to Chiredzi were 48% acknowledged having access to water for domestic use from borehole.

Table 8: Farmer Household Domestic Water source (%)

Domestic Water Source	Overall Sample	District		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Piped into yard/plot	0	0.0	.4	0.0	0.0	.8	0.0	0.0	.7	0.0	.5	0.0
Piped to neighbour	1	0.0	.7	0.0	0.0	0.0	1.4	.5	.7	0.0	.5	2.0
Protected spring	1	1.3	1.1	0.0	2.6	.8	1.4	1.5	.7	1.1	1.4	0.0
Protected well	6	17.7	2.6	5.7	2.6	10.1	3.4	6.0	6.1	6.7	6.3	3.9
Public taps/standpipe	2	0.0	2.2	0.0	0.0	1.6	2.8	2.5	.7	2.2	1.4	2.0
Sand abstraction	6	0.0	7.4	0.0	0.0	10.1	4.8	6.0	5.4	6.7	5.8	3.9
Surface water (river/dam, canal)	13	7.6	14.9	20.0	10.3	20.9	5.5	14.0	12.2	20.2	11.1	9.8
Tube well/borehole	53	48.1	54.6	45.7	53.8	41.1	65.5	49.0	58.8	47.2	53.8	60.8
Unprotected spring	5	0.0	6.3	0.0	7.7	3.1	6.9	8.0	.7	4.5	5.3	3.9
Unprotected well	13	25.3	9.7	28.6	23.1	11.6	8.3	12.5	14.2	11.2	13.9	13.7
N	**348**	**79**	**269**	**35**	**39**	**129**	**145**	**200**	**148**	**89**	**208**	**51**

In Chiredzi the results indicate that a slightly higher proportion of the interviewed farmers (25%) are accessing water for domestic use from unprotected wells. A significantly high proportion of farmers interviewed in Chiredzi (17%) indicated that their source of water for domestic use was protected wells compared to Mberengwa which had only 3% who indicated protected wells as their source of water for domestic use. Use of unprotected wells, springs and sand abstraction was common across all interventions giving a need to rehabilitated deep wells and solarizing available high yielding boreholes thus improving safe and all year domestic water availability. From the Focus group discussions it revealed that the

Environmental Health technicians periodically conduct the water quality tests to ensure that the water sources are safe to drink from the boreholes, however from the deep wells no water quality tests are conducted as wells are usually individually owned.

Household distance, time taken to and safety of domestic water source (%)

Location of water source has strong bearing on communities' access to productive and domestic water needs. Forty six percent of respondents indicated that they travel for more than 1km and above to access domestic water, 54% in Mberengwa and 20% for Chiredzi. About 28% accessed water within a distance of 0.5km and 1km whilst about 25% accessed water within 500 metres. This is in line with the recommended maximum distance of 1km to access productive water for about 54% of the targeted households. Solar borehole and water harvesting beneficiaries had 43% and 50% respectively, of the households travelling in excess of 1km to access water. With solarization, the distance might not be reduced, however, the time taken will be reduced thus freeing up productive time especially for women and girls who have to shoulder the responsibility of fetching water. Similarly, water harvesting structure beneficiaries will also benefit through reduction in distances to water sources to less than 1km as the water harvesting structures will be established within their homes. It would thus be critical to ensure that these are protected and treated to ensure water quality.

Table 9: Household distance, time taken to and safety of domestic water source (%)

Variable	Overall Sample	District Name		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Distance to Domestic Water Source												
1km and above	46	20.3	53.5	45.7	38.5	43.4	50.3	47.5	43.9	46.1	45.7	47.1
> than 500m < 1 km	28	19.0	30.1	17.1	35.9	28.7	26.9	28.5	26.4	33.7	24.0	31.4
< 500m	25	60.8	14.9	37.1	23.1	26.4	22.1	22.0	29.7	20.2	29.3	17.6
Don't know	1	0.0	1.5	0.0	2.6	1.6	.7	2.0	0.0	0.0	1.0	3.9
Time taken to walk to domestic water source												
> 1 hour	6	0.0	8.2	0.0	5.1	5.4	9.0	6.5	6.1	2.2	8.2	5.9
30min to 1 hour	28	10.1	32.7	31.4	35.9	20.9	30.3	29.0	25.7	30.3	22.6	43.1
15-30min	34	25.3	36.4	25.7	30.8	38.0	33.1	35.0	32.4	31.5	36.1	29.4
< 15min	32	64.6	22.7	42.9	28.2	35.7	27.6	29.5	35.8	36.0	33.2	21.6
Time taken queueing at water source												
30min or more	35	13.9	40.9	22.9	33.3	23.3	48.3	34.0	35.8	39.3	34.1	29.4
15-30min	18	13.9	18.6	8.6	20.5	15.5	20.7	16.5	18.9	19.1	15.9	21.6
5-15min	19	24.1	17.5	11.4	12.8	30.2	12.4	20.0	17.6	20.2	17.8	21.6
less than 5min	26	48.1	20.1	57.1	30.8	28.7	15.9	27.0	25.7	21.3	29.3	23.5
Don't Know	2	0.0	3.0	0.0	2.6	2.3	2.8	2.5	2.0	0.0	2.9	3.9
Proportion citing Domestic water safety	58	73.4	53.9	51.4	46.2	53.5	67.6	59.0	57.4	52.8	59.1	64.7
N	**348**	**79**	**269**	**35**	**39**	**129**	**145**	**200**	**148**	**89**	**208**	**51**

The time taken to domestic water sources was considerably varying across the two districts where in Chiredzi district, 65% of households confirmed that they it was less than 15 minutes while in Mberengwa district only 22% of households were taking less than 15 minutes to walk to the water source (table 9). This indicated relatively low time taken to access water. Queuing for water at water source was another indicator measuring domestic water availability which showed 48% of households in Chiredzi queued for less than 5 minutes while in Mberengwa district was 20%. The data also revealed that 41% from Mberengwa district had a waiting period of above 30 minutes while in Chiredzi district it was 14% (table 9). Typically, in Mberengwa district distance to water source, time taken travelling and queuing time was immense because the common water source is borehole and sand abstraction. Abstracting water in these

sand riverbeds take considerable time for water to filter in. In Chiredzi district, 53% of households confirmed that their domestic water was safe for use while in Mberengwa district a proportion of 54% indicated that they feel their domestic water source was safe. Overall picture on household access to water source and sanitation reveala that both districts Chiredzi and Mberengwa are in need of water harvesting structures to enable communities to have access to safe domestic water and productive all year round and enhance their food production from the proposed newly and rehabilitated water harvesting structures.

Type of Toilet used by Households

Water, sanitation and hygiene access is critical for household resilience given the need to reduce pre-disposal to diarrheal diseases, preserve development gains through limiting disposal of assets to cater for health expenses as a result of poor hygiene. The survey went on to assess the type of toilets used by Chiredzi and Mberengwa communities (table 10).

Table 10: Type of toilet used by households (%)

Type of Toilet	Overall Sample	District Name		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Double pit latrine	23	30.4	20.4	34.3	28.2	22.5	18.6	20.0	26.4	20.2	21.6	31.4
Single pit latrine	52	48.1	53.2	51.4	43.6	49.6	56.6	51.5	52.7	52.8	51.4	52.9
Flush toilet	0.3	0.0	.4	0.0	0.0	0.0	.7	0.0	.7	0.0	.5	0.0
No latrine,	25	21.5	26.0	14.3	28.2	27.9	24.1	28.5	20.3	27.0	26.4	15.7
N	**348**	**79**	**269**	**35**	**39**	**129**	**145**	**200**	**148**	**89**	**208**	**51**

The single pit latrine was common across the two districts reported by 52% ofthe overall sample, (48% in Chiredzi and 53% Mberengwa). Twenty three percent had double latrines (30% in Chiredzi and 20% in Mberengwa), whilst a significant 25% had no latrines (22% Chiredzi and 26% Mberengwa). The situation signifies that there is need for public health and hygiene education in both districts to emphasize on toilet construction to minimize open defecation.

Household/farmer dryland crop production

Dry land crop production is an important livelihood activity for farmers in Chiredzi and Mberengwa. Agriculture forms an integral part of Zimbabwe's economy with 60% of the GDP contribution coming from agriculture. Rural livelihoods (85%) are characterized by crop and livestock production which contribute towards their food and income security. The ZRBF OMS report indicated that of the 3 income sources reported by households in Chiredzi and Mwenezi, crop production was cited as the most important income source by 23% of the households. The study therefore sought to understand households' participation in crop production and gardening activities disaggregated by district, targeted intervention type, sex and age categories.

Table 11: Dryland Crop Production by targeted households (%)

Variable	Overall Sample	District Name		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Proportion in Dryland Crop Production	89	96.2	86.2	100.0	76.9	91.5	86.2	92.5	83.1	92.1	89.4	78.4

N	348	79	269	35	39	129	145	200	148	89	208	51
Crop type & Average production												
Maize	85	81.6	85.8	88.6	86.7	83.9	84.0	84.9	84.6	80.5	87.1	82.5
Maize (kg)	156.0	68.0	244.1	169.8	219.7	326.4	90.4	197.0	210.2	217.3	189.5	234.2
Sorghum	57	77.6	50.9	48.6	53.3	56.8	61.6	56.8	58.5	53.7	61.3	47.5
Sorghum (kg)	155.7	216.2	95.2	77.9	92.3	208.7	93.6	114.1	166.8	146.6	124.9	173.7
Pearl Millet	22	30.3	19.4	28.6	16.7	22.9	20.8	21.1	23.6	13.4	26.3	20.0
Pearl Millet kg	99.0	103.5	94.6	126.0	95.0	108.5	75.8	89.4	108.6	74.5	94.7	146.9
Rapoko	16	5.3	19.4	2.9	10.0	15.3	21.6	15.7	16.3	14.6	16.1	17.5
Rapoko kg	40.7	30.0	51.4	100.0	16.7	59.2	45.1	44.9	56.5	65.4	41.8	56.1
Sugar bean	7	14.5	4.3	11.4	3.3	6.8	6.4	7.6	5.7	7.3	7.0	5.0
Sugar bean kg	21.5	13.9	29.1	62.5	25.0	7.9	13.3	29.2	5.0	16.5	15.0	75.0
N	**308**	**76**	**232**	**35**	**30**	**118**	**125**	**185**	**123**	**82**	**186**	**40**

In terms of engaging in dryland crop production 89% of the interviewed farmers indicated that they are involved in dryland crop production with 96% of these in Chiredzi and 86% for Mberengwa. All the irrigation scheme beneficiaries were involved in dryland production compared to other intervention categories. By sex, female households reported a higher proportion (93%) compared tp male (83%) whilst by age category, the youth reported a higher proportion (92%) compared to the middle aged and old aged (table 11). Maize had the highest proportion of being produced with 85% from the overall sample of interviewed households indicating that were producing maize. Mberengwa had the highest production with an average of 244kg (86%). This was followed by sorghum which is grown by 57% ofd the households interviewed. Chiredzi had the highest production of sorghum with 78% and an average of 216kg compared to an average of 95kg for Mberengwa. On the contrary Mberengwa had the highest households (19%) indicating that they produce rapoko with an average production of 51kg. About 22% of the households produce pearl millet. This was however higher in Chiredzi where 30% reported production of the crop. Given the susceptibility of maize to extreme climate conditions such as drought and mid-season dry spells, there is a need to aggressively promote small grains production especially in Mberengwa. The risk of crop failure for maize is higher than that of small grains such as pearl millet and sorghum. Given that small grain production is a key activity in the two ZRBF projects, there is a need to upscale production to ensure food security for farmers. Sugar bean had the least proportion of farmers indicating that they are producing it in dry land with 7% for the whole sample and Chiredzi having the highest proportion of 15% compared to 4% for Mberengwa. Low production in Sugar beans is highly due to the lack of inputs for the farmers and also lack of market for the commodity. The farmers grow enough for family consumption. Sugar bean is an important cash crop with a ready market in Zimbabwe. Enhancing production and market linkages especially for bio-fortified varieties is thus important. The project should thus leverage of bio-fortified Nua 45 variety seed production in Chiredzi to promote sugar bean production in gardens and irrigation schemes. Bio-fortified varieties contribute towards both nutrition and income status of targeted households thereby increasing their absorptive and adaptive capacity for resilience.

Table 12: Proportion of farmers selling dryland crop produce and dryland produce market

Variable	Overall Sample	District Name		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Proportion selling dryland crop produce	15	42.1	6.5	28.6	3.3	25.4	4.8	13.0	18.7	12.2	17.2	12.5
N	**308**	**76**	**232**	**35**	**30**	**118**	**125**	**185**	**123**	**82**	**186**	**40**
Dryland Crop Produce Market												
Local market	68	59.4	86.7	70.0	100.0	63.3	83.3	70.8	65.2	70.0	68.8	60.0

Contracted company	19	28.1	0.0	0.0	0.0	30.0	0.0	12.5	26.1	20.0	18.8	20.0
Distant market (within province)	11	9.4	13.3	30.0	0.0	6.7	0.0	12.5	8.7	10.0	9.4	20.0
Distant market (outside province)	2	3.1	0.0	0.0	0.0	0.0	16.7	4.2	0.0	0.0	3.1	0.0
N	**47**	**32**	**15**	**10**	**1**	**30**	**6**	**24**	**23**	**10**	**32**	**5**

The results of the survey revealed that only 15% of the respondents indicated that they sale their dryland crops (table 12). Chiredzi had the highest proportion of farmers indicating that they sale their dryland crop produces with 42% compared to 6.5% reported in Mberengwa. The farmers who indicated that they sell were mostly for the irrigation scheme intervention with a proportion of 29% followed by those for the solar boreholes and garden. Males recorded the highest proportion of those who are selling dryland crop produce with 19% compared to 13% for females and of these involved the middle aged had the highest proportion of 17% compared to 12% for both the youth and the old aged. The major market for the dryland crop produced in both districts was the local market with a 68% for all the households interviewed and Mberengwa recording a proportion of 87% and Chiredzi also having a proportion of 28% for Contracted company market. A similar trend was observed across all categories.

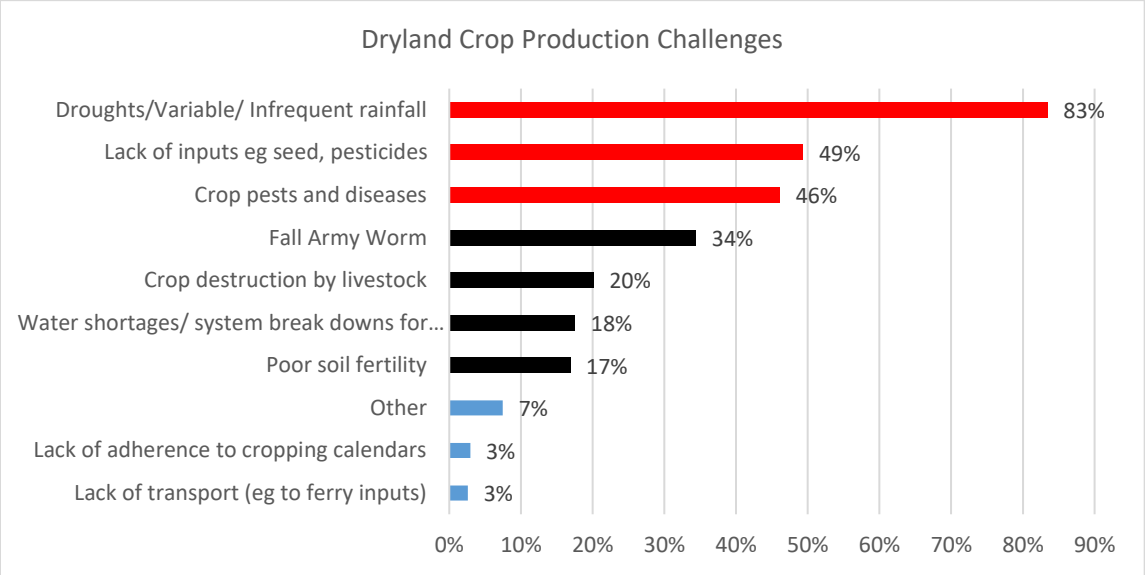

Figure 1: Dryland Crop Production Challenges

Agricultural production systems in the drylands are facing numerous challenges that threaten their resilience and future sustainability. From the findings the major challenge was droughts with 83% where below average rainfall has been received and infrequent rains in the last seasons. Lack of inputs like seed and pesticides was another challenge faced by 49% of the interviewed farmers and crop pests. Forty six percent cited crop pests and diseases and related to this, 34% cited fall army worm. Given the dominant production of maize, this is not an unusual scenario as the crop is easily affected by Fall army worm. Understanding of cropping seasons and adherence to cropping calendars was a strength that can be attributed to the capacity building being offered by the ZRBF project with only 3% indicating that they lack adherence to cropping calendars.

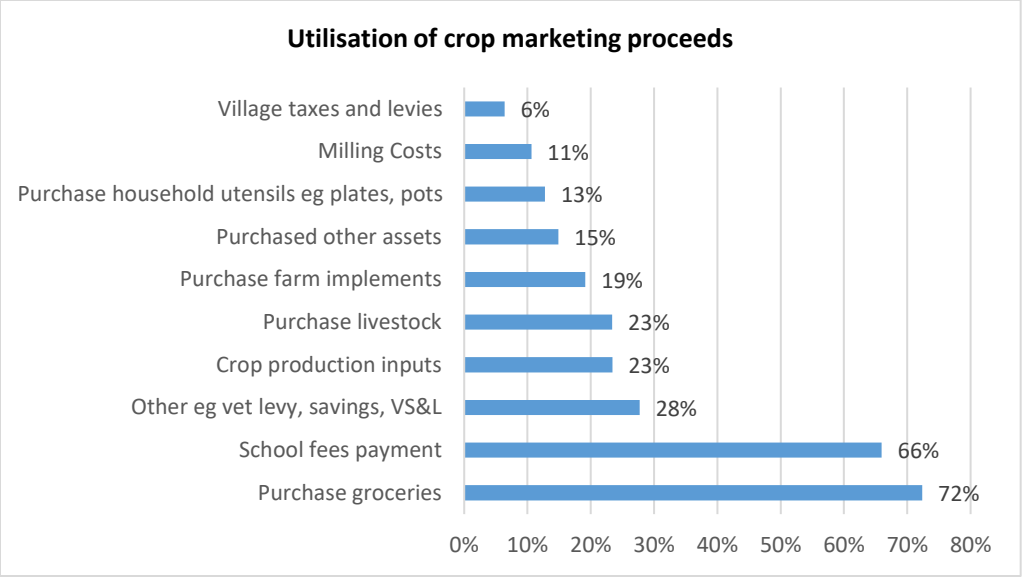

Figure 2: Utilization of Crop Marketing proceeds

The survey further revealed that majority of the crop proceeds were being used to purchase groceries and payment of school fees as shown in figure 2 above with 72% and 66% respectively. Veterinary levies, savings and village savings and lending followed with 28% whilst livestock purchases and crop production inputs was the other dominant use with 23%. 19% of the interviewed farmers indicated that they use their proceeds for purchase of farm implements. The proceeds were also being used to meet expenses like milling costs (11%) and also paying of village taxes and levies (6%). The results from the survey indicate that the crop produce contribute significantly to the livelihoods of the interviewed smallholder farmers. For the irrigation schemes interviewed they was no marketing committee and it was the duty of each farmer to market his/her own produce.

Farmer garden/horticulture and irrigation scheme production

As shown in table 13, 79% of interviewed farmers indicated that they are involved in gardening. The highest proportion was amongst the Chiredzi households (90%) compared to Mberengwa (76%). A similar trend was reported across the different categories. A seemingly higher proportion was amongst the middle aged (81%) compared to the youth and old aged

Table 13: Proportion of farmers with gardens and location (%)

Variable	Overall Sample	District		Intervention			Sex		Age Category		
		Chiredzi	Mberengwa	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Proportion involved in gardening	79	89.8	76.0	79.5	77.5	79.3	78.0	79.4	74.1	81.3	76.1
N	**313**	**59**	**254**	**39**	**129**	**145**	**182**	**131**	**85**	**182**	**46**
Garden Location											
Homestead plot	47.2	62.3	43.0	48.4	54.0	40.9	47.2	47.1	41.3	54.7	25.7
Irrigation scheme	28.9	15.1	32.6	38.7	13.0	40.0	26.1	32.7	20.6	25.7	57.1
Shared communal garden	26.0	30.2	24.9	12.9	31.0	25.2	27.5	24.0	33.3	24.3	20.0
Distant plot	3.7	1.9	4.1	3.2	6.0	1.7	4.9	1.9	3.2	4.1	2.9
Land hired from neighbours	0.8	3.8	0.0	0.0	2.0	0.0	1.4	0.0	3.2	0.0	0.0

Variable	Overall Sample	District		Intervention			Sex		Age Category		
		Chiredzi	Mberengwa	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Other	0.4	0.0	.5	3.2	0.0	0.0	.7	0.0	0.0	.7	0.0
N	**246**	**53**	**193**	**31**	**100**	**115**	**142**	**104**	**63**	**148**	**35**

The survey followed up to assess the location of the garden activities (table 13). Most plots (47%) for the interviewed farmers were located at homestead plots, 30% in irrigation schemes and 26% reported that their plots were located within a shared communal garden. Less than 6% had garden plots located distantly or on hired land. By district, Chiredzi farmers (62.3%) had homestead plots and plots in shared communal gardens (30%) whilst in Mberengwa, the households had plots at homestead level (47%), in irrigation schemes (29%) and in shared communal gardens (25%). By targeted intervention categories, farmers were generally involved in homestead plot garden production. This was the same case by age category, however, a significantly higher proportion of youth had gardens in shared communal gardens (33%) compared to the middle and old aged who had higher participation in irrigation schemes. This is indicative of low youth participation in high production interventions such as irrigation schemes and restrictions to small scale community gardens. Leveraging on the renewed focus on the Youth by the ECRAS project, there is need to intensify youth participation of crop value chain production to build their resilience adaptive capacity.

Table 14: Proportion growing garden crops (%)

Proportion growing crop	Overall Sample	District		Intervention			Sex		Age Category		
		Chiredzi	Mberengwa	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Sweet Potatoes	11	32.1	5.2	6.5	17.0	7.0	10.6	11.5	11.1	12.8	2.9
Tomatoes	90	96.2	88.1	93.5	92.0	87.0	90.1	89.4	87.3	91.2	88.6
Cabbage	19	30.2	15.5	19.4	18.0	19.1	12.0	27.9	11.1	19.6	28.6
Butternut	10	11.3	9.8	19.4	7.0	10.4	12.0	7.7	6.3	12.8	5.7
Onion	60	81.1	53.9	54.8	68.0	53.9	59.9	59.6	65.1	58.8	54.3
Leafy Vegetables	99	96.2	99.5	100.0	98.0	99.1	100.0	97.1	100.0	98.0	100.0
Carrot	12	26.4	7.8	12.9	14.0	9.6	11.3	12.5	17.5	11.5	2.9
Irish Potatoes	1	1.9	.5	3.2	1.0	0.0	0.0	1.9	0.0	.7	2.9
Okra	11	41.5	2.1	0.0	21.0	4.3	11.3	9.6	9.5	12.2	5.7
Sugar bean	16	20.8	14.5	22.6	20.0	10.4	17.6	13.5	12.7	16.2	20.0
Maize	17	28.3	14.5	29.0	17.0	14.8	19.7	14.4	14.3	18.2	20.0
Small grains	3	7.5	1.6	6.5	5.0	0.0	2.8	2.9	1.6	4.1	0.0
N	**246**	**53**	**193**	**31**	**100**	**115**	**142**	**104**	**63**	**148**	**35**

From the survey it was noted that 90% of the interviewed farmers were growing tomatoes and 99% were growing leafy vegetables (table 14). Chiredzi had the highest proportion of 96% for both leafy vegetables and tomatoes compared to 88% for tomatoes in Mberengwa. Onion was the third most grown crop as reported by 60% of the households in Chiredzi (81%) and Mberengwa 54%. Nevertheless, there is low production of other nutritional crops such as carrots, sugar beans and Irish potatoes in both districts. As a result of lack of inputs, limited access to output markets and lack of knowledge on production. There is therefore an opportunity to promote nutrition sensitive garden/ horticultural production through trainings and start up investments in inputs for the gardens to be established by the project as well as the already existing gardens established by the ECRAS and ECRIMS Projects.

Table 15: Average crop production by type

Average crop production by type	Overall Sample	District Name		Intervention			Sex		Age Category		
		Chiredzi	Mberengwa	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Sweet Potatoes (kg)	59.5	35.1	84.0	65.0	43.4	71.1	60.1	44.6	62.1	49.5	60.0

Tomatoes (kg)	255.6	95.5	415.6	319.2	80.4	588.5	488.0	140.9	184.3	465.0	96.1
Cabbage (kg)	84.2	36.3	132.2	33.2	45.6	160.3	41.5	132.4	43.7	34.0	325.4
Butternut (kg)	469.6	514.2	425.1	1199.2	23.6	316.8	37.1	1316.5	25.0	421.7	1525.0
Onions(kg)	34.5	24.0	45.1	112.6	36.8	21.0	41.5	35.3	25.3	48.4	24.9
Leafy vegetables (bundles)	114.1	53.7	174.5	195.6	75.3	200.1	169.2	121.0	190.2	76.4	95.2
Carrot (kg)	27.0	21.0	32.9	60.0	26.4	16.2	16.3	40.5	21.0	32.2	10.0
Irish Potatoes (kg)	60.0	20.0	100.0	100.0	20.0	0.0	0.0	60.0	0.0	20.0	100.0
Okra (kg)	17.1	16.7	17.5		19.4	5.8	19.2	13.0	25.8	15.1	5.0
Sugar bean (kg)	71.6	60.4	82.9	263.6	20.6	60.8	72.0	84.6	49.6	98.5	32.1
Small Grain (kg)	4.4	8.2	.5	2.1	4.5	0.0	.6	6.4	0.0	4.4	0.0
N	**246**	**53**	**193**	**31**	**100**	**115**	**142**	**104**	**63**	**148**	**35**

Overall, garden and horticultural production across most crops is higher amongst farmers from Mberengwa compared to Chiredzi. Annual average production of 257kg of tomatoes was reported overall, with Mberengwa having the highest average production of 416kg compared to 96kg for Chiredzi (table 15). Production was higher amongst the farmers targeted for water harvesting (589kg) and small weir (319kg). Despite the low proportion of farmers producing butternut, average production was high at 470kg, indicating prospects for upscaling production for both consumption and the local market. Average production is low for some crops indicating the need for uniform production which is established through trainings and subsequent development of production plans.

Table 16: Utilization of garden crops produced and main source of water

Utilisation of garden crops produced	**Overall Sample**	**District Name**		**Intervention**			**Sex**		**Age Category**		
		Chiredzi	**Mberengwa**	**Small Weir & Garden**	**Solar Borehole & Garden**	**Water harvesting**	**Female**	**Male**	**Youth**	**Middle Aged**	**Old Aged**
Household Consumption and selling	35	49.1	31.6	39.4	29.8	58.1	36.0	28.7	31.7	37.8	31.4
Household consumption	62	50.9	65.3	59.2	66.3	35.5	62.0	69.6	66.7	60.1	62.9
Selling	2	0.0	3.1	1.4	3.8	6.5	2.0	1.7	1.6	2.0	5.7
Main source of water for garden/ irrigation activities:											
Surface water eg river	48	3.8	60.1	50.7	44.2	80.6	35.0	50.4	52.4	42.6	62.9
Tube well/borehole	26	32.1	23.8	21.1	31.7	12.9	27.0	27.8	22.2	27.7	22.9
Unprotected well	9	28.3	3.6	9.9	7.7	0.0	12.0	8.7	6.3	10.1	8.6
Protected well	7	28.3	1.0	6.3	7.7	0.0	12.0	4.3	6.3	8.8	0.0
Unprotected spring	3	1.9	3.6	4.9	1.0	3.2	4.0	2.6	1.6	4.1	2.9
Sand abstraction	3	0.0	3.6	4.2	1.0	0.0	5.0	1.7	3.2	3.4	0.0
Other eg piped water, solar borehole	4	6	4	3	7	3	5	4	8	3	3
N	**246**	**53**	**193**	**31**	**100**	**115**	**142**	**104**	**63**	**148**	**35**

Sixty-two percent of the interviewed households were utilizing crops produced for household consumption (51% in Chiredzi and 65% in Mwenezi). About 35% were consuming and selling their produce whilst only 2% were only selling their produce. Most gardens in the 2 districts are small scale and have the objective of mainly addressing nutritional needs at household level hence high proportion consuming their produce at household level. In terms of water source, 48% of the participants involved in garden/ irrigation activities use surface water from rivers, 26% from tube wells or boreholes whilst other households' wells. Mberengwa households mainly rely on surface sources (60%) whilst Chiredzi households mainly use boreholes (32%), protected (28%) and unprotected deep wells (28%). This

highlights that gardens generally have different sources of water and with necessary upgrades, these can sustain farmer livelihoods through support for year-round production

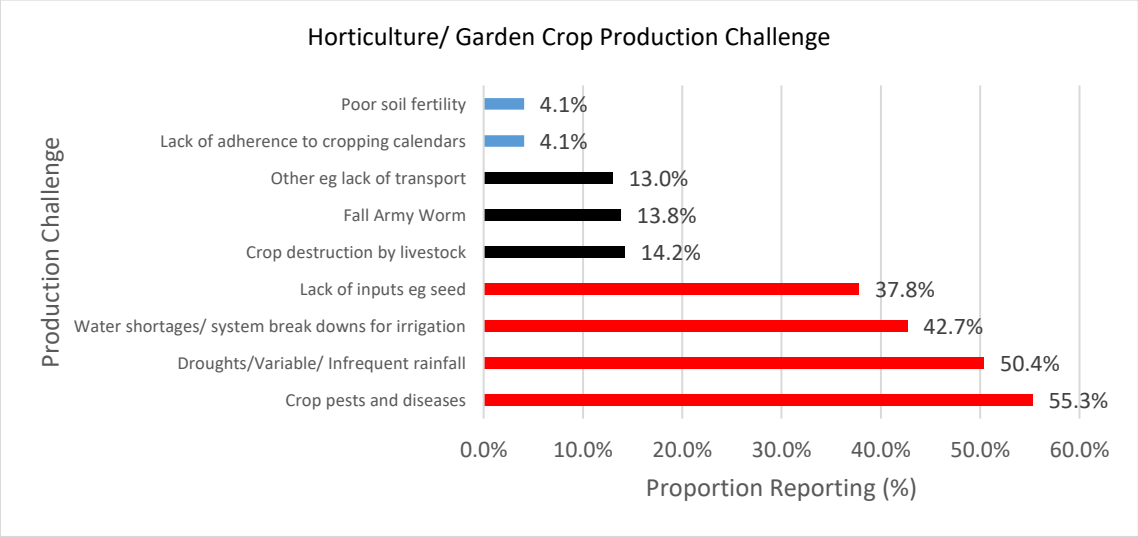

Figure 3: Horticulture/ Garden Crop production challenges (n=246, multiple responses are possible)

Given the thrust of the project of improving farmers resilience through year-round crop production, the survey followed up on the challenges farmers face in their production. The most reported challenge was crop pests and diseases (55,3%) followed by droughts or variable rainfall (50.4%), water shortages and system breakdowns (43%) as well as the lack of inputs (38%)- figure 3. Other challenges faced include crop destruction by livestock, fall army worm and lack of adherence to crop calendars. There is a need for coordinated efforts to build farmer capacity in garden management especially for challenges such as crop pests and diseases. This is through trainings and strengthening access to input and chemical suppliers. Revolving funds should be set up at all community level irrigation schemes and gardens so that farmers have funds for repair of water sources during break downs and procurement of inputs such as seeds.

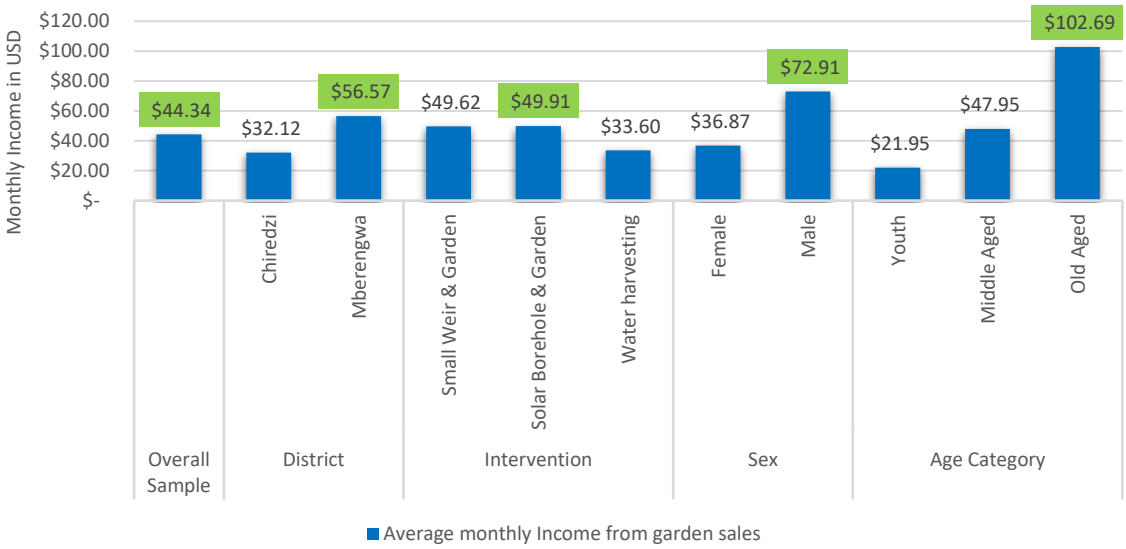

Figure 4: Average Income from Garden crop sales (n=93)

The assessment inquired on the average amount realized from garden crop production per month over the last 3 years. The amounts were captured in various currencies and converted to US dollars by the enumerators during field data collection. As shown in figure 4, the overall average monthly income was $44.34 for the whole sample, with Mberengwa having the highest average monthly income of $56.57 compared to Chiredzi which had an average of $32.12. By target intervention solar borehole beneficiaries had the highest monthly average of $49.91 followed by small weir beneficiaries with an average income of $49.62. Male respondents indicated that their monthly income was high with an average of$72.91 compared to female monthly income which was almost half ($36.87).By age category, the old aged had the highest average monthly income of $102.69 followed by the middle aged who had an average of $47.95 and on the contrary the youths had the lowest average monthly income of $21.95. Average income of $56.57 by Mberengwa beneficiaries constitutes 57% of the average household income by ZRBF-ECRIMS participants in OMS 2 whilst the $32.12 for Chiredzi constitutes 21.5% of the average household income by ZRBF-ECRAS participants (UNDP, 2019). This means that for Mberengwa, garden production is a significant livelihood activity at household level compared to Chiredzi. Layering production of garden crops should be encouraged in-order to smoothen income at household level in line with absorptive and adaptive capacities for resilience building. Cash disposal to purchase food is a first line response to shocks and stresses such as drought whilst integration of garden activities in livelihoods is necessary for adaptation to climate shocks and stresses.

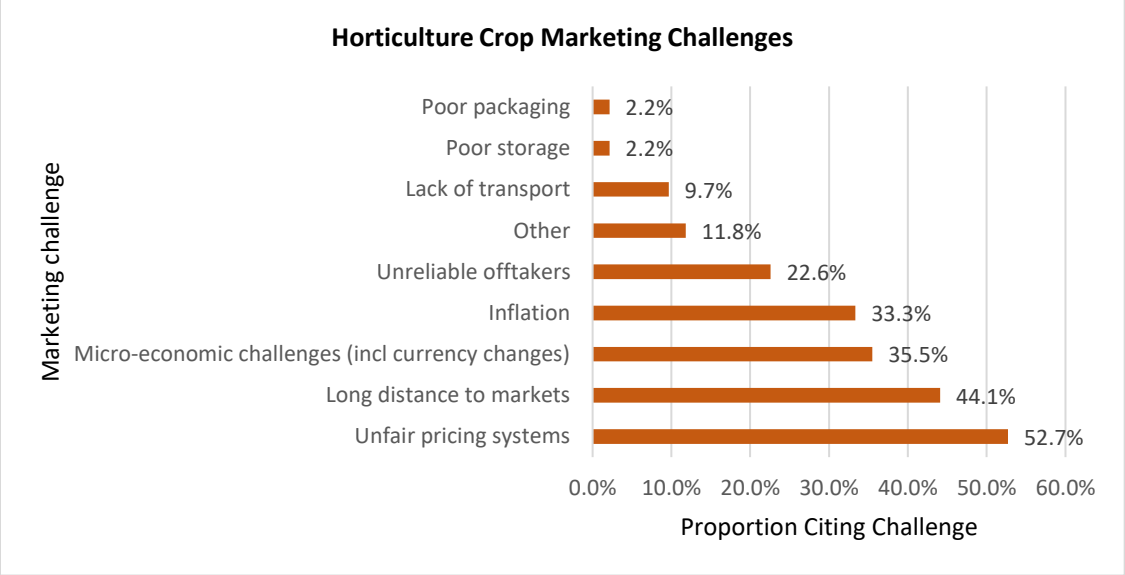

Figure 5: Horticultural crop marketing challenge (n=93, multiple responses possible)

Despite the significant income from horticulture/ garden production, farmers face marketing challenges. From the analysis 53% of the interviewed farmers cited that they experience unfair pricing systems, 44% cited long distances to markets and 36% cited the micro-economic challenges which included currency changes. Zimbabwe has been experiencing hyperinflation and this has also been cited by 33% of the interviewed farmers as a challenge (figure 5). The inflation not only has a negative impact to the economy but also to the individuals and smallholder farmer as it erodes the value of farmers' investments in and proceeds from production. A significant 23% cited the challenge of unreliable off takers for their crop produce whilst 10% cited challenges of transport to take their crops to the market. Addressing such

systemic challenges is critical in creating an enabling environment for farmer resilience building, contributing to their adaptive capacity.

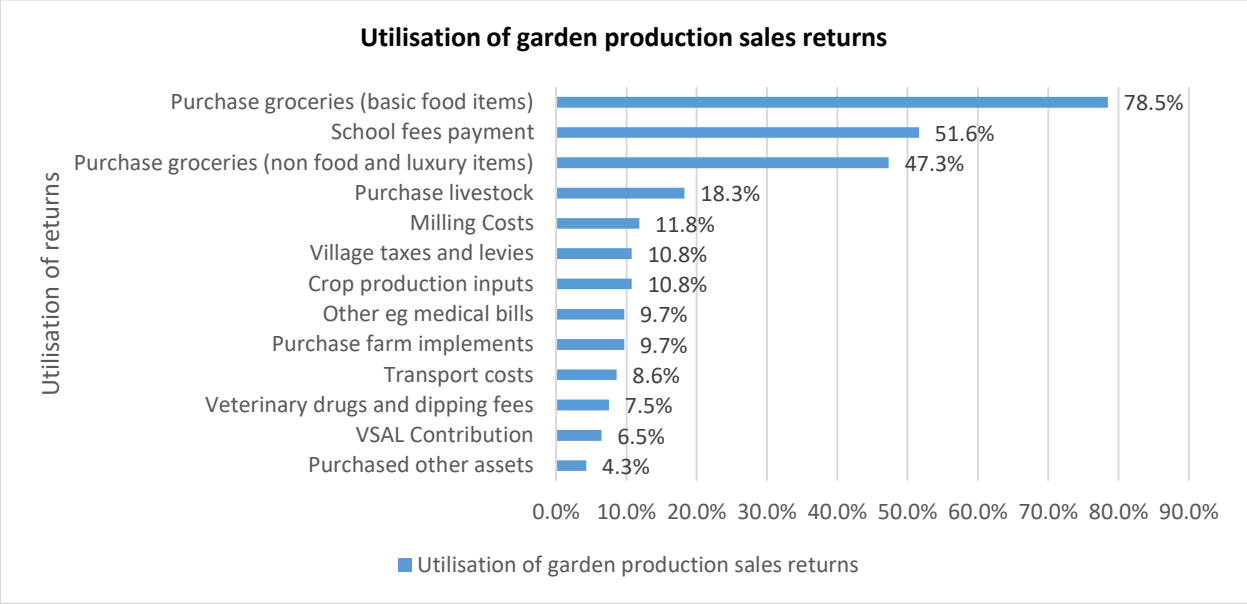

Figure 6: Utilization of Garden/ horticultural crop sales returns (n=93, multiple responses possible)

The bulk of garden production returns (79%) were found to be utilized on purchase of groceries which include basic food items. About 47% of the sales returns were used to purchase non-food and luxury items. From the study it was also noted that the garden production returns were also being used for school fees payment (52%). The results show that the garden/horticulture crops have a significant contribution to the livelihoods of the targeted communities and hence there is need to diversify and increase production for the smallholder farmers. The proceeds according to the findings were also being used on purchase of livestock (18% and meeting essential costs like milling costs (12%). As highlighted above, there is need to increase the scope of garden production into market linked horticultural production to further increase household income. Farming as a business (FAAB) training is thus crucial for graduation of farmers from subsistence to market producers. According to the focus group discussions gardening produces are seasonal and depends on the availability of water. High productivity is seen when there is adequate water utilized through conveyance systems that are not manual.

Livestock ownership by households

Livestock are important assets for farmers and are crucial for absorptive capacity building. Harnessing opportunities that emerge out of livestock ownership such as value chain participation is important for them to make decisions and changes to their livelihoods for adaptive capacity building. The assessment therefore investigated on livestock ownership amongst the farmers.

Table 17: Cattle Ownership by Farmer Households

Variable	Overall Sample	District		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Proportion owning Cattle	71%	73.4%	69.9%	71.4%	69.2%	80.6%	62.1%	66.0%	77.0%	59.6%	72.6%	82.4%
Average Cattle Ownership	7	8	5	5	5	6	6	5	6	6	6	6

Variable	Overall Sample	District		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
N	**348**	**79**	**269**	**35**	**39**	**129**	**145**	**200**	**148**	**89**	**208**	**51**
Average Ownership by class												
Oxen	2	2	1	1	2	2	2	1	2	2	1	2
Cows	2	3	2	2	2	2	2	2	2	2	2	2
Heifers	1	1	1	1	1	1	1	1	1	1	1	1
Steers	1	1	0	0	0	0	1	0	0	0	1	1
Bulls	0	1	0	0	0	0	0	0	0	0	0	0
Calves	1	1	1	1	0	1	1	1	1	1	1	1
N	**246**	**58**	**188**	**25**	**27**	**104**	**90**	**132**	**114**	**53**	**151**	**42**

Cattle in Zimbabwe represent wealth status of households and represents household ability to produce food as they are source of income through sales, draught power to work in the fields, paying lobola, and in some instances transport of goods. Generally, cattle ownership is high amongst the targeted beneficiaries with 71% the Chiredzi (73.4%) and Mberengwa (69.9%) beneficiaries owning cattle (table 17). Ownership was higher amongst the solar borehole (80.6%), male (77%) and old aged (82.4%) beneficiaries when compared to other classes within their categories. It should be noted that despite being lower than that on men, ownership of cattle by women is significantly higher at 66% indicating greater control over productive livestock previously owned by men. The survey further classified the total cattle per household interviewed and showed that on average each household owned 7 cattle being 2 oxen, 2 cows, a heifer and a steer and a calf (table 17).

Table 18: Average Poultry Ownership by households

Average Poultry Ownership by class	Overall Sample	District		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Indigenous Chickens	12.0	10.5	13.4	9.2	18.8	13.9	11.1	11.2	14.9	12.4	13.4	10.7
Broilers/Layer	1.1	.3	2.0	0.0	4.5	.2	2.5	.7	2.8	2.0	1.1	3.0
Turkeys	0.6	.2	.9	.5	.4	.9	.7	.4	1.1	.4	.7	1.4
Ducks	0.5	.8	.1	1.3	.1	.2	.2	.3	.3	.3	.4	.1
Guinea Fowl	1.0	1.5	.4	.5	.1	1.1	.4	.6	.8	.2	.9	.5
Pigeons	0.6	.9	.2	.4	0.0	.7	.1	.4	.3	.2	.5	.1

In terms of poultry ownership, every household had some type of poultry including indigenous chickens, Broilers/layers, turkeys, guinea fowl and pigeons (table 18). From the overall sample an average of 12 indigenous chickens were owned by farmers across both districts. Mberengwa had the farmers with an average ownership of 13 indigenous chickens which was slightly higher than for Chiredzi which had an average of 11. Male headed households had the highest number of chickens with an average of 15 compared to 11 for female. The middle-aged category had the highest ownership indigenous chickens with an average of 13 whilst the old aged had the least. The results indicate that the old aged owns more cattle as compared to the middle aged who owned more poultry.

Table 19: Average ownership of other livestock classes

Other livestock - average ownership	Overall Sample	District		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Goats	5.0	6.9	3.2	3.6	4.7	4.6	3.4	3.9	4.2	3.8	4.2	3.9
Sheep	0.7	1.3	0.1	0.1	0.0	1.0	0.3	0.3	0.4	0.6	0.3	0.1
Pigs	0.3	0.5	0.1	0.4	0.0	0.2	0.1	0.1	0.3	0.2	0.2	0.1
Donkeys	0.7	0.9	0.4	0.4	0.4	0.7	0.5	0.4	0.7	0.4	0.7	0.4
Rabbits	0.3	0.1	0.5	0.8	0.7	0.1	0.5	0.3	0.6	0.2	0.4	0.8

The data shows that goats were one class of livestock which was commonly being reared in the two districts with an average ownership of five (5). Goats in Zimbabwe are regarded as important livestock as they save token of appreciation and source of protein. Currently with the climate changing scenario goat have proved to have bigger survival chances as it is both a browser and a grazer. Its fertility proficiency in kidding gives households in these two districts access to household income source after selling and source of meat for household thus improving household nutrition. Chiredzi had farmers with a higher number of goats' ownership with an average of (seven) 7 compared to (three) 3 for Mberengwa. Male had the highest ownership of goats with an average of four (4) whilst the middle aged constituted the highest number of goats' ownership. Livestock are crucial in farmer absorption capacity to both covariate shocks (eg drought) and idiosyncratic shocks (eg ill health of family members) as these can be easily disposed. Livestock can also multiply hence farmers can adapt to changing conditions through value chain participation.

Sources of income

In measuring the economic well-being of targeted beneficiaries, households' sources of income were used. The assessment went on to investigate income patterns for the targeted beneficiaries. Table 20 shows the sources of household income of the respondents with casual labour, vegetable/ fruit sales, remittances being the top sources of income.

Table 20: Household Sources of Income (%)- multiple responses possible

Income Source	Overall Sample	District		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Casual Agric Labour	34	60.8	26.8	51.4	33.3	36.4	29.0	32.0	37.8	27.0	38.0	33.3
Casual Non-Agric Labour	21	7.6	25.3	17.1	15.4	18.6	26.2	23.0	18.9	18.0	23.1	19.6
Remittances	21	7.6	24.5	8.6	35.9	24.8	15.9	26.5	12.8	20.2	17.8	33.3
Veg/Fruit Sales	28	40.5	23.8	45.7	38.5	26.4	21.4	32.5	20.9	18.0	35.6	11.8
Livestock Sales	18	35.4	12.6	20.0	23.1	20.9	13.1	16.5	19.6	16.9	16.8	23.5
Salary/Pension	5	5.1	4.8	5.7	0.0	8.5	2.8	2.5	8.1	4.5	4.8	5.9
Crop Sales	11	16.5	10.0	34.3	5.1	10.9	8.3	11.0	12.2	11.2	9.1	21.6
Informal Mining	9	0.0	12.3	2.9	2.6	8.5	13.8	8.0	11.5	18.0	7.2	3.9
Skilled trade	6	7.6	5.9	17.1	0.0	5.4	6.2	5.0	8.1	5.6	6.7	5.9
Petty Trade	20	19.0	19.7	17.1	38.5	17.1	17.2	25.5	11.5	25.8	20.2	5.9
Other	13	5.1	14.9	2.9	5.1	13.2	16.6	12.5	12.8	19.1	10.6	9.8
N	**348**	**79**	**269**	**35**	**39**	**129**	**145**	**200**	**148**	**89**	**208**	**51**

Generally, the proportion of respondents who reported different sources of income were very low. The findings from the study highlighted that most households derive their income from agriculture, it accounted for 34% for casual agriculture labor whilst vegetable and fruit sales contributed 28% for the overall sample (table 21). Remittances alone contributed a substantial share of 21% as well as casual non-agriculture labor and petty trading which contributed 20% and constitute an important source of income for most households interviewed. By district, Chiredzi households largely rely on casual labour (61%), vegetable and fruit sales (40.5%) and livestock sales (35,4%) For Mberengwa there was a consistency on proportions of income sources with casual agriculture labor providing a slightly higher proportion of 27%, casual non-agriculture labor 25%, remittances 24% as well as vegetable and fruit sales which also contributed 24%. Male headed households had the highest proportion on casual agriculture labor (38%) compared to female headed households which had 32%. Middle aged category were the ones who noted a higher proportion of casual agriculture labor as an income source (38%). A higher proportion of youth (26%) indicated that skilled trade was an income source whilst the old aged had the least proportion (6%).

The results show that the youth to some extent are equipped with knowledge to do skilled trade and there is youth inclusion in development issues.

Table 21: Households' most important source of income (%)

Most Important Income Source	Overall Sample	District		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Veg/Fruit Sales	16	15.2	16.0	17.1	30.8	8.5	17.9	18.0	12.8	3.4	21.2	15.7
Casual Agric Labour	16	29.1	11.5	14.3	12.8	19.4	13.1	14.0	17.6	12.4	18.3	9.8
Casual Non-Agric Labour	12	3.8	14.1	11.4	5.1	6.2	18.6	11.5	12.2	11.2	13.0	7.8
Remittances	11	2.5	14.1	5.7	17.9	15.5	7.6	14.0	8.1	11.2	8.7	23.5
Livestock Sales	9	19.0	6.3	5.7	10.3	13.2	6.2	7.5	11.5	7.9	8.7	13.7
Other, specify	8	0.0	10.0	0.0	2.6	7.8	11.0	8.5	6.8	14.6	5.3	5.9
Informal Mining	7	0.0	9.7	0.0	2.6	8.5	9.7	7.0	8.1	16.9	4.3	3.9
Crop Sales	7	12.7	4.8	20.0	2.6	4.7	6.2	7.0	6.1	6.7	5.3	11.8
Skilled trade	5	7.6	4.8	20.0	0.0	4.7	4.1	4.0	7.4	2.2	7.2	3.9
Petty Trade	5	7.6	4.5	2.9	15.4	4.7	3.4	7.0	2.7	9.0	4.8	0.0
Salary/Pension	4	2.5	4.1	2.9	0.0	7.0	2.1	1.5	6.8	4.5	3.4	3.9
N	**348**	**79**	**269**	**35**	**39**	**129**	**145**	**200**	**148**	**89**	**208**	**51**

Respondents were asked cite their most important sources of income (table 21). Overall, vegetable sales and casual agricultural labour had the highest proportions of 16% respectively, whilst 12% reported casual non-agriculture labour and 11% reported remittances. Chiredzi had the highest proportion of households who mentioned casual agriculture labor as their important source of income with 29% followed by livestock sales (19%). For Mberengwa vegetable/fruit sales was reported as the most important source of income (16%), followed by casual agriculture labour and remittances (14%). For female headed households, 18% indicated that their most important source of income was vegetable and fruit sales. For male headed households 18% of the interviewed households noted that their most important source of income was casual agriculture labor. The results indicate that men and women and youths have diversified income opportunities and probably preference that ensures they have disposable income that ensures they are food secure. Food insecurity becomes severe when households have low income diversification.

Farmers and the market (VSLAs, Social safety nets)

An understanding of financial inclusion by district, targeted intervention, sex and age categories is of relevance with regards to spatial and differential targeting and programming. The majority (82%) of interviewed households indicated that they were not part of any Village, savings and lending and only 18% were part of VS and L members (table 22). Chiredzi had the highest proportion of 27% of VS&L membership whilst only 16% of respondents in Mberengwa indicated that they were members. By intervention irrigation scheme participants had the highest proportion (40%) compared to beneficiaries targeted by other interventions indicating previous reach by the ZRBF and other livelihoods programs hence the higher exposure.

Table 22: Farmer Household VS&L Participation (%)

Variable	Overall Sample	District		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
VS&L Membership	18	27	16	40	26	14	15	24	11	11	23	12
Non VS&L Membership	82	73	84	60	74	86	85	77	89	89	77	88
Reason for not being in VS&L												
No surplus income	36	28	38	19	34	36	39	32	40	34	34	47

No perceived any benefit	1	3	1	0	0	2	2	0	3	0	3	0
Lack of knowledge	8	10	8	10	0	13	6	6	11	6	9	9
Lack of money for contribution	41	47	39	52	52	37	40	50	30	52	40	24
Loan repayment is expensive	1	0	1	0	0	2	0	1	1	0	1	2
No interest	4	7	4	14	3	5	2	4	5	4	4	4
Not interested	4	2	5	5	7	4	4	3	5	0	5	9
Not VS&L in ward	1	2	1	0	3	1	1	1	1	1	1	0
Other, specify	3	0	4	0	0	1	7	2	5	1	4	4
N	**348**	**79**	**269**	**35**	**39**	**129**	**145**	**200**	**148**	**89**	**208**	**51**

The survey followed up on the reasons for not participating in VS&L. The major reasons for not participating in VS&L were lack of money for contribution (41%) and lack of surplus from production activities (36%). Other reasons include lack of interests and lack of knowledge. Given the low participation in VS&L, there is a need for deliberate layering of VS&L for the targeted interventions so that community members financial inclusion through low cost credit access is improved as well as their productive capacity through asset acquisition which often comes through VS&L investments. VS&L will also contribute towards social capital through bridging hence social cohesion.

Table 23: Proportion of Households with other means of saving besides VS&L and Savings type (%)

Variable	Overall Sample	District		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Households with Other Means of saving	21	41.8	14.9	31.4	20.5	21.7	17.9	24.0	16.9	21.3	23.6	9.8
N	**348**	**79**	**269**	**35**	**39**	**129**	**145**	**200**	**148**	**89**	**208**	**51**
Form of other savings												
Savings Bank	12	21.2	5.0	36.4	0.0	14.3	3.8	8.3	20.0	15.8	10.2	20.0
Mobile Money	23	48.5	2.5	36.4	12.5	32.1	11.5	20.8	28.0	21.1	22.4	40.0
Stokvel	7	3.0	10.0	0.0	12.5	0.0	15.4	8.3	4.0	0.0	10.2	0.0
Home savings	77	63.6	87.5	63.6	87.5	71.4	84.6	83.3	64.0	84.2	75.5	60.0
Other	8	9.1	7.5	9.1	12.5	10.7	3.8	6.3	12.0	10.5	6.1	20.0
N	**73**	**33**	**40**	**11**	**8**	**28**	**26**	**48**	**25**	**19**	**49**	**5**

The survey further inquired on households with other means of savings besides VS&L disaggregated by savings type as shown in table 23. The survey revealed that 21% from the overall sample indicated that they have other means of savings besides VS&L with Chiredzi having the highest proportion of 42% compared to 15% for Mberengwa. Of these the irrigation scheme participants had the highest proportion (31%) of respondents who acknowledged having other means of savings besides VS&L and the majority (24%) were female compared to 17% for male respondents. The middle aged from the study and the highest proportion of those who indicated that they have other means of savings besides VS&L. The other forms of savings included home savings with 77% of respondents from the overall sample indicating that it is one of their savings means and Mberengwa having the highest proportion of 88% compared to 64% for Chiredzi. Chiredzi also had a higher proportion of respondents who also indicated that they save through mobile money with a proportion of 49%. The highest proportion of savings in other forms was found to be done by irrigation scheme participants where 64% indicated home savings, 36% indicated bank savings and mobile money savings. These results indicate that the targeted communities have a gap in saving methodology that is more sustainable and gives value to their savings given the hyperinflation

and economic challenges the country is facing. The highest proportion of those who were practicing home savings were female with a proportion of 83% compared to 64% for male. The youth constituted the highest proportion of respondents who were doing home savings with 84% followed by the middle-aged category with 76% whilst for the old aged the proportion was 60%.

Table 24: Household Life Assurance Membership and service provider (%)

Variable	Overall Sample	District		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Proportion with Life assurance	15	3.8	17.8	17.1	7.7	16.3	14.5	15.0	14.2	9.0	15.9	19.6
N	**348**	**79**	**269**	**35**	**39**	**129**	**145**	**200**	**148**	**89**	**208**	**51**
Life Assurance Service Provider												
Doves	16	0.0	16.7	0.0	33.3	23.8	9.5	10.0	23.8	0.0	15.2	30.0
Ecosure	4	0.0	4.2	0.0	0.0	0.0	9.5	0.0	9.5	0.0	6.1	0.0
First Mutual	6	0.0	6.3	16.7	0.0	4.8	4.8	0.0	14.3	12.5	6.1	0.0
Moonlight	4	0.0	4.2	0.0	33.3	0.0	4.8	3.3	4.8	0.0	6.1	0.0
Nyaradzo	53	66.7	50.0	83.3	33.3	57.1	38.1	63.3	33.3	50.0	48.5	60.0
Other	6	33.3	6.3	0.0	0.0	4.8	14.3	10.0	4.8	25.0	6.1	0.0
Yabathandana	12	0.0	12.5	0.0	0.0	9.5	19.0	13.3	9.5	12.5	12.1	10.0
N	**51**	**3**	**48**	**6**	**3**	**21**	**21**	**30**	**21**	**8**	**33**	**10**

Fifteen percent of the overall sample acknowledged that they have life assurance, Mberengwa having the highest proportion of 18% compared to Chiredzi which only had 4% of respondents acknowledging having the life assurance (table 24). Participants from the irrigation scheme rehabilitation had the highest proportion of respondents with life assurance with a proportion of 17% and the female having a higher proportion of 15% compared to 14% for male. The old aged constituted the higher proportion compared to other age category having a higher proportion of 20%.

The most common life assurance from the study was Nyaradzo which constituted 53% overall, 67% in Chiredzi and 50% in Mberengwa. Other life assurance providers utilized by communities were Doves, Moonlight, *Yabathandana* and First Mutual. Whilst farmers investment in life assurance remains low even across the mainstream ECRAS and ECRIMS projects, life assurance remains a viable social safety net as it reduces possibilities of cash, livestock or asset disposal in the event of death of a family member. Efforts should be made to strengthen linkages with life assurance service providers and layer the intervention on VS&L.

Farming Implements and Communication Assets ownership

For the communities in both Chiredzi and Mberengwa agriculture is the most important livelihood option but the interviewed communities have limited ownership of important farm implements. Table 25 below shows the ownership of various assets by households.

Table 25: Farm Implements and Communication Assets ownership

Average Ownership by asset type	Overall Sample	District		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Ploughs	0.9	1.0	.7	.8	.8	.9	.7	.7	.9	.6	.9	1.0
Scotch carts	0.5	.5	.4	.5	.3	.4	.4	.4	.5	.2	.4	.6
Wheel barrows	0.5	.5	.6	.5	.7	.5	.6	.5	.7	.5	.5	.7
Hoes	4.6	4.5	4.6	5.1	4.8	4.6	4.4	4.3	5.0	3.9	4.8	5.0

Cultivator	0.1	.1	.2	.3	.2	.1	.2	.1	.3	.1	.2	.4
Harrow	0.2	.2	.2	.2	.2	.1	.2	.1	.3	.2	.2	.3
Television	0.2	.2	.2	.3	.2	.2	.2	.2	.2	.2	.2	.1
Radios	0.5	.5	.5	.7	.4	.4	.5	.4	.5	.6	.4	.5
Cellphones	2	1	2	2	2	1	2	1	2	2	1	2
Water pumps	0.0	.0	.0	.1	.0	.0	.0	.0	.0	.0	.0	0.0
Solar panels	1	1	1	1	1	1	1	1	1	1	1	1
Bicycles	0.4	.5	.4	.5	.5	.3	.4	.4	.4	.3	.4	.3
N	**348**	**79**	**269**	**35**	**39**	**129**	**145**	**200**	**148**	**89**	**208**	**51**

The study revealed that the most commonly owned asset was the hoe (average of 5 per household), followed by the plough with average ownership of 1 per household. No significant differences were observed across all the other categories. The interviewed respondents have access to communication assets (atleast 1 cellphone) across districts, targeted interventions, sex and age category. Similarly, there was average ownership of one (1) solar panel across similar categories. There is low ownership of water pumps by targeted farmers, showing reduced utilization of water resources by farmers. Asset accumulation is a function of productive livelihoods, hence the need to promote diversification of income generation activities by Chiredzi and Mberengwa farmers.

Access to information and utilization

Access to information is important for household and farm level decision making. Decision making maybe for crop, livestock production, farm or non-farm activities. In this baseline study, the respondents were asked whether or not they had access to specific information, utilization and source of information.

Table 26: Proportion of households with access to information by information type (%)

Information Type	Overall Sample	District		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Commodity Prices	57%	58.2%	56.9%	74.3%	56.4%	58.1%	52.4%	56.5%	58.1%	62.9%	56.3%	51.0%
Commodities on demand	50%	59.5%	47.6%	68.6%	51.3%	53.5%	42.8%	49.0%	52.0%	55.1%	51.0%	39.2%
Input prices	52%	68.4%	46.8%	80.0%	53.8%	55.0%	41.4%	48.5%	56.1%	53.9%	51.9%	47.1%
Weather forecasts	68%	69.6%	67.3%	82.9%	76.9%	68.2%	61.4%	62.5%	75.0%	67.4%	67.8%	68.6%
Crop & Livestock Diseases	68%	72.2%	66.9%	91.4%	59.0%	61.2%	71.0%	63.5%	74.3%	66.3%	68.8%	68.6%
Floods	40%	62.0%	33.5%	82.9%	38.5%	35.7%	33.8%	37.5%	43.2%	43.8%	39.9%	33.3%
Water Management	55%	62.0%	52.4%	74.3%	53.8%	45.0%	58.6%	51.0%	59.5%	51.7%	56.3%	52.9%
Veld Fires	32%	41.8%	29.4%	57.1%	38.5%	27.9%	28.3%	27.5%	38.5%	31.5%	33.7%	27.5%
N	**348**	**79**	**269**	**35**	**39**	**129**	**145**	**200**	**148**	**89**	**208**	**51**

Chiredzi and Mberengwa districts overall sample showed that at least 50% of responses acknowledged that they were accessing information on their regular livelihood needs (table 30). A higher proportion of Chiredzi respondents generally had access to information compared to Mberengwa. The most cited information types were on crop and livestock diseases, weather forecasts, input prices, floods and water management (all +60%). For Mberengwa the highest proportion of respondents acknowledged having access to information on weather forecasts (67%) and crop and livestock diseases (67%) as well. . The irrigation scheme, male and youth beneficiaries had more farmers reporting access to information by targeted intervention, sex and age category respectively.

Table 27: Proportion of households who used the information in the last 12 months by information type (%)

Information Type	Overall Sample	District		Intervention				Sex		Age Category		
		Chiredzi	Mberengwa	Irrigation Scheme Rehabilitation	Small Weir & Garden	Solar Borehole & Garden	Water harvesting	Female	Male	Youth	Middle Aged	Old Aged
Commodity Prices	91.5	91.3	91.5	96.2	95.5	90.7	89.5	92.0	90.7	92.9	92.3	84.6
Commodities on demand	92.6	80.9	96.9	91.7	100.0	91.3	91.9	92.9	92.2	91.8	92.5	95.0
Input Prices	88.9	83.3	91.3	92.9	90.5	85.9	90.0	89.7	88.0	83.3	90.7	91.7
Weather forecast	95.8	92.7	96.7	89.7	96.7	97.7	95.5	94.4	97.3	98.3	93.6	100.0
Crop and Livestock disease	93.2	91.2	93.3	100.0	87.0	91.1	93.2	90.6	95.5	93.2	91.6	97.1
Floods	81.3	79.6	82.2	89.7	86.7	67.4	87.8	82.7	79.7	79.5	84.3	70.6
Water Management	84.2	77.6	86.5	96.2	90.5	77.6	83.5	84.3	84.1	80.4	83.8	92.6
Veld fires	77.7	60.6	84.8	85.0	93.3	55.6	87.8	80.0	75.4	78.6	77.1	78.6
N	**199**	**46**	**153**	**26**	**22**	**75**	**76**	**113**	**86**	**56**	**117**	**26**

Table 31 shows the proportion of households who used information received in the last 12 months. Communities showed that they had utilized information they received from their respective sources in the last 12 months. Collected data showed that information on weather forecast (96%) from the overall sample was being utilized widely. This is attributed to the Seasonal Participatory Scenario Planning sessions held annual in both Chiredzi and Mberengwa districts. These have resulted in development of seasonal plans and advisory every season. The trend showed that impact and probability of the subject information had a strong bearing on percentage of utilization. As the two districts are livestock areas, crop and livestock diseases (93%) were seconding weather forecast with the least being veld fires (78%).

Table 28: Sources of information by information type (%)

Source of Information	Type of Information							
	Commodity Prices	Commodities on demand	Input prices	Weather forecasts	Crop & Livestock Diseases	Floods	Water Management	Veld Fires
Agricultural commodity traders	.5	.0	3.9	1.3	1.7		1.6	1.8
Contracting company worker	.5	.6					1.6	
Family/friends	34.7	40.0	29.4	19.9	8.0	20.1	11.6	10.7
Govt Extension officer	3.5	8.0	12.8	26.3	68.4	9.4	56.3	28.6
Market place posters	9.5	3.4	3.9					
Newspaper		.6		.4		.7		
Other	1.5	.6		.4	.4		5.3	1.8
Other Farmers	14.6	15.4	19.4	8.9	10.5	10.8	13.2	17.9
Radio	25.1	22.9	23.3	33.5	8.0	39.6	5.8	25.9
SMS	8.5	6.9	5.0	6.8	2.1	15.8	3.2	12.5
TV	1.5%	1.7%	2.2%	2.1%	.4%	3.6%	1.1%	.9%
N	**199**	**175**	**180**	**236**	**237**	**139**	**190**	**112**

The major sources of information were from friends, radios, other farmers and government extension workers. The source of information depended on the type of information. Respondents showed that they were aware of the market situation regarding price of commodities, demand and inputs prices was largely shared with family and friends with a proportion of 35% for commodity prices, commodities on demand with a proportion of 40%. Livestock and crop diseases and information of veld fires were mostly coming from government extension workers with a proportion of 68% for crop and livestock diseases, while the radio disseminated most (40%) weather forecast information. SMSs showed fair responses across all types of information and this reflected level of cellphone handsets ownership. A few would use agriculture commodity traders, contract company workers as the two-district agriculture productivity is very low hence fewer of these people. Newspapers and TVs were hardly used which may be attributed to

unavailability of electricity in communities to power TVs and limited access to newspapers doubled by literacy levels in the communities of operation.

Food Security and Nutrition

Household Food Consumption Score

The Household Food Consumption Score (FCS) was used in this study as a measure of dietary diversity, food frequency and the relative nutritional importance of the food consumed. This forms the basis for the Average Food based Coping Strategy Index score (FCS) for households in targeted communities. The respondents were asked about frequency of consumption of 10 food groups (in days) over a recall period of the past 7 days. The average FCS was 40.56 which indicates reasonable access to all 10 food groups by households. Chiredzi households have a higher score (42.06) when comparing male and female households. Likewise, irrigation scheme beneficiaries and the old aged have marginally higher food consumption scores of 44.66 and 43.27 respectively (figure 7). This can be attributed to that the households from the category are producing more as shown above on average crop production section.

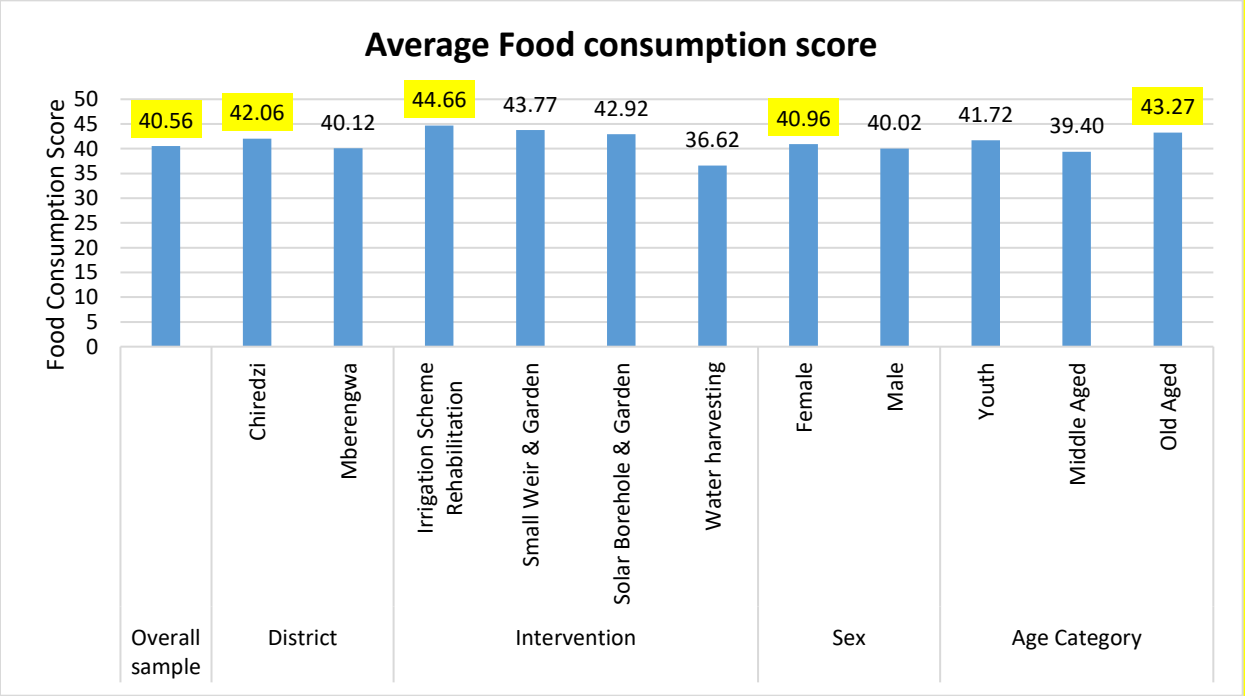

Figure 7: Average Food Consumption Score for Households in Chiredzi and Mberengwa

The scores were further categorized using the ZRBF Indicator Reference Guide, i.e poor, borderline and acceptable food consumption. ***Poor food consumption (FCS = 0 to 21);*** means households are not consuming staples and vegetables every day and never or very seldom consume protein rich food such as meat and dairy. ***Borderline food consumption (FCS = 21.1 to 35)*** means households are consuming staples and vegetables every day, accompanied by oil and pulses a few times a week. ***Acceptable food consumption (FCS = >35)*** means households are consuming staples and vegetables every day, frequently accompanied by oil and pulses and occasionally meat, fish and dairy. On average 58% of the sampled households have an acceptable food consumption score. About 37% % fall within the border line whilst only 6 % have poor food consumption (figure 8). More households in Chiredzi fall within the acceptable category (66%) compared to the 55% in Mberengwa. An analysis of the intervention categories showed

that a higher proportion of the households targeted by solar boreholes and gardens had acceptable food consumption of 70.5% whilst those targeted by water harvesting had largely borderline consumption. Female led households have a higher proportion falling within the acceptable category (59%) and less than 5% within the poor category compared to their male counterparts. By age category, the youth had the highest proportion of households in the acceptable category (65%) whilst the old aged had the least within the poor consumption at 2%.

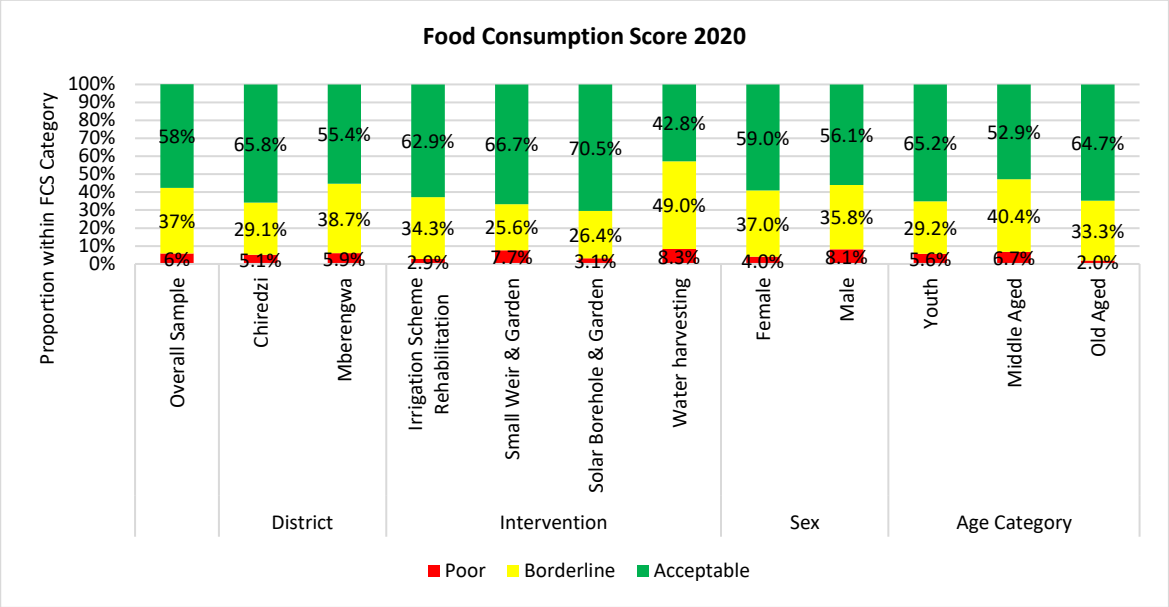

Figure 8: Food Consumption Scores for Chiredzi and Mberengwa

Household Dietary Diversity Score

Household Dietary Diversity Score is a measure of household food access (food consumption) that reflects household access to a variety of foods defined by the number of unique foods consumed by household members over a given period. The assessment sought to provide an estimation of the quality of the diet of households in the 2 operational districts of Chiredzi and Mberengwa by looking at 7 food groups which are: Cereals, roots and tubers, pulses and legumes, vegetables, fruits, meat, fish and eggs, milk and milk products and oils and fats. The average dietary diversity score is 4.62 for households who participated in the questionnaire survey (figure 7). This indicates that households have reasonable access to at least 5 food groups which is important for their absorptive capacity to shocks and stresses. Programming should thus seek to improve access and utilization of protein and vitamin rich foods which households have limited access to.

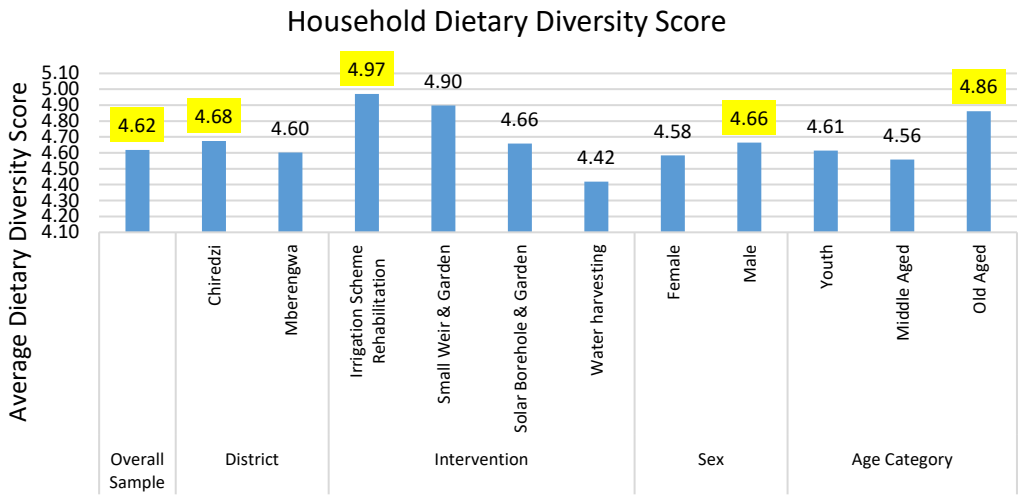

Figure 9: Average Household Dietary Diversity Score

Results in figure 8 indicate that the majority of the Chiredzi and Mberengwa households had low dietary diversity (48%) whilst 45% had medium dietary diversity whilst only 7% had good dietary. The overall sample results were consistent with results of the district. There is a difference by targeted interventions where, irrigation scheme farmer households had a higher proportion falling within the good dietary diversity category (17%) compared to the other intervention categories. However, beneficiaries targeted by the small weir and garden intervention had the highest proportion of households with medium dietary diversity (56%) and lowest within the low dietary diversity (36%). By age category, the middle aged had a higher proportion with low dietary diversity (50.5%) compared to the youth and old aged.

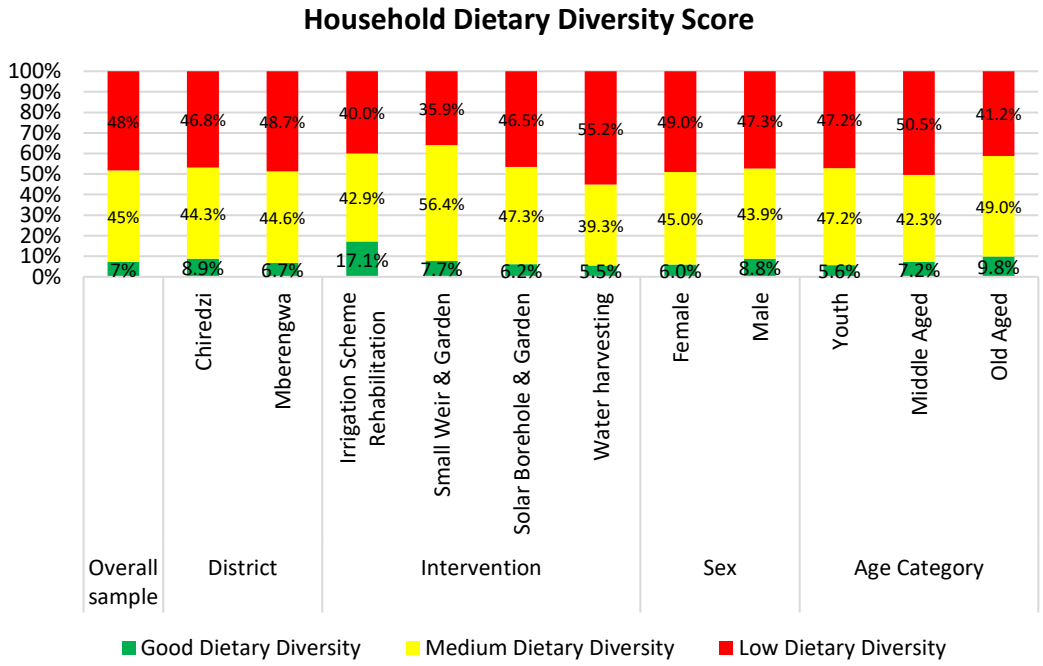

Figure 10: Household Dietary Diversity Score- Chiredzi and Mberengwa District

Governance of irrigation scheme facilities and water points facilities

Operation and maintenance of the irrigation scheme and Borehole water point committees

From the five (5) Focus Group Discussion conducted with the WPC for the boreholes targeted for Solar installation (three in Chiredzi and two in Mberengwa) and two with irrigation committees one in each district, it emerged that committees worked with a number of key stakeholders such as DDF, the MoHCC, the RDCs through councilors, community leaders and AGRITEX. Water point committees generally had knowledge on water point roles and duties. Some of duties mentioned included: spearheading maintenance of the borehole in times of break through partnering with pump minders. These are outlined in box 1. In terms of constitution of the committees, the water point committees had 68% women (74% Chiredzi and 54% Mberengwa). There are more female members (68% female: 32% male) in water point committees because women are the principal users of a water system and as such, they are the first to recognise problems at water points. This is in line with increased access, control and decision making over productive assets linked to resilience by women and youth (ZRBF Gender and Youth Inclusion Strategy, domain 3). Women are less likely to migrate from the villages in search for work as compared to men hence the need to have them in Committees.

Box 1: Management Committee Roles and Responsibilities

Water Point Committee

- ✓ Bringing together and directing water users on water use on proper use of the borehole.
- ✓ Planning to minimize downtime of the borehole and ensure all year time supply of water.
- ✓ Ensuring high level of hygiene at the water point.
- ✓ Mobilize the community on any required task at the water point.
- ✓ Managing all water point issues and mediate with local leadership in problem solving affecting proper functioning of the water point
- ✓ Record keeping on water point management
- ✓ Enforce collection of water point revolving fund for maintenance of the water point.
- ✓ Income generation for water point maintenance and sustainability.

Irrigation Scheme Committee

- ✓ Management of the daily activities of the irrigation scheme
- ✓ Water pumping system maintenance,
- ✓ Collection of irrigation scheme fees (water user fees and revolving funds)
- ✓ Sourcing for commodity loans and markets for commodities produced in the irrigation scheme
- ✓ Management and maintenance of scheme structures (including canals and storehouses.
- ✓ Bring together irrigation scheme members on water use and irrigation scheduling.
- ✓ Conflict resolution
- ✓ Stakeholder co-ordination
- ✓ Record keeping and management
- ✓ Monitor adherence to cropping calendar

On the contrary, irrigation scheme committees were largely constituted by men (80%). Despite women being 57% of the total irrigation scheme targeted beneficiaries in Chiredzi (55%) and Mberengwa (71%), they were not in control of key decision making for their production. Traditionally men have always held positions of influence in key asset management. These can be challenged through gender dialogue platforms which seek to raise awareness on the need to include women in management committees, their role as well as advocate for their inclusion.

In case of a breakdown the borehole committees indicated that it will take them an average of less than 72 hours to have the system restored and for the irrigation scheme the time taken to have the system restored is around a week. This is particularly because for the boreholes they are community based

trained pump minders and for the irrigation they rely on outsourcing expertise who are not residents of the local community. Mobilizing of resources to outsource takes long indicating the need for community-based trouble shooting and basic maintenance.

The survey followed up on how the water point committees were raising funds for operation and maintenance of their water assets. On average each household was contributing US$0.50 /month. The average contribution for Chiredzi households was $0.50 and for Mberengwa was $0.40. Against an average water point: user ratio of 1:100, each WPC was able to raise $10/month. This may however indicate that the community's capacity to meet the maintenance or break down costs is low as the amount generated per month cannot procure components such as leather cups which currently cost $10 each. Asked on how much each WPC had in their revolving fund at the time of data collection, only 3 of the committees had on average $2 and they had last collected the fund 2 months back with some collecting only when there is a problem.

There is therefore a need to strengthen management of water point management committees through training on community based sustainable management of water points. This is critical in improving the governance of these structures. About 66% of the boreholes also indicated that they save their funds in strong foreign currency due to hyperinflation whilst the irrigation committee indicated collecting their funds in local currency. Given that the productive capacity of irrigation schemes will be increased whilst at the boreholes it will be established, there is a need to encourage members to save their revolving funds in stronger currencies which are not easily eroded by exchange rate increases. The revolving fund can be diversified through integration with VS&L or invested into productive livestock so that it's value is preserved.

COVID 19 mitigation measures

Despite the community's knowledge of the COVID 19 pandemic, the communities were reluctant to take any mitigatory measures such as wearing of masks when attending public meetings and washing of hands. About 33% of the interviewed WPC indicated that they had put in place a measure to ensure that people practice social distancing and appointed a member of the committee who ensures people do not crowd at the water source. The committees indicated that they were VHW who were trained on COVID 19 and were ensuring that knowledge on the COVID pandemic is imparted to everyone. A number of participants in the committees also indicated that they were receiving awareness messages on COVID 19 in vernacular from ZRBF. For Chiredzi the communities indicated that they were highly at risk with returnees from the neighboring South Africa who come through unofficial ways and instead of going for quarantine at the center established they choose to go at their homesteads and continue to attend public places and functions with other community members. There was thus a need to continue engaging district task force to strengthen surveillance given the proximity of the district to South Africa.

Conclusion and Recommendations

Conclusion

The study concludes that generally all age groups, that is the youth who are aged 18-35, middle aged 36-65 and the old aged above 65 were targeted by the project. The majority were amongst the middle aged (70% in Chiredzi and 57% in Mberengwa) with the youth following at 25%. This is consistent with ZRBF targeting in the 2 districts where 25% of direct program participants are youth. Given the participation of all targeted age groups, the proposed interventions could thus benefit all community members. About

43% of the respondents were in ZRBF as direct participants which shows complementarity of the projects as was envisioned in the design of the project. Layering of productive water development activities on software activities being implemented by the ZRBF is a key output of the project.

In terms of sources of water for both domestic and productive use, both districts, Chiredzi and Mberengwa receive low annual rainfall and are characterized by high temperatures, prolonged mid-season dry spells which result in far lower water tables. This in turn adversely affects crop, livestock productivity and access to safe drinking water for communities. Households generally have reasonable access to productive water. However, this was from different water sources with the majority being from surface water sources. There is therefore a need to improve these into properly constructed structures that can promote healthy water sharing between livestock and human beings. In terms of domestic water access, boreholes constitute the majority of the sources, followed by surface water sources such as rivers, protected and unprotected wells. Households generally accessed water within reasonable distances of 1km or below which is in line with the sphere standards. The time taken to walk to domestic water sources and time taken queuing was however high hence taking up farmers' productive time. Solarization and water harvesting would thus contribute towards reducing the time taken to access water and improved WASH, making them relevant interventions.

Dryland crop production was found to be a dominant livelihood activity contributing towards household food security. Despite this, the average production of cereal grains was lower amongst the targeted households. On average a household was producing 160kg of maize or sorghum which can sustain a family of 6 for 2 months using a per-capita cereal requirement of 150kg/annum. This indicates a hunger gap of over 7 months before the next season and possibility of resort to negative coping mechanisms such as disposal of productive livestock when shocks such as drought occur. Drought was highlighted as a key production challenge accounting for low dryland crop production in both districts. There is therefore a need for improved access to water for year-round production.

A significant proportion of farmers are involved in garden activities which is indicative of commitment by households towards their food, nutrition and income security. Forty seven percent of these were within their homesteads showing the commitment to nutrition at household level. Garden production was reasonably diversified with crops such as tomatoes, cabbage, green leafy vegetables, onions, butternut, maize and okra. Garden production is a significant livelihood activity at household level given the average monthly income of US$44,00 hence the need to leverage of it for diversification of small-scale farmer livelihoods.

Livestock data from the survey showed that common livestock in both Chiredzi and Mberengwa district included one or all livestock classes such as cattle, goats and indigenous chickens but generally there is a low ownership of livestock like cattle as compared to small livestock like poultry. These livestock require access to all year-round drinking water which is to be satisfied by the establishment and rehabilitation of water harvesting structures with livestock drinking water troughs to be constructed at high yielding boreholes. Livestock is critical for households' absorption of shocks through disposal when the need arises and also providing an opportunity for farmers to diversify livelihoods. Ownership of farming implements was only limited to hoes for both districts and smallholder farmers lacked other important farming implements considering that agriculture from the study contributed much of the livelihood for communities in the two districts.

Households sources of income were mainly casual agricultural and non-agricultural labour, vegetable or fruit sales, remittances and crop sales. Generally, there is reliance of income sources outside the homestead due to limited production at household level. This may not be sustainable in the event of drought which affects casual agricultural labour prospects. All year-round production at household level is thus of crucial importance.

Financial inclusion may be concluded to be low amongst the targeted Chiredzi and Mberengwa households. This was shown by the low Village Savings and Lending participation which was reported by only 18% of the respondents. The targeted households thus have limited access to low cost, locally available credit which could provide an opportunity for them to invest into income generating activities and smoothen income levels at household level. Moreover, VS&L is more than the pulling of resources as it contributes towards bridging social capital and community cohesion which is critical for response to both covariate shocks (e.g. poor market access) and idiosyncratic shocks (e.g. death of family members).

Farming households in Chiredzi and Mberengwa have access to information on commodity prices, commodities on demand, input prices, weather forecasts, water management, crop and livestock diseases. At least 80% of these were using this information for household decision making which is important for adaptive capacity through making decisions about their long-term livelihood changes. The sources of information varied by information type, ranging from government extension officers for information on weather forecasts, crop and livestock diseases to family and friends for commodity prices and input prices.

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. The average food consumption score was 40.56 and 58% had acceptable food consumption. This means that households are consuming staples and vegetables every day, frequently accompanied by oil and pulses and occasionally meat, fish and dairy products. In terms of dietary diversity, the average score was 4.62 indicating reasonable access to at least 5 of the 7 food groups.

An analysis of the management committees who are the bearers of governance of assets showed that committees were aware of their roles and responsibilities. They were also allowing for participation of women as 75% of WPCs were women. Despite this, committees are weak in enforcing the collection of revolving funds, hence do not have resources to meet their operation and maintenance obligations.

The condition of household food security depends mainly on physical and economic means (accessibility). Economic, social, and environmental sustainability are essential for the accessibility to food for all people. without integrating sustainability to food security, it is impossible for policymakers to mitigate food insecurity. In Zimbabwe, about 80% of the society lives in rural areas where there are not sufficient infrastructural facilities and also where the majority of the households are smallholders as seen from the study where production of dryland crops is very little and participation in social safety nets is minimum. Exacerbated by the lack of infrastructural facilities, drought, weather variability, and others, food insecurity becomes a major challenge in rural communities in the rural districts of Mberengwa and Chiredzi. Developing of water infrastructure like the solar boreholes and establishment of nutrition gardens will ensure food security to the targeted communities in both districts.

Recommendations

In light to the above conclusions the following recommendations are made to the LDSC grant:

- Improving house hold access to water for domestic and productive use which will strengthen their resilience and sustainability. Establishment of water harvesting structures, rehabilitation of irrigation schemes and solarization of boreholes will increase productivity for smallholder farmers.
- Improving income and increasing the number of income streams that smallholder farmers have. Any interventions should seek to build on already existing knowledge and familiarity in exploring potential opportunities for farmers with access to all year-round water.
- Improving irrigation infrastructure through rehabilitation and upgrading of existing pumps. Irrigation can enable smallholders to engage in year-round production, increase yield and improve food and nutrition security. From the study it was noted that production was generally low.
- With solarization of boreholes the distance might not be reduced, however, the time taken will be reduced thus freeing up productive time especially for women and girls who have to shoulder the responsibility of fetching water. Similarly, water harvesting structure beneficiaries will also benefit through reduction in distances to water sources to less than 1km as the water harvesting structures will be established within their homes. It would thus be critical to ensure that these are protected and treated to ensure water quality.
- Whilst response to water access is critical, the situation on hygiene as indicated by the 25% who do not have latrine facilities signifies that there is need for public health and hygiene education in both districts to emphasize on toilet construction to minimize open defecation.
- Given the susceptibility of maize to extreme climate conditions such as drought and mid-season dry spells, there is a need to aggressively promote small grains production especially in Mberengwa. The risk of crop failure for maize is higher than that of small grains such as pearl millet and sorghum. Given that small grain production is a key activity in the two ZRBF projects, there is a need to upscale production to ensure food security for farmers.
- Low production in Sugar beans is highly due to the lack of inputs for the farmers and also lack of market for the commodity. The farmers grow enough for family consumption. Sugar bean is an important cash crop with a ready market in Zimbabwe. Enhancing production and market linkages especially for bio-fortified varieties is thus important. The project should thus leverage of bio-fortified Nua 45 variety seed production in Chiredzi to promote sugar bean production in gardens and irrigation schemes. Bio-fortified varieties contribute towards both nutrition and income status of targeted households thereby increasing their absorptive and adaptive capacity for resilience.
- There was a significantly higher proportion of youth who had garden plots in shared communal gardens (33%) compared to the middle and old aged who had higher participation in irrigation schemes. This is indicative of low youth participation in high production interventions such as irrigation schemes and restrictions to small scale community gardens. Leveraging on the renewed focus on the Youth by the ECRAS project, there is need to intensify youth participation of crop value chain production to build their resilience adaptive capacity.
- In line with gardening, there is an opportunity to promote nutrition sensitive garden/ horticultural production through trainings and start up investments in inputs for the gardens to be established by the project as well as the already existing gardens established by the ECRAS and ECRIMS Projects. Despite the low proportion of farmers producing butternut, average production was high at 470kg, indicating prospects for upscaling production for both consumption and the local

market. Average production is low for some crops indicating the need for uniform production which is established through trainings and subsequent development of production plans.

- There is a need for coordinated efforts to build farmer capacity in garden management especially for challenges such as crop pests and diseases. This is through trainings and strengthening access to input and chemical suppliers. Revolving funds should be set up at all community level irrigation schemes and gardens so that farmers have funds for repair of water sources during break downs and procurement of inputs such as seeds.
- Average income of $56.57 by Mberengwa beneficiaries constitutes 57% of the average household income by ZRBF-ECRIMS participants in OMS 2 whilst the $32.12 for Chiredzi constitutes 21.5% of the average household income by ZRBF-ECRAS participants (UNDP, 2019). This means that for Mberengwa, garden production is a significant livelihood activity at household level compared to Chiredzi. Layering production of garden crops should be encouraged in-order to smoothen income at household level in line with absorptive and adaptive capacities for resilience building. Cash disposal to purchase food is a first line response to shocks and stresses such as drought whilst integration of garden activities in livelihoods is necessary for adaptation to climate shocks and stresses. There is need to increase the scope of garden production into market linked horticultural production to further increase household income. Farming as a business (FAAB) training is thus crucial for graduation of farmers from subsistence to market producers. According to the focus group discussions gardening produces are seasonal and depends on the availability of water. High productivity is seen when there is adequate water utilized through conveyance systems that are not manual.
- Given the low participation in VS&L, there is a need for deliberate layering of VS&L for the targeted interventions so that community members financial inclusion through low cost credit access is improved as well as their productive capacity through asset acquisition which often comes through VS&L investments. VS&L will also contribute towards social capital through bridging hence social cohesion. These results indicate that the targeted communities have a gap in saving methodology that is more sustainable and gives value to their savings given the hyperinflation and economic challenges the country is facing. Whilst farmers investment in life assurance remains low even across the mainstream ECRAS and ECRIMS projects, life assurance remains a viable social safety net as it reduces possibilities of cash, livestock or asset disposal in the event of death of a family member. Efforts should be made to strengthen linkages with life assurance service providers and layer the intervention on VS&L.
- Despite households having reasonable access to at least 5 food groups which is important for their absorptive capacity to shocks and stresses, programming should seek to improve access and utilization of protein and vitamin rich foods which households have limited access to. This is through building farmer productive capacity that allows for investments in resilient small livestock such as indigenous chickens and goats which can support value chain activities and household consumption as well as bio-fortified crop production.
- There is a need to strengthen management of water point management committees through training on community based sustainable management of water points. This is critical in improving the governance of these structures. About 66% of the boreholes also indicated that they save their funds in strong foreign currency due to hyperinflation whilst the irrigation committee indicated collecting their funds in local currency. Given that the productive capacity of irrigation schemes will be increased whilst at the boreholes it will be established, members should be

encouraged to save their revolving funds in stronger currencies which are not easily eroded by exchange rate increases. The revolving fund can be diversified through integration with VS&L or invested into productive livestock so that it's value is preserved.

Appendices

Annex 1- Baseline Indicator Values

Indicator	Unit of Measurement	Target	Baseline	Baseline-Chiredzi	Baseline-Mberengwa	Direction of Change	Source
Prevalence of the population with moderate or severe food insecurity, based on the food insecurity experience scale (FIES)- **12 Months: Moderate to severe**	Percent of beneficiaries/ HHs	40%	66.5%	64.2%	68.9%	Decrease is better	ZRBF OMS Report and End line survey
Prevalence of the population with moderate or severe food insecurity, based on the food insecurity experience scale (FIES)- **12 Months: Severe**	Percent of beneficiaries/ HHs	10%	21.6%	19.6%	23.5%	Decrease is better	ZRBF OMS Report and End line survey
% of people implementing practices/actions that reduce vulnerability and increase resilience, disaggregated by climate-related economic, social or environmental events	Percent of beneficiaries/ HHs	TBA				Increase is better	Baseline & End line survey
Hectarage being utilised in irrigation	Ha	TBA		13 hectares		Increase is better	Baseline survey and End line survey and project progress update
Household cash income (in USD equivalent) from selling horticultural crops/ average income	Average (in USD) per HH	$70,00	$44.34	$32.12	$56.57	Increase is better	Baseline survey and End line survey
% of disaster/crisis affected people supported by CARE who had access to safe drinking water	Percent of beneficiary/ HHs	80%	57%	74.4%	53.9%	Increase is better	Project progress update reports
Cattle trekking distance/ average distance	Km	less than 2km	+2km	+2km	+2km	Decrease is better	Project progress update reports
Supplementary Indicators aligned to ZRBF Projects							
Food Consumption Score (measure of food	Average score per HH	60	40.56	42.06	40.12	Increase is better	Baseline & End line survey

Indicator	Unit of Measurement	Target	Baseline	Baseline-Chiredzi	Baseline-Mberengwa	Direction of Change	Source
consumption relative to the 7 food groups)							
Proportion of Households with acceptable Food Consumption score	Percent of beneficiaries/ HHs	70%	58%	65.8%	55.4%	Increase is better	Baseline & End line survey
Household Dietary Diversity Score (measure of quality of diet)	Average score per HH	5.0	4.62	4.68	4.6	Increase is better	Baseline & End line survey
Proportion of households with medium to good dietary diversity	Percent HHs (in three HDD categories)	60%	52%	53.2%	51.3%	Increase is better	Baseline & End line survey
% of households participating in Village Saving and Lending	Percent of beneficiary/ HHs	50%	18%	27%	16%	Increase is better	Baseline & End line survey
Proportion of households taking between 5-15 Minutes to access water	Percent of beneficiaries/ HHs	70%	45%	72%	38%	Increase is better	Baseline & End line survey
% of households reporting access to safe water	Percent of beneficiaries/ HHs	80%	58%	74.4%	53.9%	Increase is better	Baseline & End line survey
Proportion of households participating in gardening activities at household or community level	Percent of beneficiaries/ HHs	90%	79%	90%	76%	Increase is better	Baseline & End line survey
% of households consuming and selling garden/ irrigation/ horticulture produce to supplement household income	Percent of beneficiaries/ HHs	55%	37%	49%	35%	Increase is better	Baseline & End line survey

Annex 2- Sites overview

Dendere Irrigation Scheme, ward 2, Chiredzi District targeted for rehabilitation

The scheme is situated along Save river in Chiredzi District of Masvingo Province. The scheme has a capacity of 242 farmers, 42 of the farmers occupy the old scheme whilst majority of the farmers occupy the extension portion which needs some connections to be done so that it becomes functional. It covers 40 hectares but 20 of the hectares are in the extension portion where no productive works have resumed due to a number of issues. The first one is on the old portion of the scheme with 20 hectares. The site is constrained in terms of production due to the small pump size which makes it impossible to water the 20 hectares, if water has been channeled well the capacity of the pump can water only 13 hectares. However, the canals are also damaged and this result in loss of water as the water is being channeled. For the extension to be functional there are connections that need to be done. The connections need to be done at the dam where there is need for a by-pass that requires pipes and valves. The smallholder farmers indicated that they cleared the land in preparation for production but trees are growing as they wait to have water running in the extension portion.

Figure 11: Canals at Dendere irrigation scheme, in Chiredzi District and two pumps at the irrigation scheme.

Water harvesting sites

In Chiredzi 30 wells are targeted for protection. Chiredzi has a different topography from Mberengwa and hence water harvesting structures are impossible to construct. well. The sites that are targeted are sites with an average of five (5) households accessing the water point. Currently the wells are being used for water for drinking, domestic use, gardening and livestock watering. The wells are constructed with materials that are not sustainable and also, they risk the communities to diseases as they are not protected and for hygienic purposes it's not safe for drinking. From the survey a 53% of the interviewed noted that their water is safe for drinking. However, they are no livestock drinking troughs at the sites and some are constructed with non-sustainable materials as anchoring poles and are not protected.

Figure 13: Deep well targeted for protection in ward 2 of Chiredzi

Six water harvesting structures Kondoni ward 5, Makhanje ward 18, Mahonye ward 19 Kefasi ward 33 including a small dam in Maperekeni village ward 23 are being constructed on streams in Mberengwa

district after communities raised challenges in accessing domestic and productive water needs saving approximately 1700 households from 38 villages. The streams fail to hold water for almost 8 months of the year exposing livestock to malnutrition starving related deaths. For households who have able bodied members of the family the spend much of their time trekking animals to more than 5km thus wasting their productive time. Some community members do brick moulding and all left stunned without water for this income generating activity. Household nutrition levels are relatively low because there is no water for irrigation. Community recreational and fishing space is not available due to unavailability of adequate water in the Mberengwa communities. The picture below shows Makanje stream which has a weir on the foreground of the picture below. This has seen households getting water for livestock from sand abstraction which is tiresome and time consuming given that most of the habitats in these communities own big and small livestock.

Figure 11: Weir Dam sites Dry Makhanje stream (ward 18 , Mberengwa(L)& Dry river bed at Maperekeni in ward 23 Mberengwa (R)

Solar Borehole targeted for installation and Nutrition garden establishment and livestock trough construction

In Chiredzi three (3) high yielding boreholes are targeted for solar installation which are Gwaimani Borehole in ward 7, Pahlela borehole and Bete Borehole both in ward 9. At the three boreholes a 1-hectare nutrition garden will be established. Seven livestock troughs will be constructed, three at the three boreholes targeted for solar installation and four from other boreholes that were rehabilitated under the ZRB-ECRAS project. The boreholes are being used by the communities to access water for domestic use, gardening and watering livestock. Of the three boreholes only one had a small garden which is currently being watered using a deep well and cannot accommodate people with disabilities and the elderly as they is a lot of work involved. There are also no livestock drinking troughs at the sites. One of the site, Pahlela Borehole in Chiredzi is usually on breakdown due to the corrosiveness of the water.

*Figure 14: Pahlela borehole ward 9, Chiredzi(L) and Ndove Borehole ward 23, Mberengwa targeted for solar pump installation,*In Mberengwa district three boreholes have been identified and successfully capacity tested in ward 8

Madhekwani Borehole, ward 22 Masaga Borehole and ward 30 Ndove Borehole. The boreholes are high yielding but community has challenges with the water point regarding long distances of an average of 3km from their homesteads. At Madhekwani village the borehole is not in use as it does not have the pumping unit which has been dismantled. Livestock and human are mingling on the water point posing outbreak of diseases which will be minimised by construction of water troughs. After solarisation, community taps are to be evenly spaces to minimise distances currently being travelled. Currently hand pumping has got low output flow rate which is going to be improved through use of solar power easing waiting or queuing time of users at the borehole.