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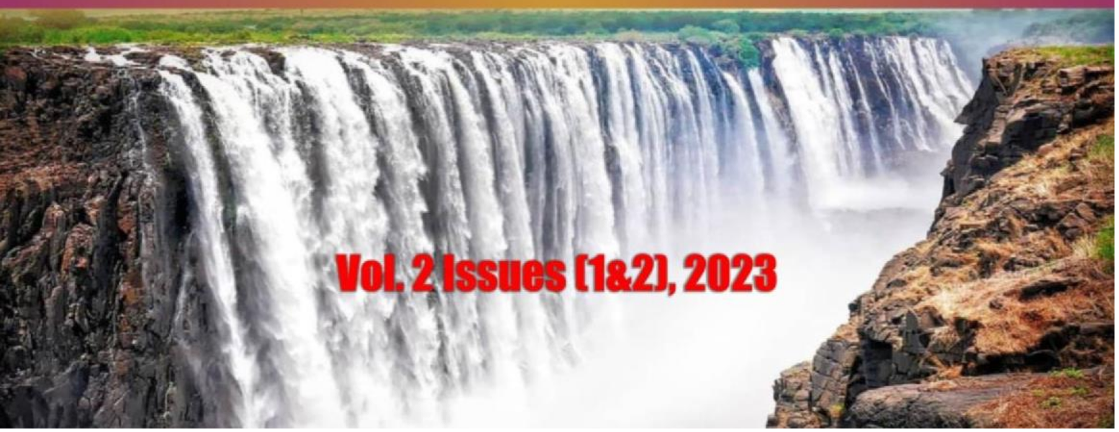

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Leaders (coming from various circles of life), professional associations, students, researchers and practitioners will be the primary contributors and consumers.

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CLIMATE-SMART AGRICULTURE IN ZIMBABWE: LESSONS FROM WORLD VISION ZIMBABWE PROGRAMMING

MTHABISI MSIMANGA, PRECIOUS MUBANGA, NOMQHELE NYATHI, GILBERT MUSHANGARI, SITHANDEKILE MAPHOSA, DERECK NYAMHUNGA[1], FELIX MADYA[2] AND INNOCENT CHIRISA[3]

Abstract

Climate change has become a public concern with governments and global governing organisations such as the United Nations setting goals aimed at reducing its adverse impacts on public and poor smallholder farmers in developing countries. The article aims to provide an overview of climatesmart agriculture in Zimbabwe. Climate change has disrupted livelihoods in the country as the economy has always been agrarian-backed. In this article, we set out to understand the lessons relating to ways of reducing the adverse impacts wrought out by climate change drawn from World Vision Programming since 2000. It makes the argument that lack of technology and institutional support has been the main hindrance to the adoption of climate-smart agriculture. Moreover, the article makes the argument that climate-smart agriculture suffered a stillbirth in Zimbabwe due to lack of information dissemination to farmers and targeted beneficiaries. The study utilised a qualitative research methodology with a bias towards a case study research design. The study discovered that climate-smart agriculture has had an impact on the agricultural sector with the use of irrigation systems and the adoption of cash crop farming in Zimbabwe.

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Keywords: livelihoods, agrarian, technology, institutionalism, system, foreign systems

INTRODUCTION

Climate change impacts on agriculture productivity point to a clear consensus that Sub-Saharan Africa will experience severe consequences of climate change soon (FAO et al., 2020, IPCC, 2021). Heat and drought increase variability of precipitation and rising temperatures will strain water resources, reduce crop productivity and increase the incidence of pests and diseases, with serious impacts on agriculture throughout the continent, especially in dryland regions (Bongole et al., 2020). Crop productivity may decrease if the climate change trajectory continues, though anticipated declines vary among crops with expected mean yields reduction estimated to be high on maize, unlike on small grains (Jagermeyr et al., 2021). Food insecurity and malnourishment are the biggest challenges of the modern world with the highest hunger and undernutrition levels observed in South Asia and Africa (Kaur & Kaur, 2016).

Sub-Saharan Africa needs to increase food production to meet the demand and predicted dietary changes (Tilman and Clark, 2014), accompanied by reduced greenhouse gas (GHG) emissions (Kurgat et al., 2020). Agricultural practices and associated land use changes account for one-third of GHG emissions in Africa (IPCC, 2014). There is significant political will to increase agricultural productivity under climate change while reducing the impact on the environment (ibid.). Agriculture is the most important sector for many developing countries and is expected to produce global food for a population that is expected to reach 9.1 billion by 2050 (Branca et al., 2011). To secure and maintain food security, agricultural systems need to be transformed to increase the productive capacity and stability of smallholder agricultural production (ibid.).

Climate-smart agriculture (CSA) is a viable alternative to addressing the adverse effects of climate change and increase crop productivity while reducing GHG emissions (Djufry et al., 2022) and this has been in line with the Paris Agreement (Richards et al., 2016). Climate-smart agriculture, as a concept and practical approach, aims to address the intertwined challenges of food security and climate change (Lipper et al., 2014). It has three objectives, which are sustainably increasing agricultural productivity to support an equitable increase in farm income, food security and development; adapt and build the resilience of food systems to climate change; and where possible, reducing GHG emissions from agriculture (Kurgat et al., 2020). Technology can be considered climate-smart, based on its impact on these outcomes and agricultural interventions that meet climate-smart goals (FAO, 2013). Interventions ranging from climate information services to field management, have the potential to achieve these goals (Chhetri et al., 2017). Climate-smart agriculture has been included in development declarations that set continental plans and targets such as the African Union Malabo Declaration (Jones et al., 2023).

CONCEPTUAL FRAMEWORK

The conceptual framework grounding this study is the climate-smart agriculture framework. This framework has three pillars which have a view to increasing food productivity and adaptation to climate-induced impacts and reducing GHG emissions (Chhetri et al., 2017). The realities of climate variability and change call for drastic action by farmers to combat potential detrimental impacts on food security, the environment and resilience sustainability and livelihoods (Chitakira and Ngcobo, 2021). Potential and sustainable action includes adaptation strategies that enable farmers to cope with socioeconomic, environmental and agricultural production challenges such as implementing climate-smart agriculture (ibid.). The concept of climate-smart agriculture emerged around 2000, motivated by the need to develop solutions for integrated goals of increasing agricultural productivity and yields, reducing GHG emissions from the agricultural sector and enhancing the resilience and adaptation of farmers and agricultural systems (Andrieu et al., 2017).

Climate-smart agriculture strategies and technology are gaining purchase globally and are seen as a way of addressing climate change and improving agro-based economic growth (World Bank, 2014). Climate-smart agriculture is a broad term that encompasses climate resilience agriculture and it comprises practices and technologies useful for the adaptation to climate change by farmers and helps to increase productivity, while simultaneously reducing GHG emissions (Viswanathan et al., 2020; Chitakira and Ngcobo, 2021). It assists governments in achieving national food security and reducing poverty (Barnard et al., 2015) through increased productivity and reduced climate change on the smallholder farmers.

Literature Review

Climate change adversely affects agricultural productivity and output, the backbone of the economies of most developing countries and much of the food consumed globally are direct products of agriculture. Climate-smart agriculture emerged as a solution to the global food crisis and insecurities induced by climate change. The biggest global challenges are food insecurity and malnourishment. With global hunger currently at a moderate level, the highest hunger and undernutrition levels were observed in South Asia and Africa (Kaur et al., 2023). India is facing serious levels of hunger as the most serious consequence of climate change on food security is malnutrition causing poor growth in children (ibid.). The high economic growth achieved by India has not had an impact on food security as the masses continue to languish in hunger and starvation (Saxena, 2018).

Several developing countries‘ economies are agro-based and agricultural production systems are expected to produce food for the exponentially growing global population that is expected to be 9.1 billion people by 2050 (Branca et al., 2011). In a bid to secure food security, agricultural systems need to be transformed to increase the productive capacity and stability of smallholder agricultural production to avoid the trapping of the poor rural families in poverty (ibid.). Most developing countries have developed economically, showing an aberration in the balance between economic growth and food security owing to an imbalanced GDP that has much wealth concentrated in the hands of a few individuals.

The Food and Agriculture Organisation (FAO) introduced the concept of climate-smart agriculture (Lopez et al., 2020). Climate-smart agriculture is based on three pillars which are aimed at building resilience through reducing GHG emission, improving adaptation using technology in agriculture and the reduction of household poverty through improved food security. CSA is an approach to transform and re-orient agricultural development in climate-vulnerable environments (Ramirez et al., 2015). The practices and technologies merged in climate-smart agriculture are reasonably effective in achieving high productivity for ensuring food security, climate change adaptation and GHG emission reduction with the cost-effective generation of additional benefits (Dinesh et al., 2015).

CSA has huge potential for carbon sequestration, although the extent varies depending on the types of intercropping and specific farming practices (Raj et al., 2018). The components of climate-smart agriculture comprise smart technologies of weather, carbon, water, nutrient, knowledge and energy management (Kaur et al., 2023). The global climate-smart agricultural practices aim to improve sustainability through the increase of agricultural productivity and incomes, building adaptation and resilience to climate change in poor smallholder areas and reducing or eliminating the emission of greenhouse gases. Countries throughout Sub-Saharan Africa need to increase food production to meet the demand and predicted dietary changes (Tilman and Clark 2014). Under an increasingly inhospitable climate, this increase in food production must be achieved alongside the reductions in GHG emissions (van Ittersum et al., 2016, IPCC, 2014). Current GHG emissions in Africa (Kurgat et al., 2020). There is a strong political will to increase agricultural productivity under climate change while reducing its impacts on the environment (ibid.).

CSA in Africa is an approach that aim at developing agriculture with an interest in addressing the intertwined challenges of food security and climate change (Lipper et al. 2014). It has been implemented in the region of SubSaharan Africa with many farm-based management practices and technologies being implemented to deliver two or three of the climate-smart agriculture benefits (Reppin et al., 2019). In Kenya, Reppin et al. (ibid.) found that agroforestry system tree provides firewood for household consumption and timber for income generation and carbon sequestration.

The strategies for achieving sustainability of agricultural systems and food security in smallholder farming areas have greatly depended on several programmes advanced by organisations. The programming of climate-smart agriculture has emerged as one of the strategies that are implemented to mitigate the impacts of adverse climatic conditions.

Weather-smart technologies are used to reduce the impacts of adverse climatic conditions in developed countries, while reducing climate changecausing agents, such as GHG emissions. Climate-smart housing for livestock, weather-based crop advisory and crop insurance have been used in developing countries like India (Dheebakaran et al., 2020). Such advisory services are quite beneficial to farmers as they provide timely weather information and suggest suitable agronomic advice (Manjusha et al., 2019).

Advisory services help farmers avoid risks associated with adverse climate change (Dheebakaran et al., 2020). Knowledge-smart technologies such as contingent crop planning, if properly used, improves crop planning which would, in turn, improve crop varieties and seed. Fodder banks are being used as knowledge-smart technologies (Lu et al., 2021). Contingent crop planning is the cultivation of a crop suited to a region, sown despite the normally sown crop failure because of aberrant weather conditions (Reddy et al., 2017). There has been climate-smart pest management programming in the developed world, an approach that targets reduction of pest-related yield losses, enhancing eco system services and strengthening agricultural resilience to climate change (Heeb et al., 2019). The implementation and programming of climate-smart agriculture have been found in Zimbabwe and Tanzania through the diversification of crops to improve crop productivity and food security, household income and dietary diversity (Makate et al., 2019; Kurgat et al., 2020; Kimaro et al., 2023). CSA through the programming of crop diversity increases resilience and biodiversity on farms, improves soil fertility and controls pests and diseases (Lin, 2011). Conservation agriculture and agroforestry improved maize production, increased resilience and adaptation to climate change and offered mitigation benefits in Tanzania.

In Ethiopia, climate-smart agriculture technologies improved farm-level production by 22% over non-adopters because of reduced climate-related risks (Asrat and Simane, 2017). CSA, therefore, improves food security and the availability of food at a reduced level of climate change. Despite the potential benefits adoption of climate-smart agriculture, relevant technologies are generally low in Sub-Saharan Africa (Kurgat et al., 2020). The adoption of maize-legume rotation in Tanzania, minimum tillage in Malawi and soil conservation ridges and soil bounds in both Kenya and Tanzania, are below

10% (Tesfaye et al., 2017). Ogundeji et al, (2023) observe that in the Congo Basin, climate-smart agriculture has been programmed to work in liaison with rural development to reduce deforestation, stabilising the agriculture industry, improving land use planning, feasible management systems for the region's natural forest and reducing poverty and forest degradation.

The very first soil and agricultural carbon finance initiative in Africa benefitting smallholder farmers and rural society is the Kenya Agricultural Carbon Initiative, in western Kenya (Ogundeji et al., 2023). The initiative deals with issues such as increasing land pressure, unstable livelihoods and the relative inefficiency of smallholder agricultural production all of which is made worse by the adverse effects of changing climate and the rising global food demand, unsuitable farming methods and significant greenhouse gas emissions (Nyber et al., 2020). Farmers in Zimbabwe are becoming more interested in conservation agriculture, with indicators of output increases of 50 and 200% (Simelton et al., 2021).

METHODOLOGY

This article utilised qualitative methodology with a bias towards the case study design in analysing climate-smart agriculture programming in Zimbabwe. The case study research design gives rich and detailed data to build a clear picture of the research context and the research problem (Mutamba and Mugoya, 2014). The article used thematic data analysis to analyse the emerging themes within the study. Secondary data from various regions of Zimbabwe were used to craft the discourse on the climate-smart agriculture programmes.

RESULTS: LESSONS FROM WORLD VISION PROGRAMMING IN ZIMBABWE

Africa and Zimbabwe, in general, are most vulnerable to climate change due to widespread poverty and limited coping capacity and highly variable climate (Madzwamuse, 2010). Climate change has affected the farming landscape in Zimbabwe with most of the regions that once had enough rainfall going down to the semi-arid position due to the variability of rainfall. Most smallholder farmers in Zimbabwe are now specialising in small grains that are drought-resistant (Mugandani, et al., 2012). Keeping small livestock has increased in Zimbabwe due to climate variability, forcing farmers to abandon cattle-rearing as most of the areas are becoming arid (Makate, et al., 2018). The impacts of climate change are affecting smallholder farmers who cannot adopt technology and other farming methods. The government and other stakeholders have brought programmes to help the agricultural landscape and provide a safety net for poor households from the adverse impacts of climate change. Zimbabwe particularly is vulnerable as it heavily depends on rain-fed agriculture and climate-sensitive resources (Chagutah, 2010). Extreme temperatures have led to dry spells with water stress, droughts and poverty, leading to farmers opting for wage work on farms.

Climate-smart Agriculture (is a good initiative, but some barriers hinder its strategies in ensuring environmental stewardship. A greater proportion (67%) of the respondents participated in conservation agriculture. With significant support from extension workers, the WV Livelihoods Technical Programming (TP) focused on encouraging the adoption of simple climatesmart agricultural practices inclusive of Conservation Agriculture (CA), drip irrigation and solar-powered irrigation. These practices assisted farmers to take better care of the land, improve soil fertility and water-holding capacity and make the land more resilient to drought. Drought-resistant, nutritious, early maturing and high-yielding crop varieties were promoted to maximise production in contexts characterised by high temperatures and reduced erratic rainfall. Several studies have assessed the impact of CSA and found both direct results (improved crop and livestock productivity and reduced total variable costs) and indirect results (improved food security through the increased availability of staple crops at the household level and in markets, per capita consumption and increased household income (Fentie and Beyene, 2019; Sani, 2019). A study by Ogada et al. (2020) found that the adoption of CSA, such as multiple stress-tolerant crops, improved household income by 83%. This, in turn, improved household asset accumulation.

Water points were established in most villages. The WASH TP by WV enabled improvement in access to water mainly through the rehabilitation of water points, drilling of boreholes, the establishment of solar piped water schemes and installation of taps in communities, schools and health institutions. Installation of water points in the villages helped to reduce the distance that community members had to travel to access water. The use of solar-powered drip irrigation infrastructure allowed for improved water efficiency and efficacy. The TP also provided water to communities to facilitate the sustenance of crop and livestock production. Sixteen (16) water systems (irrigation schemes and solar-powered boreholes) were rehabilitated or established in support of crop and livestock production. These interventions resulted in 2 576 smallholder farmers gaining access to water for crop and livestock production. as a result, 1 434 households (households) reported increased crop yields and 951 reported increased livestock production. establishments of irrigation gardens were reported to have enabled most smallholder farmers to plant a variety of food crops for consumption and selling. The introduction of solar-powered water systems around irrigation schemes overall was reported to have made year-round cropping possible with farmers able to cultivate different crop varieties for sale throughout the year.

It was found that 88.4% of households contribute to the maintenance of water sources and several community members were trained to carry out basic repairs to the water points, but this did not seem to be sufficient enough to halt water service disruptions significantly. Umuntu lomuntu
lipholisa leproject meaning it is everyone's responsibility to ensure the security of all community projects. Trespassers are reported to local authorities. They report to the police and irrigation committee. They have a constitution that was approved by local leaders to guide them towards sustainability and continuity.

The application of climate-resilient agricultural practices, including improved post-harvest management practices, resulted in 32 904 households reporting increased crop production, while 31 774 households reported increased small livestock production. Nutritional gardens and postharvest techniques improved food availability in the community. Interventions also helped to reduce post-harvest losses, particularly among small-holder farmers.

Acquisition of machines like ploughs, racks, mechanised boreholes, drip irrigation and solar-powered irrigation farming systems, inter alia, enhanced food security as production increased. There was access to irrigation systems, reducing reliance on rain-fed agriculture and technical support to strengthen the acquisition of inputs and production management. TP focused on improving livestock and crop production to achieve food security through increased production by enhancing agricultural mechanisation support and product training. The establishment of mechanised boreholes significantly improved access to water for crop production, livestock production and even household use. A total of 513 community members trained in business or entrepreneurial skills. Following training and other support in the form of productive assets, 951 households reported increased livestock (fish, small livestock, cattle) production. A total of 1 434 households also reported increased crop yields because of WV project interventions in FY19 (Financial Year 19. The TP also provided water to communities to facilitate the sustenance of crop and livestock production. The majority of households (85%) were using at least one sustainable agriculture and natural resource management (Technical Programme Evaluation Report Zimbabwe, June 2021). One hundred and eighteen (118) households practiced agroforestry, conservation agriculture, integrated pest management and other methods following related training by World Vision Zimbabwe. These programmes helped to increase environmental protection and income as carbon sinks increased and pests reduced.

In Chihota, poultry projects were said to have contributed to abundant meat and eggs for households for sale and consumption, strongly contributing to children‘s nutrition. Manure from the poultry also boosted vegetable production and sales. Most smallholder farmers pointed out how the general improvement in agricultural production, especially through the selling of farm produce within irrigation gardens and livestock breeding, had enabled most of them to have disposable income to purchase other diversified foods that they previously had no access to. This emerged through the main thriving value chains, especially poultry and fish products.

The production of small grain crops such as sorghum, pearl millet and finger millet, offers a feasible climate change adaptation model for smallholder farmers, particularly in Africa. A study by Wossen et al. (2017) found that the adoption of drought-tolerant maize varieties increased maize yields by 13.3% and reduced the downside risk exposure by 81%. Mulching is covering the soil surface with organic or inorganic material to improve soil structure, conserving soil moisture condition and soil temperature and reducing nutrient loss, salinity and erosion problems. Mulching is important as an organic fertilizer, soil regulator, water, nutrient and residue manager and improver of crop yield and productivity. Due to WV interventions, farmers are enhancing farming with techniques like mulching, composting and tower gardening. Mulching is one of the existing sustainable agricultural practices in Zimbabwe (Huyer and Nyasimi, 2017).

Crop rotation is the process of producing a variety of crops in the same place over the course of several growing seasons. The study discovered that rotating cowpeas and soybeans with maize considerably boosted net returns (up to US$312 to $767 per hectare, compared to only US$64 to $516 under conventional practices), yields and returns on investment (ROI).

Reducing soil disturbance by cultivating land using mechanical techniques and not ploughing, is known as minimum tillage or reduced tillage (Bodner et al., 2015; Hallama, 2019). Soil and water management CSA practices safeguard the soil through low tillage, reduce water losses from runoff and enhance water infiltration (mulching), reduce evaporation and enhance soil fertility (intercropping, rotation and manure use). The use of enhanced crop types, such as drought-tolerant maize, orange maize and improved legumes, complements these.

FARMERS' KNOWLEDGE- BARRIERS CAN BE LINKED TO FARMERS' KNOWLEDGE

Knowledge means the power to improve environmental stewardship. In Mudzi, women have historically been excluded and marginalised from mainstream developmental projects due to patriarchy. However, through the World Vision Zimbabwe S4T Programme, both men and women were trained to save money together in a secure, practical and flexible manner, thereby increasing HH financial resilience. There was a general increase in agricultural knowledge, practice and capacity among most smallholder farmers which contributed to a significant shift from seasonal to all-yearround production and introduction of diversified agricultural options. Some communities in Bolamba used to have small individual gardens that they watered using the bucket system which resulted in low yields.

Interventions by World Vision Zimbabwe (WVZ) targeted youths in schools to increase access, learning and life skills for 400 000 children to address the decline in education access and literacy levels among them. These interventions included Learning Roots, Unlock Literacy, Youth Ready, Citizen Voice and Action. Other interventions were implemented through various funding streams such as the IGATE-T, Learning for Life, Profuturo, Higherlife Foundation and Nechishala Secondary Child Protection Support

(Technical Programme Evaluation Report Zimbabwe □ June 2021). This blending of programmes combines direct education interventions using teacher training, technology and learning materials provided and improving and empowering girls for protection and participation in education.

In Financial Year (FY) 18 alone, over 200 teachers were trained in unlocking literacy, of which 152 were found to be utilising the skills gained from the training and 1 267 children were supported through reading camps. Children not in the formal system were supported through out-ofschool learning initiatives. During the course of this support to out-of-school children, many opted to re-enrol in the formal system. Six classroom blocks were constructed or rehabilitated and furniture was provided – particularly to support ECD – thereby benefiting 2 500 children across all the Areas of Programming (APs).

The proportion of children enrolled and attending school increased from 78% in FY18 to 87.5% in FY19, while that of children who can read with comprehension increased from 38.6% in FY18 to 44.4% in FY19. However, there was a decline in the proportion of parents and caregivers who promoted learning for children 3-5 years, from 86.4% in FY18 to 42% in FY19 and in adolescents who rank themselves as thriving on the ladder of life, from 56.6% in FY18 to 46.4% in FY19.

The agriculture situation in 2020 (before programme implementation) was characterised by low yields because of climate change-induced droughts, which was exacerbated by poor farmer performance because of knowledge gaps, a lack of cooperation and coordination amongst farmers resulting in limited agricultural output, which contributed to the prevalence of malnutrition within most areas. Most smallholder farmers improved farming performance overall due to the cross-pollination of ideas brought about by working as cooperatives as well as external support and visits from different organisations and advancements in technology.

GAPS IN WORLD VISION'S WORK

Although production increased, yield did not reach its full potential due to low rainfall patterns and a lack of fertilizers and other critical inputs. Women and young people had less access to financial services than males. The unequal treatment, financial exclusion and lack of access to banking services, disproportionately harm women, particularly in rural areas. The sharing of information with district stakeholders was particularly prominent at the beginning of projects. District officials like district Environmental Health Officers were ignored during the implementation of borehole projects and when projects were completed, they were no longer provided with reports in some areas. The officers were consulted only when problems emerged in the community. Not addressing economic challenges resulting in high inflation and price fluctuations were mentioned as one of the major impediments to the productivity of smallholder groups. This was worsened by the economic instability caused at the onset of the COVID-19 pandemic. Most youths, young women and people with disabilities were reached through livelihoods interventions as some were also part of producer groups. However, vulnerable groups were said to have lacked representation in the disaster preparedness committee, especially children and people living with disabilities.

Despite the strong exhibition of local ownership and partnering, the longerterm sustainability of achievements in agricultural productivity still had potential challenges, especially considering the recurrent droughts and the volatile economic environment that strongly affected agro-based enterprises and the changes in the monitory policies.

In light of the WV programming, it is recommended that:

- the paravet training includes strategically located dip tank assistants. Priority should also be given to local dip tank attendants since they are already part of the disease surveillance and investigation team government payroll. Professional Development Hours (PDHs) training should also focus on the in-laws and more men to reduce cultural barriers that affect exclusive breastfeeding (EBF)..
- despite the worsening food insecurity and livelihood instability experienced, nutrition gardens were repeatedly highlighted as a beneficial intervention to increase access to nutritious foods for young children and

vulnerable people as well as a source of income. To improve the gains of the nutrition gardens, it is recommended that water points be established to allow for irrigation of the gardens. Training to improve sales of products from the garden is also recommended.

- to ensure year-round access to improved water facilities, there is a need for minimal disruptions to improved water supplies.

OTHER GOVERNMENT INTERVENTIONS AND PARTNERSHIPS WITH KEY STAKEHOLDERS The Department for International Development (DIFID)-funded ENTERPRIZE project and the Office of U.S. Foreign Disaster Assistance (OFDA) Food Security emergency projects complemented the food distributions and AP livelihoods interventions resulting in a total of 38 586 Households applying at least one natural resource management and Climate-smart agricultural practice. According to the 2018 Annual TP Report, the application of climate-resilient agricultural practices, including improved post-harvest management practices, resulted in 32 904 and 31 774 Households reporting increased crop production and small livestock production, respectively. When juxtaposed to FY18, WV interventions improved the proportion of households with at least one adult earning a regular income from 27% to 35.8%. A quarter (25%) indicated an increase in HH income due to WVZ interventions and the majority mentioned the source as the sale or exchange of their farm crop and livestock or from skilled trade and/or small business enterprises.

Market linkages were limited in FY19 due to a poor performing economy. However, partnerships with the private sector and technical government institutions, inclusive of the Harare Institute of Technology (HIT), the Department of Irrigation and Mechanisation, the Department of Agricultural Extension Services, the Grasslands Research Station, Irvine‘s Chickens and the Pig Industry Board, were maintained to increase agricultural production for targeted Households.

The partnership between WV and key government stakeholders is strong and the capacity of local partners was strengthened. Sustainability improved through partnering and the partnership between the RMNCH TP and the district is good with most officials satisfied with the level of partnership and engagement. Technical support was improved through collaboration with Agritex and the government‘s Veterinary Department.

During implementation, WVZ engaged government stakeholders, market and community actors to increase family access to income. These improved families‘ economic well-being by facilitating income-generating activities for smallholder farmers to increase their production. The inclusion of key government staff, particularly from the Ministry of Agriculture, Lands, Water and Rural Resettlement in the design, monitoring and evaluation of TP interventions was deliberate to enhance public institutions‘ acceptance of programme interventions for continuity following the exit of WV in the targeted operational areas.

APs collaborated with extension staff from the parent Ministry of Agriculture, Lands, Water and Rural Resettlement during the design and implementation of livelihoods interventions. APs also collaborated with private organisations such as Irvine‘s Chickens and Novatek who continue to offer technical support to poultry producer groups; the Pig Industry Board in support of piggery projects as well as National Organic Produce which provided Boschveld‘s chickens and feed to producer groups involved in freerange chicken production. The Zimbabwe Women‘s Microfinance Bank, Steward Bank, Quest and Virl Micro Finance were involved to facilitate smallholder farmers in APs to access affordable credit for their farming and IGAs. Other non-governmental organisations (NGOs) were engaged in the development of strategic partnerships in response to requests for proposals from donors. Research institutions like the Grasslands Research Station, were reported to have been engaged at national level offer technical support in crop and livestock production to smallholder farmers in APs.

DISCUSSION

Governments and international governing bodies like the United Nations have set targets to reduce the adverse effects of climate change on the general population and impoverished smallholder farmers in developing nations. A critical overview of Zimbabwe's climate-smart agriculture was proffered by the study. The study reflects an acute awareness of the lessons drawn from World Vision programming since 2000. It is obvious from climate change's effects on agricultural productivity that Sub-Saharan Africa will soon experience the effects of climate change. If climate change continues on its current trajectory, crop productivity may diminish, albeit anticipated declines differ by crop, with maize expected to see higher mean yield reductions than small grains. Agriculture systems must be revamped to boost the productive capacity and stability of smallholder agricultural production to achieve and maintain food security. The practical solution to combat climate change and boost crop output, while lowering greenhouse gas emissions is CSA. A strategy for agricultural development known as "climate-smart agriculture" seeks to solve the interrelated problems of food security and climate change.

CSA has been incorporated into development declarations establishing continental goals and strategies, such as the Malabo Declaration of the African Union. CSA is a method and conception encompassing climateresilient agriculture and includes techniques and tools that help farmers adapt to climate change, while also boosting productivity and cutting GHG emissions. The idea was first suggested by the Food and Agriculture Organisation (FAO). The FAO introduced the idea of CSA which is based on three pillars: building resilience by reducing GHG emissions, improving adaptation by using technology in agriculture and lowering household poverty by increasing food security. CSA includes smart technologies for managing the weather, carbon, water, nutrients, knowledge and energy. The goal of CSA in Africa is to advance agriculture, while tackling the twin problems of food security and climate change. It has been noted that using climate-wise agriculture practices through the programming of crop diversity, increases resilience and farm biodiversity enhances soil fertility and manages pests and diseases. Therefore, CSA can result in increased food security and food availability at a lower level of climate change. Soil conservation ridges, low tillage and maize-legume rotation is used in Tanzania.

To address the emerging challenges and harness a few benefits of climate change in Zimbabwean agriculture, there is need to be climate-smart, which is defined as an integrated approach for developing technical policy and investment conditions to achieve sustainable agricultural development for food security under climate change (FAO, 2013). Technologies and policy options for CSA include weather forecasting agro-advisory, geo-ICT delivery, eco-regional crop planning, crop water increased efficiency in microirrigation drainage and approaches like direct-seeded rice, nutrition management and stress-tolerant livestock breeds (Archak and Pathak, 2022). Novel genetic resources would infuse excellent adoption benefits, productivity, gain income, along with ease of implementation and sustainability to smallholder farmers (Agrawal et al., 2021).

CONCLUSION AND FUTURE DIRECTION

Conservation agriculture is gaining currency among Zimbabwean farmers, as evidenced by indicators of output gains of between 50% and 200%. In the Sub-Saharan African region, there is still a dearth of programming for climate-smart agriculture and the majority of technologies encounter resistance from farmers who are reluctant to recognise and accept the negative effects of climate change. Due to inadequate information, sharing with farmers and the intended beneficiaries, CSA experienced a stillbirth in Zimbabwe. There is a strong political desire to boost agricultural output in the face of climate change while minimising environmental damage. In many nations throughout the world, CSA tactics and technologies are being used to address climate change challenges, boost economies and expand the agricultural sector. The worldwide food crisis and food insecurity brought on by climate change have been addressed via CSA. Since CSA has resulted in a positive development for farmers, educated farmers should be a priority for development practitioners because of their better capacity for adoption. To increase acceptance, information, education and communication (IEC) products tailored for ignorant farmers, should be pursued. Government should offer incentives to agro-dealers so they will make investments in rural agricultural companies that sell inputs. Although taxes increase government revenue, the government should lower the taxes for rural agro-dealers to facilitate easier access to inputs by bringing suppliers and distributors closer to farmers' homes. The government should also avail financial service providers with incentives to offer agro-dealers affordable finance products so they can stock the necessary commodities in sufficient quantities.

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