

The Impact of Climate Change on Food Security and Livelihoods In Zimbabwe: Assessing the Sustainability of Intervention Strategies Adopted In the Matabeleland South Province, Zimbabwe.

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Abstract

The study explores the knowledge levels held by communities about the impact of climate change on food security and livelihoods in Matabeleland South Province of Zimbabwe. The study identifies and describes how climate change has impacted on these variables; and establishes the types of micro-mechanism coping measures the communities have initiated to address challenges that frustrate attainment of their food security and livelihoods in this Province. The study goes further to identify the long term intervention strategies adopted; and subsequently assesses their sustainability towards ensuring food security and livelihoods. The study finally advocates for a more sustainable model of intervention strategies resilient enough to take care of, nurture and rehabilitate the natural resources base, the ecosystems and biodiversity. Such strategies are projected to be robust enough to withstand all forms of challenges that emanate from the dynamics and numerous impacts of climate change for the purposes of maintaining equilibrium in terms of serving the needs of the current and future generations. To achieve resilience, robustness and sustainability, the study brought on board the participatory concept and monitoring and evaluation elements to the intervention strategies to close the gap that exist in the strategies for continuity. The study reviews various journal papers, chapters in books, conference proceedings and summit meetings [14 , 70]. Articles relevant to the topic under review were utilised to show the gap(s), contradictions and silences in the existing knowledge base. The review process uses the desk type of research method.

Keywords: Climate change; impact; food security; livelihoods; adaptation; mitigation; sustainability; intervention strategies; Zimbabwe.

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1. Introduction

Climate change is emerging as a critical development issue [2]; and has become very topical not only in Zimbabwe, but the entire sub-Saharan Africa as well as globally. Zimbabwe has been experiencing a marked shift from its normal climate as evidenced by droughts and erratic rains that have now become more frequent; with wet seasons becoming shorter. Droughts and floods have become more intense; thus threatening food security and livelihoods of the poor people; particularly in the countryside [7, 74].

68% of the Zimbabwean population is found in the rural areas [80] where climate change hits hardest. By and large, all sectors of the society end up being affected; and yet the capacity of Zimbabwe towards handling climate related disasters in terms of mitigation, intervention and adaptation strategies as well as the gaps that exist in addressing climate related problems has presented many challenges that need to be addressed [51, 72]

Integrating climate change into issues of development and food security has been a challenge for many governments. The issue of climate change is being given low priority, treated separately from food security; thus it has had to compete for government time and financial resources [59]. The integration of climate change issues across all affected national interests and international policy domains is deficient [51, 10]. Meanwhile, the knowledge available is that climate change is intensifying hazards that affect human livelihoods, settlements and infrastructure [2, 41, 58]. Furthermore, climate change is also weakening the resilience of livelihood systems in the face of increasing uncertainties and the frequency of disasters [3].

In Zimbabwe, management of disasters resulting from the impacts of climate change is biased towards emergency responses rather than mitigation. The tendency in Zimbabwe is to wait and then start running around for resources after disasters have hit communities; thereby creating a short sighted response despite the fact that damaged or disrupted livelihood systems take time to mend and rebuild [51, 60]. A case to mention are the Tokwe-Mukosi floods in February 2014 where people who had settled very close to the peripherals of the Tokwe – Mukosi River got marooned after the walls of the dam collapsed following the heavy rains that led to floods. Subsequently, people and livestock were marooned in water; prompting helicopters to fly to the affected areas to advise people to move to higher ground. However, it was too late because people were already surrounded by water; and communities lost their homes, livestock and assets [82].

The major droughts of 1992 and 2003 caused losses of livestock, but focus was largely directed towards restocking efforts without addressing the critical issues of the carrying capacity, sustainability of thresholds and the ecological footprint of large livestock numbers in the context of diminishing grazing areas and the special contingent measures on the feed [40].

The most recent case in point is the impact of Cyclones IDAI and Kenneth that hit the South East African region in the months of March and April, 2019; and left hundreds of thousands of people homeless in Manicaland [34, 47]. The assessment has revealed that the types of houses built in the rural areas cannot withstand the impacts of cyclones; and this is despite the number of times cyclones have destroyed several areas in the eastern districts of Zimbabwe; particularly Chimanimani, Lotito and Inyanga [15]. Homes were destroyed because they were

built with material not robust enough to withstand the strengths of cyclones and strong winds. This is regardless of the propositions to reconstruct and improve homes and other infrastructures to withstand the impacts of cyclones [41]. Again in this case, the corrective measures have been more reactive confirming lack of preparedness.

2. The Discussion

Climate change has emerged not only as a critical global development subject affecting many sectors of the world, but is considered as one of the most serious threats to sustainable development [9 ; 44; 5 ; 68 ; 2 ; 79 ; 69]. Climate change and its variability is a major threat to biodiversity and natural ecosystems and is not only here amongst us, but it is real [44 , 71]. The complex, dynamic and periodic challenges that emanate from climate change have created problems in predicting the true climatic conditions likely to prevail in any given geographical area globally; Africa inclusive [62 , 4]. The ubiquitous, harsh and destructive nature of climate change has resulted in the rising of oceans, cyclones, floods, strong winds, extreme temperatures, hailstorms and erratic rainfall patterns that have caused severe droughts with adverse effects to ecosystems, human life and other species [1 , 43 , 71 , 6 , 76]. The climatic patterns affect agricultural activities that form the major source of food security and livelihoods in Africa and the Asian – Pacific countries [59 , 25 , 20 , 26] . Such developments have driven a lot of countries to embark on research studies on climate change and variability for various purposes [2], but predominantly to identify, describe and locate challenges and bring forth solutions to address the varied impacts of climate change through adaptation and mitigation amongst other efforts [68 , 31 , 56]. As a result, the terms “climate change and variability” have become very common, but complex brand names for scholars, researchers and development practitioners; let alone the man in the street and in the rural areas in almost every country in the world.

Albeit, the local people in Southern Africa are not strangers to climatic risks. For that reason, they have developed assorted mechanisms to cope with challenges thereof, except for the most extreme events [7 , 63]. However, climate change may bring about new sets of weather patterns and extremities well beyond what the local communities in this part of the world are capable of handling and dealing with [2 , 6]. This predicament may exacerbate the need for external help to be necessary to rebuild or enhance social and ecological resilience amongst the rural communities [35].

Zimbabwe is prone to periodicity of droughts [13], shifting rainfall patterns, destructive cyclones and floods. This situation has the potential to increase in intensity and frequency as the global climate changes; resulting in severe droughts and extreme weather events likely to affect food security and livelihoods [2 , 41]. Notably, in the recent years covering period 2000 to 2019, this situation has contributed to serious food shortages, damage to infrastructure and degraded natural resources on which people’s livelihoods are based [32 , 20 , 49]. Amongst the regions greatly affected is Matabeleland South Province plagued with recurrent droughts, strong winds and floods; and the area experiences the highest levels of food insecurity. Further, this province falls under region five which is the driest of the regions in Zimbabwe and its major livelihood is biased towards cattle ranching [7 , 13 , 57].

Significantly communities in this region heavily rely on rain fed agriculture, however, climate change has created droughts that have resulted in prolonged food insecurity in the Matabeleland South districts; thereby attracting the perennial presence of government owned assistance and humanitarian agencies that have run food aid programmes in the past 15 years [13]. Notably, this state has encouraged a dependency syndrome within communities [31 , 50 , 57]; subsequently hijacking the capabilities and potentials of communities [52]. The often unpredictable and potentially violent effects of changing climates are influenced by and deeply affect how food is produced, how weather and forests resources are managed. These factors present opportunities for mitigation and adaptation on climate change [49].

The authors in [16] and [7] have highlighted the need for adaptation within communities. In support, [60] , [8] state that the benefits of strong and early action on adaptation far out weight the economic costs of inaction. In a bid to bring adaptation to the community level, [8] undertook participatory vulnerability and adaptation assessments at scale and across a number of sectors both in the rural and urban areas in several communities in the southern parts of Matabeleland South Province to improve livelihoods. The focus was to introduce development of community based adaptation (CBA) strategies to enhance adaptive capacity, anticipate, cope with and respond to and recover from climate variability and extremes. The major activities undertaken were on irrigation, crop mixing, breed mixing, availability of fodder, nature conservation and monitoring of climate. Having executed these activities, results indicated that it is pertinent to recommend re-conceptualisation of participation in CBA projects qualifying this strategy as an instrument to empower communities to influence policy making at all levels.

The author in [71] observes that of 49 least developed countries in the world; 33 are in Africa and need to undertake national adaptation programmes of action (NAPAs). These policy frameworks are dedicated to identifying and prioritising critically important activities, however, any further delays might increase vulnerability or lead to higher adaptation costs. The Author in [23] states that some of these adaptation measures are spelt out in the Paris Agreement of 2015; which essentially urges countries to promise a certain level of mitigation they are comfortable with. However this Agreement also mandates these states to reach their own targets. The aim of the Paris Agreement is for the world to have long term effectiveness and gradual decrease in the control of emissions of Greenhouse Gases. Authors in [61 , 71] define adaptation as a process that societies need to undertake to increase their ability in terms of coping with uncertainties of the future. Author in [46] is of the view that adaptation involves taking appropriate actions and making adjustments and changes within communities to reduce negative impacts of climate change on food security and livelihoods.

The authors in [69] explore the perceptions of smallholder farmers in the relation to the impact of climate change on livelihoods in the Mangwe District, in the Matabeleland South Province; and how it affects their decision making in instances of adopting adaptation strategies. Mixed farming was found to be the main source of livelihoods in this part of the country [42]. Though smallholder farmers perceived changes in climate, majority did not clearly understand causes of this phenomenon regardless of its visible negative effects on agricultural production in both crops and livestock. Gold panning, formal and informal activities and remittances serve as alternative sources of livelihoods. Authors in [69] recommend training of smallholder farmers to provide information through awareness campaigns and mainstreaming of programmes related to

issues of climate change to address limited knowledge of information on this phenomenon. This prescription is viewed to have a potential towards attaining sustainable food security and livelihoods. However, this presents an element of assumption, and falls short of any follow up in terms of monitoring and evaluation to ensure the successful implementation.

Authors in [81] located their research in the Munyawari Ward, in the Goromonzi district, Mashonaland East Province in Zimbabwe to understand the types of livelihoods, the perceptions and socio-economic problems affecting communities in the face of climate change in this district. The study assessed the impacts of climate on communities; and observed that communities use traditional methods to harvest rain water, ration and recycle this commodity to irrigate their gardens. Findings indicate that there is a myriad of sources of livelihoods adopted such as harvesting forest products like wild fruits, fire-wood and thatching grass for both consumption and sale, selling of small livestock, migration, gold panning and growing of small grains to earn a living. However, in the height of droughts, Christian Care and other non-governmental organisations provide food relief to communities.

The authors in [81] suggest incorporation of indigenous knowledge and weather systems into climate change policies to develop effective strategies that are participatory and sustainable towards ensuring food security and livelihoods. For example, indigenous knowledge systems are used in forecasting the weather to guide communities in their preparations for related agricultural activities. Authors in [81] concur with [12] on the incorporation of indigenous knowledge systems into climate change policies for effective adaptation strategies that are cost effective and sustainable to address climate variability. However, no elaboration is made on how to achieve the suggested sustainable ways; and so are the wetlands and how such natural assets could be used sustainably to achieve livelihoods.

Authors in [50] investigate the impact of climate variability with a special focus on drought as the key climate risk on the sustainability of agricultural production and development in the Chivi district, Masvingo District in Zimbabwe. Findings suggest that drought has an effect on the sustainability of crop and livestock production. Although smallholder farmers seek off - farm employment, sell livestock, partake in the food for work programmes, they also receive food aid from non-governmental organisations in the quest to manage risks emanating from the impact of climate variability.

Albeit, findings further suggest that in the long run, growing of small grains namely; millets and sorghum, conservation agriculture, crop diversification and soil and water conservation are likely to be more sustainable adaptation options. However, shortage of labour and inputs, unreliable water sources and grain-voracious birds that destroy crops are cited as the main constraints to achieving sustainability of these adaptation options. However, [50] do not suggest or explore how the constraints can be mitigated against.

The author in [31] explores how climate change and variability has impacted on agriculture as a livelihood activity for many peasant farmers in the Bikita communal area, Masvingo Province. The study examines the adaptation and mitigation strategies devised by farmers in dealing with the vagaries of climate variability; and interrogates the sustainability of such measures by looking at the strengths and weaknesses of the adopted

strategies. Chiefly reviewed is crop diversification, drought resistant crops and small grains, sale of livestock and diverse livelihoods such as firewood trade and brick moulding for sale, conservation agriculture and social capital. Findings suggest that crop and livestock are heavily affected by drought; with livestock strictly sold as a last resort. As such, author in [31] discourages selling of such assets to avoid households plunging into abject poverty; and thus concurs with [56]'s sentiments on this strategy. Besides being drought resistant, small grains (millets and sorghum) are used to brew traditional beer to raise cash and serve as payment for labour. Commercial brick moulding, firewood trading and beer brewing comprise diverse livelihood economic activities that households embark on to address the failing agricultural production. These activities help to widen sources of income to enhance sustainable livelihoods and food security. However, extractive processes from fauna and flora have been described as unsustainable because of their destructive and desertification effects to the environment; and findings thereof corroborate with those of [38]. Crop diversification and mixing tend to create chances of a good harvest and help to improve food security in the long run; particularly in the Bikita district. Though conservation farming serves as a mitigation and adaptation strategy, it needs draught power and good training for farmers to be effective. Despite many households taking up this farming, this adaptation strategy has not yielded desired results in Bikita district. As a result, smallholder farmers receive food aid to cushion themselves against the vagaries of climate variability. Albeit, author in [31] discourages this dependency and donor sponsored inputs; and recommends distribution of subsidies to production to counter this syndrome. Use of indigenous knowledge systems and traditional myths and social capital are found to be ideal for addressing the impacts of climate change and variability in the Bikita district.

2.1 Food Security and Livelihoods Perspectives

The author in [56] takes a look at the vulnerability of low income rural households to food insecurity and environmental risks encountered in the Matobo district. Special focus is on how climate change and socio-economic factors have affected households' food security; leading to hunger that has caused nutrition and health problems that have inhibited sustainable development of human resources. Findings reveal that most households are vulnerable to food insecurity at household level resulting from erratic rains and unemployment; leading to loss of assets such as livestock. Inselbergs have decreased the cultivation space and harbour wild animals that are a threat to livestock; an important endowment in times of crisis. Family size and HIV / AIDS are contributory factors to vulnerability to food insecurity. Shortage of inputs and labour deter agricultural production and frustrate achievement of food security. Drought resistant crops, forest products nutritional gardens are used to address shortage of food, however, these coping measures have proved seasonal and inadequate in addressing vulnerability to food insecurity. Social networks and remittances are complementary sources of livelihoods, but suffer from inconsistencies. Contrary to author in [56]'s findings, [31] found social capital to be working well for the communities in the Bikita District. To address causes of food insecurity, [56] prescribes setting up of all year round irrigation schemes for crop cultivation and establishment of pen feeding to prevent livestock mortality.

2.2 Food Security

The author in [64] explores the determinants of household food security in the semi-arid areas of Zimbabwe by

comparing irrigation farming with dryland farming situated in the Tshongokwe and Lukhosi in Lupane and Hwange respectively. The investigation establishes problems experienced by households who operate irrigation schemes and non-irrigation farmers; and findings indicate effectiveness of irrigated farming over dryland farming. However, drought, unreliable rainfall resulting in scarcity of water, household and farm sizes have a negative and significant relationship on the household food security. These factors coupled with unsuitable production techniques have a greater probability of driving households to be food insecure. Also revealed is a positive and significant relationship between access to irrigation farming, application of fertilizers, cattle ownership, per capita aggregate production and household food security. Proven is the effectiveness of irrigated farming over dryland farming in the semi-arid areas where irrigation scheme operators are able to feed themselves throughout the year, diversify their crops and earn higher incomes from irrigation farming in comparison with dry land farming.

It is important to mention that the effects of the family size are also highlighted by [79] in their research in Ethiopia. Though author [56] did not focus on irrigation schemes, his study cited sizes of plots that were affected by too many inselbergs as a deterrent factor in achieving food security in the Matobo district. Author in [64] presents findings of a comparative study between irrigation farming and dryland farming; and benefits of the former and factors that affect food security. Notably, the study under review intends assessing the sustainability of irrigation schemes to determine inherent problems that deter their efficient operation for rectification to achieve sustainability.

The author in [54] investigates the impacts of frequencies of droughts on smallholder farmers and how these affect food security status of households in the Lower Gweru and Lupane Districts of Zimbabwe. Also assessed is the vulnerability of smallholder farmers to food insecurity resulting in poverty in the context of climate change. The argument of the research is that most studies are done at global and national level instead of local levels; and the study measures vulnerability through use of Chaudhuri's model. Findings indicate that cereal crop production is the main coping strategy in the two districts; and this is confirmed by large pieces of land allocated to cereal production. However, 88% of the households in both districts are vulnerable to food insecurity and still have more chances of being food insecure. However, cited is the role of non-governmental organisations in their efforts to help reduce households' vulnerability against the effects of climate change. Notably, the role of NGOs is also cited by [52; 31 and 50].

The author in [31] explains that the NGOs provide food aid rations to offset food shortages due to the recurrent poor harvests. These institutions introduce new crop varieties that are able to withstand the long and protracted hot spells; and the new cropping systems such as conservation agriculture to enhance food security in drought prone regions. Author in [50] contends that the NGOs also provide inputs such as seeds and fertilisers and training to the communities to help adapt to the vagaries of climate change. However, [52] and [31] lament the provision of handouts that tends to create a chronic dependency syndrome as peasant farmers become reluctant to grow their crops because they will be knowing fully well that they will get food rations in the subsequent seasons [52 , 31 , 50 , 17].

The author in [68] calls for strengthening of the coping capacity of the poor, and explains that anticipatory

action is essential to safeguard lives and livelihoods; and also provides various adaptation options that include growing of crops to cater for animal feed and forage as well. Item 5.3.2 of [68] - the [68] urges monitoring of existing practices and performance as important. Also needed is rigorous evaluation of the effects of mitigation and adaptation interventions for their impacts and relevant outcomes as well as on food security to ensure there are no unintended negative consequences. However, [68] just mentions this recommendation but in passing, with no fulfilment in terms of how this has to be achieved. Hence the inclusion of monitoring and evaluation processes in the project under study to strengthen the resilience of intervention strategies adopted in the Matabeleland South Province.

The authors in [57] analysed changes in climate and weather patterns in the Gwanda, Mangwe and Matobo districts and discussed impacts of climate change on traditional farming practices over the past 20 years. The Government of Zimbabwe, 2013 [as cited by the author in [57] states that weak disaster risk – reduction institutional arrangements for climate change at the village, ward, district, provincial and national levels have not assisted in facilitating building of resilience on livestock and crop management in Zimbabwe. Resultantly, smallholder farmers are vulnerable to droughts, heat waves, mid-season dry spells, frost and floods; necessitating concerted efforts to be undertaken by stakeholders to come up with viable mitigation and adaptation strategies to promote resilient farming practices amongst subsistence farmers [18 , 27 , 28 , 73].

The author in [7] carried out a study in the Mangwe and Bulilima Districts in Matabeleland South Province on the approaches centred on livelihoods; and encouraged community based planning to promote community empowerment and ownership of development processes to address challenges related to disaster risk management, development planning, transport, sanitation and health problems. Observations indicated that largely missing from the plan is the input from the community grassroots particularly towards addressing the slow onset of disasters namely droughts and HIV / AIDS. The study by [21] on the effects of climate change on livelihoods in Matobo District, South West Zimbabwe suggest that urgent climate change programming steps be taken to prevent catastrophic effects on livelihoods in the semi-arid regions in the Sub-Saharan Africa.

Regardless of being surrounded with waters and oceans, Timor Letse in the Island in Madagascar is also affected by the impacts of climate change [75]. The author in [11] presents a report on the evaluation of the effectiveness and sustainability of CARE programming on selected projects set up in the Timor Letse Islands in relation to households' adaptive capacity and reduced vulnerability to climate hazards. Though these Islands enjoy a range of food sources from agricultural activities and forests, many households experience food shortages at some point in the year resulting from high temperatures and erratic rainfall. Notably, there are fewer alternatives to ensure food security and livelihoods [75 , 11 , 76]. To address this vulnerability, author in [11] has set up a range of projects on food security and for disaster risk management activities in these Islands. The evaluation exercise targeted the vulnerable people to integrate climate change adaptation into development planning and programming to ensure activities are effective and sustainable. The findings of the evaluation are to instil community based disaster preparedness and drought mitigation to reduce vulnerability and increase resilience and food security .

The evaluation focused on checking the effectiveness, impact and sustainability of CARE programming in the

Timor Leste Islands in relation to the strength of planning for climate hazards, agricultural production and livestock farming. Findings concluded that to-date, the programme impact is limited in part because vulnerability is not well understood. In addition, activities could have achieved a stronger impact if they had more specifically designed responses in relation to relevant hazards. Though author in [11] brings in the concept of evaluation, focus is on checking the effectiveness, impact and sustainability of CARE Programming in relation to the strength of planning for selected projects on food security and livelihoods in the Timor Leste Islands.

The authors in [39]'s research augments very little literature that concentrates on the critical relationship of social variables, agriculture, food and climate change together. To bridge this gap, author in [39] examines the relationship between agricultural practices and social practices in relation to the severity of food security; and concentrates on the potential impact of socio demographic factors and climate change. The study examines how the agricultural practices in terms of selection of seeds, choices of irrigation methods, use of fertilisers and pesticides are strongly associated with different socio demographic factors such as land ownership, religion, gender, education and occupation; and how these factors affect food security in the rural households of Bangladesh.

Based on the data from the 2012 Bangladesh Integrated Households Survey (BIHS), findings suggest both agricultural practices and food security are very complex issues associated with different socio demographic factors and climatic variabilities; and these variables play an important role as predictors of agricultural practices for household food security. Production of food and sources of livelihoods are the two dimensions of agriculture significantly influenced by socio economic factors and climatic variability. Land ownership, religion, gender, education and occupation also affect food security in the rural households of Bangladesh. Further, gender and food insecurity factors are significantly associated; and likewise the small land ownership and food insecurity.

2.3 Adaptation Strategies

Authors in [2] review agricultural adaptation strategies employed by farmers in various countries in Africa in cushioning themselves against effects of climate change; and examined is how these strategies can be maximised for efficiency. Crop and livestock are presented as the mainstay of most African economies and adaptation strategies adopted to address the effects of climate change and variability in Africa. Authors in [2] define adaptation as adjustments in natural or human systems undertaken to respond to actual or expected climatic stimuli or its effects; to moderate harm or exploit beneficial opportunities likely to arise from the impact of climate change. Chiefly tackled are numerous crop strategies, processes of carrying them out and their advantages; and these comprise drought resistant crops, diversification of crops, changing of crop patterns and calendar planting, conservation of soil moisture, irrigation and mixed cropping practices. Afforestation and agroforestry that serve as adaptation and mitigation methods to discourage the emissions of greenhouse gases are brought up too, to deal with effects from climate change [78]. Various methods of enhancing livestock breeding particularly to withstand the critical drought times, to tolerate heat and diseases are highlighted and integrate pasture management. Reduction of livestock numbers is a mitigatory measure to reduce emissions of

GH gases. The discussion includes water harvesting methods and setting up of underground dams to augment water sources for livestock [29]. Encompassed is training of livestock herders to produce, conserve and improve animal feed and fodder to deter malnutrition and mortality in herds. Labour migration and remittances form a major source of livelihoods and provide a key coping mechanism during droughts and non-drought years. Nomadic movements of pastoralists are migratory and adopted as a pasture management and environment conservation method to minimise pressure on grazing land and scarcity of water sources.

To address lack of knowledge expertise and data on climate change issues that limit adoption of agricultural adaptation strategies in Africa, authors in [2] prescribe training programmes, research activities and initiation of specific institutional frameworks for climate change to bridge such gaps; with proactive adaptation to be taken into account in long term decision making. Non dependency on climate change and income diversification activities are recommended to supplement food security and livelihoods; and the introduction of incentives to modify behaviour in response to climate change. The authors in [2] state that the human capital can be strengthened through education, outreach programmes to enhance the capacity to adapt to the impact of climate change.

Though the study under review intends assessing livestock and crop as long term intervention strategies, it takes into account ranching management systems; and assesses small grains adaptation only. The study intends addressing the reactive concept and therefore concurs with [2] on proactive adaptation.

The authors in [5] view conservation agriculture as one of the most promising ways of implementing sustainable agriculture; while minimising the environmental degradation affecting the African continent. Due to scarce documentation of results and lessons learnt, the study seeks to assess and distinguish conservation agriculture from a theoretical perspective and practical view. The purpose is to develop a framework that enables rigorous analysis of ongoing conservation agriculture projects, experiences encountered and to document how such practices are adapted, adopted and their effects in a holistic way [55 , 66]. This farming system uses core principles of minimum soil disturbance, no tillage seeding, soil cover and use of crop rotations; to protect the environment, improve productivity and sustain environmental resilience.

Ghana, Kenya, Uganda and Zambia are used as the case study countries for conservation farming. Focus is on the controversial issues that farmers face in implementing conservation agriculture, techniques, processes, lessons learnt, short comings and successes to improve conservation agriculture, project planning and implementation [5]. Findings reveal challenges and problems that farmers face in taking up conservation agriculture within and outside Zambia. While conservation agriculture takes advantage of early rains, it increases labour for weeding that doubles compared to the conventional plough system. Two to three weeding processes are done per season instead of the recommended six. Meanwhile, HIV / AIDS is a constraint to labour too. Dryland preparations are difficult to dig; and are affected by grazing, roaming animals and termites. The Zamwibe pesticide provided to destroy weeds and resolve labour issues, faces challenges and fears of affecting soil fertility [5]. To overcome related problems, [5] prescribe training, mid to long-term investment and careful monitoring of systems for several years. However, this type of farming method is also affected by lack of data concerning its benefits. The concept of monitoring is brought up, however, “for several years”

sounds too indefinite and lacks the appropriate breakdown and the implementation process. While conservation agriculture is one of the intervention strategies to be assessed to determine its sustainability in the study under review, there are other strategies to be assessed too, towards coming up with a model to enhance the resilience of intervention measures against the impacts of climate change.

The author in [13] identifies rural livelihood strategies devised by people in Mandiwongola Ward 12, Gwanda South, Zimbabwe to manage droughts and fight food insecurity in the harsh climatic conditions. Characteristics of particular strategies are assessed to qualify what makes them resilient during droughts; and challenges that face households in implementing such strategies are highlighted. Growing of drought resistant crops namely millet and sorghum, intercropping, conservation agriculture, increased crop spacing and livestock rearing are the commonly adopted strategies. However, the grainivorous (seed eating birds) feed on crops; whereas the stream bank, steep and down slope cultivation affect water inflows into the rivers. Gold panning, harvesting of mopane worms and food - for - work projects enhance livelihoods. Conservation agriculture, increased crop spacing and interspacing are viewed to have potential of creating efficiency in the management and storage of limited soil moisture to ensure food security in the harsh climatic conditions. Livestock provides draught power and serves as an endowment equivalent to bank savings. Movement of livestock to better grazing areas supplements inadequate feed and water, helps to conserve the environment and reduces mortality rate [13]. Use of early warning systems with improved dissemination of climate change related information, construction of more dams and desiltation, irrigation schemes and harvesting of crop residues in favour of livestock feed are prescribed to enhance food security and livelihoods. Intensification of non-farm production is encouraged to be given equal attention like on - farm activities to reduce vulnerability to food insecurity.

Like authors in [56] and authors in [2]'s studies, the study encourages giving non-farm production an equal attention like on - farm activities to enhance livelihoods and setting up irrigation schemes. However, there are no measures recommended on how to ensure effective management of such adaptation options to achieve sustainability. Meanwhile, the study under review intends identifying the flaws that hinder efficiency in the implementation of intervention strategies such as irrigation schemes, livestock and fodder and pasture management amongst others to maximise resilience to achieve sustainability.

The author in [79] analyses the status of small householders' food security and its determinant factors, the vulnerability to food insecurity and coping strategies used in the three districts in East Hararghe, Ethiopia. The study further examines the current degree of vulnerability to food security in the face of climate change in the three districts in Ethiopia; and projects the future trends of vulnerability. The study identifies the most effective food insecurity coping strategies adopted by households against climate change; and focuses on the Kersa, Fedis and Babile districts. Findings indicate a high rate of food insecurity in Fedis; with more households likely to be food insecure in the future than present. The increase in the members in a family and their location is likely to reduce food security status of households. More importantly, the family size is viewed to be one of the leading causes of food insecurity in terms of consumption. The author in [79] observe that households who perceive effects of climate change and adopt adaptation strategies such as soil and water conservation, change their planting dates and utilise the onset of rains at any given time tend to be more food secure than non-users of such strategies.

Community savings, accumulation of livestock and assets and reduction of food consumption are adopted to enhance livelihoods. The authors in [81] also mention reduction of food consumption as a coping strategy against the impact of climate change. Social capital helps during droughts and findings corroborate with those of [31]; meanwhile diversification of sources of livelihoods to include non-farm activities is encouraged as recommended by [56, 31] and [13]. Family planning is recommended to optimise family size; and have this measure given adequate attention by federal and regional governments. The concept of family size is also highlighted by [64]; and reliance on government food aid is discouraged. While adaptation and coping with climate variability and change have become key themes in the current global climate discourses and policy initiatives [61, 66,], author [46]'s argument is that literature on coping strategies as distinct from adaptation strategies appears to be still limited, with literature making reference to adaptation broadly. Using a case study of Zambia and Zimbabwe, [46] sets to understand farmers' perceptions and the nature of risks and strategies employed by farmers in dealing with the adverse effects of climate change. Identified are the coping strategies, indigenous and innovative adaptations adopted by four selected districts in Zambia towards addressing this phenomenon.

2.4 Coping strategies

The author in [46] bases this move by citing IPCC, (2001 p.80) and states that this was imperative as current knowledge of adaptation and adaptive capacity is insufficient for reliable predictions of adaptations; and for rigorous evaluation of planned adaptation options, measures and government policies. The study clarifies between coping strategies and adaptation strategies as intervention measures adopted to address the effects of climate change and variability. Author [46] cites researchers such as Cooper and colleagues 2007; Ellis, 2000; Mortimer and Manvel, 2006 who describe coping strategies as actions invoked following a decline in the "normal" sources of food levels, and regarded as involuntary responses to disasters or unanticipated failures in major sources of survival. These actions are believed to have evolved over time through people's long experiences in dealing with the known and understood natural variations.

2.5 Adaptation strategies

Davies, 1993 [as cited in in author [46] explains that adaptation strategies are "means of permanent change in ways in which food is acquired, irrespective of the year in question. Adger and colleagues 2003; IPCC, 2001; Reid and Vogel, 2006 [as cited in author [46] add that such strategies include positive actions adopted to change the frequency and / or intensity of impacts, as opposed to coping strategies devised in response to impacts once they occur. Author in [46] explains that coping strategies are short - term measures reactive in nature; and adopted to address shocks and crises, however, these are let go when shocks are overcome. Climate change and variability impact negatively through drought spells, floods and excessive rains; resulting in poor agricultural production, loss of livestock, destruction of infrastructure and cause scarcity of drinking water either through drying up of water sources or contamination of same during floods. However, floods provide water to the forests and for watering animals and resuscitate underground water levels. Remittances are driven by the impacts of droughts, and predominantly qualify as a positive response against adverse effects of droughts; and serve as a long-term source of livelihoods.

Conservation farming methods, upland cultivation, crop diversification are adopted during floods; while drought coping strategies comprise drought tolerant crop varieties, livestock rearing and crop diversification. Classified under coping strategies and as rapid responses to crises is gardening, sale of crops and of livestock which is a sign of wealth; making disposing of such assets strictly discouraged and done as a last resort. Author in [46] gave a clear distinction between coping and adaptation strategies which have however, become contextually defined, interchangeable and dictated by specific geographical and temporal circumstances. Albeit, the study under review initially identifies intervention measures which comprise coping strategies and long term types; and subsequently assesses the sustainability of long term strategies in the sense of having realised that such strategies have been adopted and used repetitively to address the impacts of climate change in many countries of the world; Zimbabwe inclusive, and these determine food security and livelihoods.

The authors in [38] examine the interaction of people with the environment in the process of securing livelihoods to earn a living in the Chivi district, in Masvingo Province. This follows a high unemployment rate emanating from economic meltdown, recurrent droughts and collapse of the agricultural production. Findings reveal serious damage to the environment in the process of extracting natural resources [65, 53, 19, 29] such as gold and chrome, river and pit sands, clay for bricks and cutting down of trees for sale and for art and craft to earn a living. The extractive processes have affected the infrastructure, degraded the environment on which peoples' livelihoods depend; and the damaged environment has not only encouraged emission of greenhouse gases, but has become a death trap for wild animals, livestock and people [53]; and extractive processes have been qualified unsustainable. The study under review assesses the sustainability of illegal gold panning as an intervention measure to address the adverse impacts of climate change.

3. Discussion of the Review

Extensive research work has been carried out on climate change and recommendations drawn up to address the impacts of climate change and variability to ensure sustainable food security and livelihoods. This is through mitigation and adaptation, however, the term 'sustainable' is rather loosely used for the meaning it deserves; and recommendations tend to lack a brief directive or elaboration of how continuity has to be achieved to make them sustainable. Prescriptions to address the impact of climate change tend to fall short of measures to manage and check effectiveness in the implementation to guide resilience and continuity to achieve sustainability [33, 77]. Authors in [57] call for viable mitigation and adaptation strategies to promote resilient farming practices amongst subsistence farmers. The authors in [21] suggest urgent programming steps on climate change to prevent catastrophic effects on livelihoods in the semi-arid regions in Sub-Saharan Africa. Though the concept of monitoring recommended in [5] is in tandem with [68], monitoring of conservation agricultural systems is "for several years" and sounds rather too long for measuring effectiveness to direct meaningful implementation for any corrective action. Though [38] recommend bottom – up formalisation in the extraction of natural resources to enable effective environmental legislation, rehabilitation and protection, it is uncertain how this measure has to be managed to achieve sustainability. The author in [46] backs up this observation and mentions that there is insufficient knowledge of adaptations and adaptive capacity, for rehabilitation and prediction of adaptations and for evaluation of planned adaptation options.

Notably, not much effort has been done in assessing the sustainability of intervention strategies let alone the long term ones to enhance the resilience of such measures in the Gwanda District of the Matabeleland South Province; and more so, with a view of crafting a model of intervention measures. Mawere, 2013 [as quoted in [37] affirms this assertion and notes that there has been failure to review and develop appropriate risk reduction strategies and models that are effective, efficient and economical for disaster reduction.

It is from the foregoing highlights that this research is set to close up this gap by way of identifying and assessing the sustainability of the long term intervention strategies used by the communities to address challenges emanating from the impacts of climate change in the in Garanyemba ward 13, in Matabeleland South Province. Gwanda District is amongst the hardest hit with perennial droughts and faces serious disastrous problems of food insecurity that threaten human life and livestock amongst other species. Children even drop out of school due to hunger; with some villagers eating leaves of certain tree species [36]. The droughts have stretched for over a decade [20]; however, these have gotten worse in the last few years [45]. The region receives low and erratic rainfall averaging between 300 and 350 mm annually [48 , 22 , 13 , 80]; rendering communities to harvest virtually nothing; thereby posing serious threats to human life and animals.

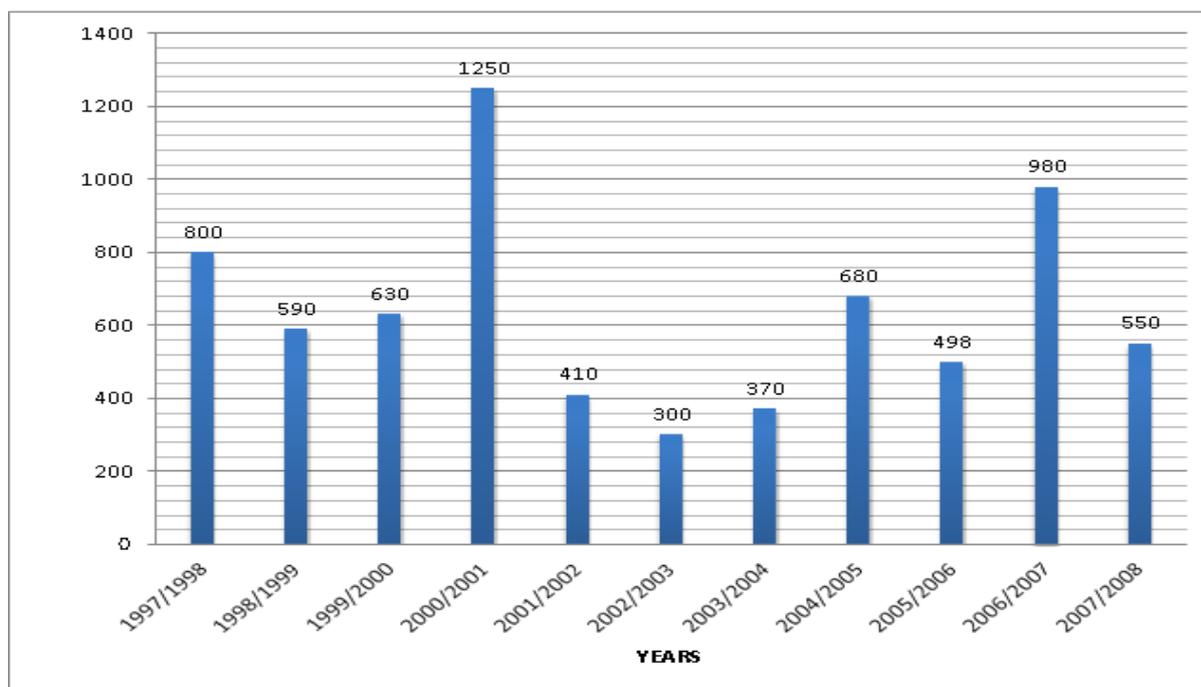


Figure 1: Highlights of Rainfall Patterns for Gwanda District for Period 1997 to 2008.

Source: [22].

Figure 1 shows rainfall as low as 401mm in 2001/2002, 300mm in 2002/2003 and 370mm in 2003/2004. Crops wither at their infancy resulting in thousands of planted hectares of land becoming a complete write off due to the reduced amount of rainfall [7 , 83 , 31]. During droughts, communities suffer from food insecurity and the collapse of livelihoods; leaving livestock not spared either [56]; and the situation is characterised by increased poverty where many people are not affording basic needs for their survival [7].

4. Conclusion

It is against the presented backdrop that this research explored the impact of climate change on the communities' food security and livelihoods for the purposes of identifying the types of long term intervention strategies adopted to avert the hardships emanating from the impacts of climate change. This is with a view to assessing the sustainability of the long term intervention strategies adopted; particularly to highlight problems inherent in such strategies that work against the efficiency of the communities at the grassroots level. The aim is to create proactive mind-sets in addressing problems inherent in the intervention strategies and use results to construct a model to strengthen resilience within the communities to enhance sustainability. Taking such measures is projected to equip communities with skills and knowledge to realise their potentials and build their capacities to reduce the dependency syndrome biased towards receiving food aid and the dependency on the rain fed agriculture [52, 13, 81, 50]. The research recommends the process of monitoring and evaluation to be applied on the long term strategies at community level to strengthen the intervention strategies adopted. Monitoring and evaluation serve to ensure resilience and the continuity of adopted strategies to avert the impact of harsh climatic challenges that affect food security and livelihoods for the wellbeing of current and future generations to achieve sustainability.

In the final analysis, while this study pursues the concept of sustainability as initiated by the Brundtland Commission Report of the United Nations [77], it also advocates for consideration of monitoring and evaluation at the end of research projects. The objective is to help projects to achieve sustainability in the best interest of beneficiaries, programme sponsors and the current and future generations in the face of the dynamic changes in climatic conditions currently affecting the world. However, at times, this concept may not have a buy in, in all circumstances; as this may be depended on various factors such as appreciation of sustainability and monitoring and evaluation, knowledge of same and budget constraints.

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