



# The contribution of climate smart interventions to enhance sustainable livelihoods in Chiredzi District

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## ABSTRACT

Climate change impacts are exposing populations to many losses. Climate change impacts namely severe floods, droughts, extreme temperatures and storms are hindering attainment of sustainable livelihoods to most populations. This study sort to analyze the contribution of climate smart interventions targeting enhancement of sustainable livelihoods in Chiredzi District's agricultural rural communities. Interventions have been implemented by Non-Governmental Organisations (NGOs) (CARE & PLAN) in collaboration with Government departments and communities. A pragmatist research philosophy encompassing both interpretivist (qualitative) and positivist (quantitative) paradigms was adopted to comprehensively answer research objectives. Household survey questionnaire was the main quantitative tool administered to randomly selected households. Interviews were conducted with purposively selected key informant interviewees from the Department of Agriculture Technical and Extension services, CARE, PLAN International, District Development Coordinator and Rural District Council. Adoption of climate smart interventions by 60.6% of the respondents in communities studied yielded notable successes whereby it enhanced sustainable livelihoods through ending poverty amongst vulnerable communities. Some, 67% of the respondents did fodder production to manage livestock production challenges induced by climate change. It also improved community well-being by increasing sources of livelihoods. The study recommends adoption of more climate smart interventions that ensures livelihood sustainability.

## 1. Introduction

The concept of sustainable livelihoods is a reference point for a wide range of people involved in different aspects of development policy formulation and planning (Scoones, 2015). Sustainable livelihoods can be described as livelihoods which can cope with and recover from shocks and stressors, maintain or enhance its capabilities and asserts (Morse and McNamara, 2013). They are able to provide sustainable livelihoods opportunities for the next generation and which provides net benefits to other livelihoods at the local and global levels in the short and long term (Krantz, 2001; Serrat, 2017). The basic material and social tangible and intangible assets that people use for constructing sustainable livelihoods are conceptualized as different types of capital. They are explored in the sustainable livelihood framework, these are namely; natural capital, financial capital, human capital and social capital (DFID, 2000).

Climate variability and extreme weather events have devastating impacts on communities causing loss of life, human suffering and the destruction of infrastructure and natural resource base which livelihoods depend on (UNEP, 2010; FAO, 2015; Ongoma et al.,

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2018). Devastating impacts of climate variability and extreme weather events have compromised three main constituent domains which sustainable livelihoods are measured on which are namely; Environmental sustainability, Social sustainability and Economic sustainability (Adams, 2006; Narula et al, 2017). The extensive manifestation of climate change impacts and reversal of attaining sustainable livelihoods has caused development of ideas based on achieving sustainable livelihoods in identified vulnerable communities.

In both developing and developed countries efforts are being made by development actors to attain sustainable livelihoods. Various critical climate smart interventions are being launched and implemented to enhance sustainable livelihoods. Climate smart agriculture is being undertaken towards development and food security, built on three pillars; increasing productivity and incomes, enhancing resilience of livelihoods and ecosystems, reducing and removing greenhouse gas emissions from the atmosphere (Sen, 2000; Arslan et al., 2015). The interventions significantly aided on attainment of three constituent domains which are used to measure sustainable livelihoods. Achieving sustainable livelihoods through adoption of climate smart interventions could contribute to achieving the Sustainable Development Goals (SDGs) of reducing hunger and improve environmental management (Sachs, 2015). Climate smart agriculture is a holistic approach which unites numerous issues related to agricultural development and other development objectives (Corsini and Moultrie, 2019). It covers environmental issues, for example, energy and water as well as social issues such as gender and economic issues.

Development actors in countries like Zimbabwe have noted that achieving sustainable livelihoods requires a management and governance practice that integrates multi-stakeholder coordination and cooperation (Agrawal, 2010; Bahadur et al., 2015). Interventions in rural communities for transforming the agriculture sector including crop and livestock production, fisheries and forestry are being implemented to respond to climate change which is the major drawback to achieve sustainable livelihoods.

Numerous interventions, practices and technologies that contribute to reaching the objectives of sustainable livelihoods are in place. These are supporting food security, boosting agricultural systems and strengthening resilience of communities (Misselhorn et al. 2017). The Food and Agriculture Organisation (FAO) is promoting agriculture practices and policies that ensure food security while safeguarding the natural resource base for future generations (FAO, 2015). Such interventions by FAO are assisting vulnerable communities to withstand recurrent droughts. These FAO Agricultural policies are the basis for achieving food security and improving livelihoods. A combination of sustainable agriculture and climate change policies work towards eradication of hunger and poverty (sustainable livelihoods) (Hallegatte et al., 2015).

In Zimbabwe, the Zimbabwe Resilience Building Fund (ZRBF) is the supporting implementation of resilience building interventions in 18 rural districts of Zimbabwe through seven project consortia (Building Resilience Crisis Modifier report, 2018). The interventions' targets/aims is to achieve adaptive, absorptive and transformative capacities to withstand shocks and stressors, that is, sustainable livelihoods. The currently functioning ZRBF are namely; Enhancing Community Resilience and Sustainability (ECRAS) in Mwenzezi and Chiredzi; Matebeleland Enhanced Livelihoods Agriculture and Nutrition and Adaptation (MELANIA) in Matebeleland; Zambezi Valley Alliance for Building Communities (ZVA) in the Zambezi Valley; Building Resilience Through Improving the Absorptive and Adaptive Capacity for Transformation (BRACT) in Binga, Kariba and Mbire Districts and Enhancing Community Resilience and Inclusive Market Systems (ECRIMS) in Zvishavane and Mberengwa Districts. The projects have climate smart interventions that targets to improve community resilience and safeguard the environment that is, working towards attaining sustainable livelihoods (ZRBF, Crisis Modifier, 2018). The study therefore assessed the contribution of climate smart interventions on enhancing livelihood sustainability in Chiredzi District communal areas.

## 2. Theoretical framework: sustainable livelihood framework

The research was guided by the sustainable livelihood framework. The framework reiterates the importance of access to productive assets, institutional structures, processes and the livelihood strategies pursued by households (Davy et al. 2017). The critical productive assets that are key for attaining sustainable livelihoods as highlighted in the sustainable livelihood framework are namely; natural capital, financial capital, human capital and social capital (DFID, 2000; Constan et al., 2014). The framework highlights that, combining the production assets, policies, institutions, processes and livelihood strategies results in attaining sustainable livelihoods. The study assessed interventions that are securing, enhancing human, social, natural, physical, financial and household asserts based on the sustainable livelihoods framework.

## 3. Study area

### 3.1. Location of study area

Chiredzi district is found in Masvingo Province on the South Eastern side of the Lowveld. The district is in agro-ecological region five which is characterized by aridity and uncertain rainfall patterns. The area experiences average temperatures of 22.3 °C in winter and 27.4 °C in summer (Mugari et al., 2016a, 2016b). Annual rainfall is generally below 600 mm with annual evaporation exceeding 1600 mm (Gavera, 2012). Most of the soils in the district are heavy clays. Vast tracts of land in Chiredzi District is taken by Gonarezhou national park and other conservancies like Malilangwe.

Chiredzi District is a semi-arid to arid area which is marginal for production of crops and most suitable for livestock production. Majority of people earn a living from rearing livestock goats, cattle and chickens. Some own large herds of livestock which had caused extensive grazing of surrounding environments. However livestock production is being affected by climate variations and changes. Increased frequency of droughts (especially mid-season dry spells, higher than normal temperatures and altered precipitation patterns)

is affecting livestock production leading to livestock poverty deaths and crop failure. As a strategy to mitigate the consequences of climate change, communities are engaging in cross border trading, men and young boys are migrating to work in neighbouring countries (Fig. 1).

### 3.2. Justification of the study

The severity of climate change impacts has destroyed assets and undo development gains and as such development agendas / plans should include strategies that reduce impacts of climate change (Thomalla et al., 2018). Hence this study shall explore the effectiveness of implemented strategies to reduce the impacts of climate change.

Climate smart agriculture is roofed in sustainable agriculture and rural development objectives which if reached would contribute to achieving the Sustainable Development Goals (SDGs) of reducing hunger and improved environmental management (Mango et al. 2017). Therefore this study shall outline the contribution of climate smart agriculture to attainment of SDGs in Chiredzi District communal areas.

More so, climate smart agriculture is a pathway towards development and food security on three pillars (availability, utilization and accessibility) increasing productivity and incomes enhancing resilience of livelihoods and ecosystems (Mutami, 2015). This research shall focus on assessing the basic climate smart agriculture practices implemented in Chiredzi District and determine how they contribute to attainment of sustainable livelihoods.

## 4. Methodology

The research was conducted guided by the pragmatist research philosophy a paradigm based on the proposition that researchers should use the philosophical/ methodological approach that works best for a particular research problem that is being investigated and it is associated with mixed method approach (Maxcy, 2003; Lincoln and Guba, 2011). A mixed method approach that combines both qualitative and quantitative approaches was utilized in this study (Creswell and Clark 2011). Qualitative data for this study was acquired through key informant interviews using open ended questions, focus group discussions and direct field observations. Quantitative data was mainly obtained from closed ended questions in household survey questionnaires.

The research adopted purposive sampling to select wards 3 and 4 of Chiredzi District. According to ZimStat 2012, ward 3 has 725 households, ward 4 has 1305 households. A 10% sampling frame was adopted to determine the actual number of questionnaire respondents. In ward 3, 73 households were selected while in ward 4, 130 households were selected; thus a total of 203 households were selected for this study. Simple random sampling was used during questionnaire distribution to the 203 households of the study. With simple random sampling, all households in the study area had equal opportunity of being selected as a respondent hence questionnaire distribution had no pattern. Questionnaires have both closed ended and open ended questions. Questionnaires contained information

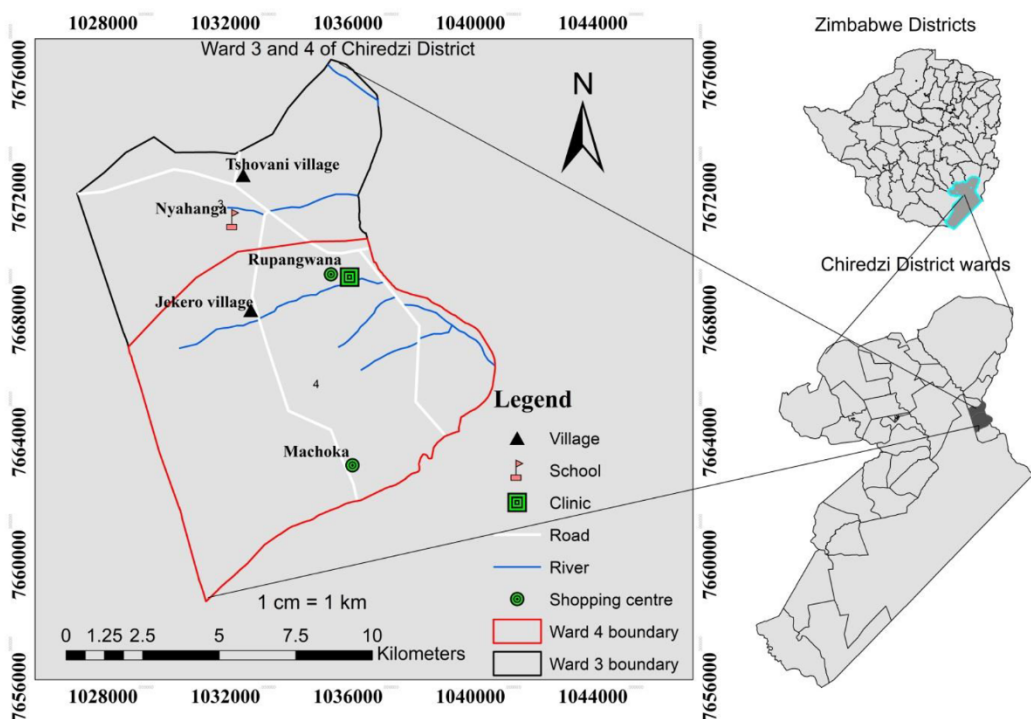


Fig. 1. Study area map for Chiredzi District wards 3 and 4. Source: Authors.

on the contribution of climate smart interventions to enhancing sustainable livelihoods in Chiredzi District. Purposive sampling was adopted to select six key informant interviewees namely; District Development Coordinator, District Crops and livestock Specialist, Ward Councillors from wards 3 and 4, Project Facilitator from Plan International and Monitoring and Evaluation Officer from Care. Interviews were conducted guided by an interview guide. Two focus group discussions were done, one per ward. Each focus group comprised of 12 people (six males and six females), of varying age groups, that is, the youth and the elderly. Focus groups were conducted guided by a discussion guide with key questions formulated according to the research objectives.

Quantitative data from the questionnaires were firstly cleaned, coded and uploaded into the Statistical Package for Social Scientists (SPSS) version 20.0. SPSS was used to analyze the quantitative data. Quantitative data was presented on charts, graphs and tables generated with Microsoft Excel (office 2016). Relationship tests were performed using chi-square to affirm effectiveness of implemented climate smart interventions. Qualitative data from focus group discussions and key informant interviews were subjected to content analysis.

## 5. Results and discussions

### 5.1. Climate/ weather variables impacting livelihoods in Chiredzi District

#### 5.1.1. Extremely high temperatures

Of the sampled population, 79% of the respondents highlighted high temperatures as the major climate variable impacting livelihoods in the District. The District Crops and Livestock Specialist highlighted that extreme temperatures are always experienced during summer and they range between 43 °C and 45 °C. Chiredzi District is in Zimbabwe’s agro-ecological region five which is characterized by high temperatures. Chiredzi also experiences heat waves associated with extensive water loss to evapotranspiration. Focus Group Discussion narratives revealed that these extreme temperatures are affecting people’s health giving rise to severe headaches, dehydration and suffocation. [Mupakati and Tanyanyiwa \(2017\)](#) in their study on cassava production in Chiredzi District also highlighted that over 70% of smallholder farmers in Chiredzi District are vulnerable to climatic extremes. Extreme temperatures are causing water stress to the environment leading to wilting of crops and vegetation, hence environmental degradation.

#### 5.1.2. Flash floods

Some, 49% of the selected respondents in Chiredzi District highlighted flash floods as one of the climatic variables affecting livelihoods. Though Chiredzi District characteristically receives very low annual rainfall amounts of below 600 mm; it sometimes experiences flash floods. The occurrence of flash floods was highly attributed to convectional rainfall of greater intensity over a short period of time which is usually accompanied by severe thunderstorms, strong winds and lightning. One of the extension service providers from the Department of AGRITEX in ward 4 highlighted that flash floods occurred on 14 February 2019 and 70 mm were recorded in 2 h and in excess of 300 mm in 4 h. [Mamombe \(2017\)](#), highlighted that Chiredzi District is characterized by large hail stones, (weighing up to 1.5 kg), strong winds and heavy overnight rainfall. Flash floods have devastating effects; they destroy people’s fields, crops and vegetation and damage community/ household infrastructure. This is a strong retarding factor towards achieving sustainable livelihoods since it destroys major resources critical for enhancing people’s livelihoods.

#### 5.1.3. Drought

Sampled respondents (63%) mentioned drought as a significant challenge being experienced in Chiredzi District. The District Crops

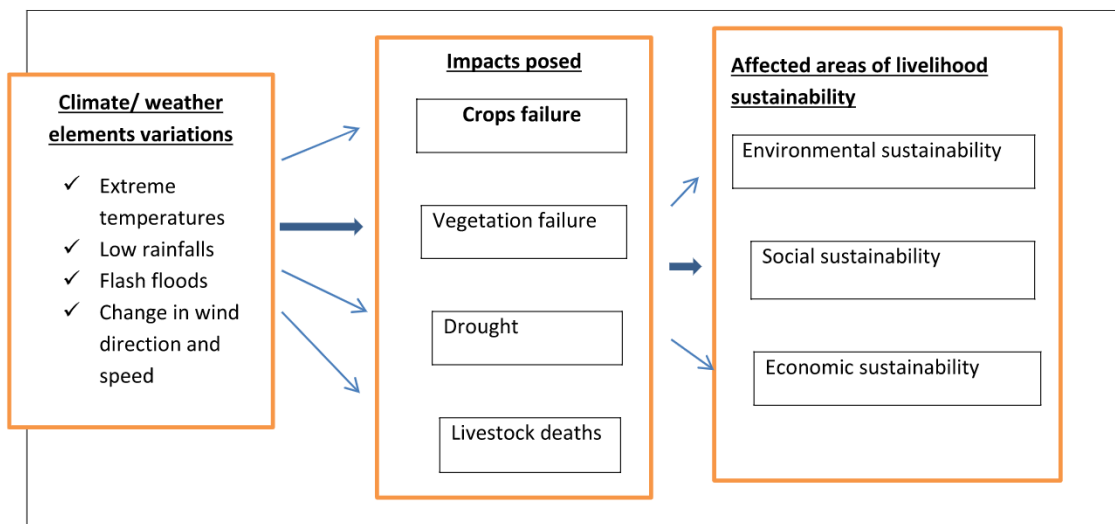


Fig. 2. Manifestation of climate change impacts. Source: Field data.

and Livestock Specialist and the District Development Coordinator both explained that households residing in wards 3 and 4 strongly suffer the consequences of drought. This type of drought is induced by erratic rains and high temperatures. In the studied wards meteorological drought has caused poor harvests, food shortages, reduced rejuvenation of forests, inadequate grazing for livestock. The District Crops and Livestock Specialist echoed that drought has caused crop failure and livestock poverty deaths because of pasture unavailability.

A combination of high temperatures, low erratic rainfall conditions have caused failure of household livelihood options. Farmers in Chiredzi District consider the agriculture sector (crops and livestock) as the lynchpin intervention to earn a living. However, due to climate variations being experienced, agriculture production is obtaining generally low yields. Similar findings were obtained also during the Enhancing Community Resilience and Sustainability Multi-Hazard Risk Assessment of 2019 in Chiredzi District which stated that climate change impacts are generally affecting all livelihood sources in communal areas of Chiredzi District. There is high livestock poverty deaths due to pasture shortage, crops failure and poverty prevalence amongst human beings. This has resulted in failure to achieve sustainable livelihoods since sustainable livelihoods according to the sustainable livelihood framework are able to withstand shocks and stressors (resilient), are poverty free and largely they utilize available resources in a sparing manner (Narula et al. 2017). As a result of the above discussed weather elements, communities are engaging Government departments and Non-Governmental Organisations to design and foster implementation of climate smart interventions to enhance sustainable livelihoods across the District. Fig. 2 shows how climate variations impact the attainment of sustainable livelihoods in Chiredzi District.

### 5.2. Climate Smart Interventions to enhance sustainable livelihoods

Manifestation of the impacts of climate variability and change has prompted implementation of climate smart interventions to enhance sustainable livelihoods in communities studied. The implemented interventions are categorized into crop production interventions, livestock production interventions and community development interventions. Interventions are targeting to attain critical domains of sustainable livelihoods (environmental sustainability, social sustainability and economic sustainability) as highlighted by the sustainable livelihoods framework.

### 5.3. Crop Production Sector

#### 5.3.1. Conservation agriculture

Research findings reveal that of the sampled households, 60.6% are practicing conservation agriculture. Various conservation agricultural practices have been implemented following the training received by farmers. It was established that in the selected studied wards (3 and 4) majority frequency (81%) are practicing minimum tillage; 47% are doing minimum tillage and 17% are doing mulching (Fig. 3). Department of AGRITEX trained farmers to do conservation agriculture. Farmers practiced conservation agriculture to conserve soil, water and maximize production. The intervention helped farmers to alleviate food shortages that existed in the studied wards of Chiredzi District

#### 5.3.2. Winter ploughing

Research findings reveal that, winter ploughing was practiced by 31% of the sampled respondents. The Extension Service Providers highlighted that few farmers are undertaking winter ploughing due to lack of know-how and less understanding of the benefits which arise from undertaking winter cropping. The Extension Service provider explained that farmers ignore winter ploughing yet it is important to plough the land after harvesting because it helps conserve moisture, decomposition of stalks and leaves that would have been left in the fields after harvesting. Winter ploughing helps conserve residual moisture which helps farmers plant with the first rains. The District Crop Specialist further highlighted that if the fields are not ploughed, weeds continue to grow and scatter seeds around the field. From the explanations raised by the Crops Specialist, if correct procedures are followed, yields are maximized, land is successfully conserved (environmental sustainability) and this will ensure a positive step towards attaining sustainable livelihoods.

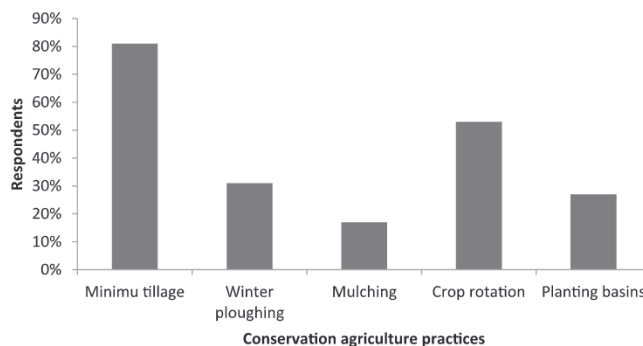


Fig. 3. Conservation agriculture practices in the studied wards.

5.3.3. *Mulching*

Study findings revealed that, 17% are doing mulching. Farmer training specialists raised a range of reasons why farmers should do mulching on their farms. Some of the mentioned reasons include conservation of soil, improving soil fertility, health of the soil and reducing weed growth. The mentioned benefits of mulching helps in increasing farmers’ resilience capacity to overcome food shortage and food scarcity. According to the sustainable livelihood framework, successful sustainable households can better withstand shocks and stressors while at the same time utilizing resources to meet the three critical sustainable livelihoods domains.

5.3.4. *Planting basins*

It was established that 27% of the sampled respondents are planting their crops in planting basins. Construction of planting basins was mentioned as the best strategy as it enhances the capture and storage of rainwater and it allows precision application and utilizing of limited plant nutrients. However this conservation agriculture practice is being undertaken by considerably few farmers because it is labour intensive. In a focus group discussion, farmers termed it “*dhiga udye*” describing its labour intensive nature. Extension service providers highlighted that construction of planting basins helps to reduce crop failure due to unreliable rainfall since basins are designed to conserve little moisture received. Focus group discussion narratives reveal that use of planting basins has an advantage that soil nutrients for enhancing plant growth are not wasted rather are confined for plant life. Another advantage of using planting basins is that, there is less soil tillage hence minimum soil disturbance occurs. This however, helps to promote achieving environmental sustainability as mentioned on the sustainable livelihood framework. Planting basins have another advantage of increasing crop production thereby reducing outbreak of food shortages to vulnerable communities.

5.3.5. *Crop rotation*

Of the proportion doing conservation agriculture, 53% practiced crop rotation. The Ward Councilor of Ward 3 helped to mobilize farmers for Crop Rotation trainings. The District Crop Specialist explained that crop rotation reduces reliance on one set of nutrients, pest and weed pressure and the probability of developing resistant pests and weeds. Focus group discussion narratives reveal that a program launched by extension service providers on crop rotation reduced manifestation of weeds which had negatively affected many fields in the studied areas. Witch weed (*bise*) had dominated in most fields and was minimizing expected yields. Farmers in the studied communities, had however, managed to overcome witch weed through crop rotation.

5.4. *Reasons why some are not practicing conservation agriculture*

The study identified reasons why some farmers are not practicing Conservation Agriculture. Varied reasons were attributed to people’s failure to practice conservation agriculture practices. A greater proportion of the sampled respondents (57%) indicated that they are not doing conservation agriculture because of lack of knowledge, while 14% lack labour and 11% highlighted that it is labour intensive (Fig. 4).

5.5. *Adoption of small grain crops*

Due to the prevailing weather conditions in Chiredzi District of low rainfall and high temperatures, crop production is being significantly challenged. The Crops and Livestock Specialist in agreement with the District Development Coordinator being supported by NGOs (Care and Plan International) are advocating adoption of small grains by farmers as a coping strategy to harsh and extreme climatic variations. NGOs intervened to assist farmers with small grains inputs like velvet bean, sorghum and millet. Government departments like AGRITEX intervened to offer extension advisory assistance. Rural District Council represented by ward councilors helped to mobilize farmers to attend trainings. The small grain intervention improved food production in communities studied. This is

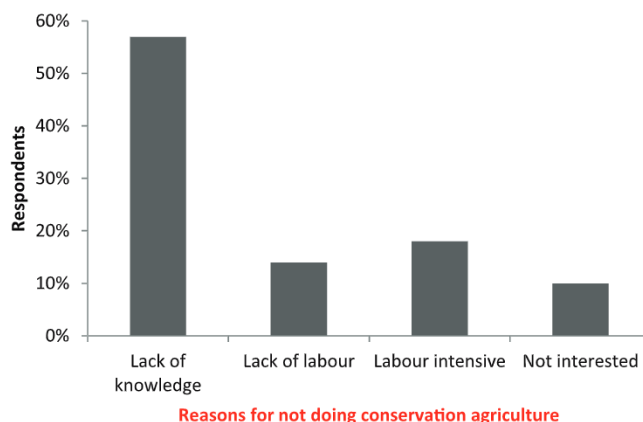


Fig. 4. Reasons for not practicing conservation agriculture.

so because the crops advocated for better withstand harsh climatic conditions contributing to attaining social sustainability.

Notable successes were obtained as reflected by adoption rates. At the time the study was conducted (January 2020), the proportion of farmers who indicated to have chosen different varieties of small grains were: rapoko 17%, red sorghum 19%; white sorghum 43%; pearl millet 38% (Fig. 5). However some farmers, though very few (11%), still grow maize.

Pearl millet and white sorghum has the highest proportion of respondents as revealed by the study findings (Fig. 5). Sampled respondents highlighted that pearl millet and white sorghum are better grain options to substitute maize. Small grains enhanced food availability in the communities since better yields were obtained as varieties grown were able to withstand extreme weather variables. Focus group discussion narratives revealed that, the intervention successfully contributed to attaining societal sustainability.

### 5.6. Post-harvest management strategies

According to the sustainable livelihood framework, a sustainable livelihood is measured on its capacity to withstand the effects of shocks and stressors. However, Chiredzi District is characterized by food scarcity and shortages being experienced which are attributed to weather conditions. Care and Plan International intervened to assist vulnerable communities to conserve little grain they would have obtained from their fields. Farmers were trained on post-harvest management. The facilitators of post-harvest management trainings assisted farmers to construct metal silos. Metal silos as revealed in focus group discussions, have the advantage of conserving grain for a considerable duration of time rather than the pole and dagg granaries which farmers were using. In the studied wards, majority expressed interest in using metal silos but indicated they had no capacity to build metal silos due to unavailability of financial resources. One of the extension service providers highlighted that some cases of food shortages being experienced are attributed to poor post-harvest management of grain. Use of pole and dagg granaries increases grain vulnerability to decomposers such as bacteria, fungi and stalkborers.

### 5.7. Livestock Production sector

Chiredzi is more suitable for livestock production considering the prevailing weather conditions. Basically various forms of livestock are being kept which range from poultry, goats and cattle. However the livestock sector has experienced challenges and significant losses have been incurred. As a result mechanisms have been initiated to manage multiplication of losses.

#### 5.7.1. Fodder production and preservation

The fodder production and preservation intervention helped reduce overgrazing. Of the sampled respondents, 67% managed to prepare fodder to feed their livestock. Focus group discussion narratives reveal that farmers who managed to prepare fodder managed to sustain their livestock during pasture poverty times, that is, after the rain season. The benefits of this intervention are many; feeding livestock with fodder improved livestock quality and reduced livestock poverty deaths, it enhanced income generation for farmers (economic sustainability) and it also saved the environment through reducing livestock reliance on grazing (environmental sustainability). Respondents who did not prepare fodder cited several reasons like lack of knowledge (47%), unavailability of resources (24%) and lack of interest(11%).

Pasture shortage has been mentioned as a significant challenge of livestock production. As a result Plan International and the Veterinary services department introduced an intervention to preserve and prepare fodder to feed livestock. The two organisations trained the farmers to prepare fodder using locally available resources which include stover, urea and molasses.

#### 5.7.2. Improved livestock structures

Of the sampled respondents, in ward 3, 17% have constructed three cross sectional kraals while in ward 4, 11% have constructed three constructional kraals (Fig. 6). With three cross sectional kraals, farmers have an opportunity to rotate their cattle to reduce mud accumulation which is the root cause of foot rot and other bacterial cattle diseases while with old kraal structures farmers cannot rotate

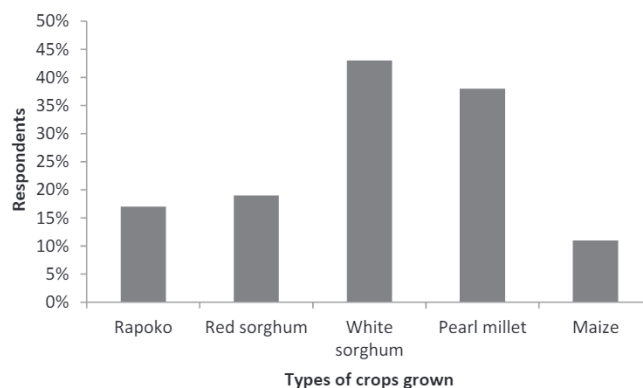


Fig. 5. Types of small grain crops grown.

their cattle during incidences of mud accumulation to reduce their vulnerability to shelter induced diseases.

The type of housing structures in relation to the type of weather experienced in Chiredzi district was reported to have caused some diseases on livestock. The most common types of livestock kept are goats and cattle, these have suffered foot rot due to extensive accumulation of water in kraals which is due to flash floods. Chickens were reported to have suffered air borne diseases due to poor housing structures with no proper ventilation. As a remedy to the above mentioned disasters communities are improving livestock structures. They are working with the Veterinary services department and support by Plan International.

5.8. Off-farm climate smart interventions

5.8.1. Village savings and lending (VSL)

Research findings revealed that household poverty is a strong factor that inhibits attainment of sustainable livelihoods in communities as mentioned by 71% of the selected respondents. Communities in the studied wards have formulated cash based off farm climate smart interventions that targets to alleviate poverty. People have formulated Village Savings and lending (VSL) groups with each having group members within the range of 12 to 25, making monthly contributions. The contributed funds were loaned to willing individuals who would re-pay at an agreed date but with an interest attached. In ward 3, 63% females and 29% males indicated to belong to one of the VSL groups formed while in ward 4 it was 71% females and 22% males (Fig. 7).

The Village savings and lending scheme was a fundamental source of income. Income generation is critical as it facilitates attainment of economic sustainability and social sustainability in communities.

Economic challenges and devaluation of the bond note in Zimbabwe has made people to adopt various options for their monthly contributions. In the studied area, 21% indicated that they were using United States Dollars, 38% were using South African Rand, 13% used goats as form of contribution while 11% are still using bond notes (Fig. 8).

Majority of households in Chiredzi District also depend on remittances. This helps to explain why some of the households have adopted the South African rand (ZAR) for their monthly contributions. Findings indicate that ZAR rand was mostly used because South Africa is one of the closest neighbouring countries where the economically active population (especially men) migrates to earn a living and remit home.

5.8.2. Benefits of the VSL scheme

The VSL scheme brought innumerable benefits to the communities where it was implemented. VSL participants used proceeds generated to improve their roofing and walling materials on their houses. The findings revealed that participants managed to deviate from traditional pole and dagga shelter structures thatched with grass. Of the sampled proportion of VSL participants, 31% have used asbestos sheets for roofing, 59% have used iron sheets and 12% are still using grass. This justifies the significance of the off-farm climate smart intervention as a strategy for mitigating impacts of climate change fostering to attain social sustainability. Use of better materials to construct houses helped to increase communities’ capacity to withstand the effects of flashfloods which sometimes occur in Chiredzi District.

5.8.3. Biogas system

Plan International launched the biogas project in communities of Chiredzi District. It assisted farmers with biogas digesters and cement for constructing tanks. It also engaged trainers of the biogas project to train farmers. The biogas project was mentioned as important to conserve the environment through reducing forest loss for fire wood. People who adopted the biogas system used cow dung instead of firewood. However very few people used the biogas system due to lack of incapacity. Plan International only assisted a few homesteads considered as learning points for the project. Majority failed to acquire resources.

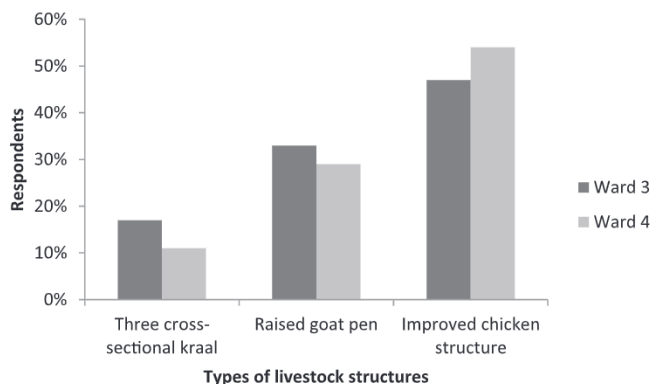


Fig. 6. Improved livestock structures constructed.



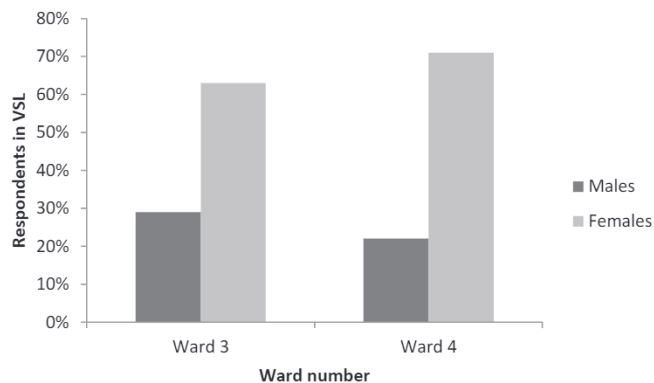


Fig. 7. Percentage of farmers in VSL groups.

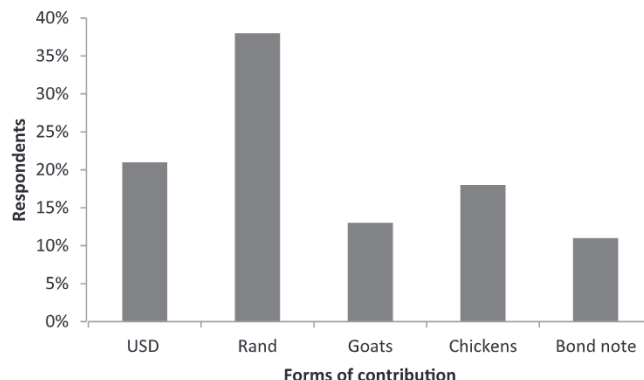


Fig. 8. Forms of VSL contributions.

## 6. Conclusion

Climate smart interventions are very critical in managing consequences of climate change and fostering attainment of sustainable livelihoods. Climate/weather variables such as extreme temperatures, low and erratic rains have been identified as having negative impacts on efforts to achieve sustainable livelihoods. These climate variables impact all three critical domains of sustainable livelihood namely: environmental sustainability, social sustainability and economic sustainability. The combination of these three make up sustainable livelihoods.

Climate smart interventions such as adoption of small grains, post-harvest management practices have improved food production and availability in the studied area. This is so because the adopted practices ensured food availability. Some livestock production practices for example fodder production also aided to food security status of the households in the district.

Various climate smart interventions have been identified during this study which are being implemented in communities as possible solutions for the attainment of sustainable livelihoods. In the studied area people have adopted conservation agriculture. Various conservation agricultural practices were practiced and it was explained that they aid in increasing food production and conservation of agriculture land for future generations while meeting immediate needs of the present generations.

## 7. Recommendations

The Government of Zimbabwe must encourage more stakeholders/ development actors to assist vulnerable communities to adapt and cope with climate change impacts. This will help to manage environmental degradation which is being aggravated by climate change, hindering sustainable livelihoods. Chiredzi Rural District Council (RDC) and Development Coordinators must organize education and awareness campaigns in areas of their jurisdiction. This will help information dissemination to most vulnerable community members. Availability of knowledge will aid in decision making. More climate smart interventions must be designed in communities to manage agricultural hazards from various angles to buttress sustainable livelihoods in the path to sustainable development.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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