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TOWARDS 'LEAVING NO ONE BEHIND': A CASE STUDY OF CLIMATE CHANGE ADAPTATION IN MUTOKO DISTRICT, ZIMBABWE

Shingirai Stanley Mugambiwa 

University of Limpopo, South Africa
Email: shingirai.mugambiwa@ul.ac.za

Happy Mathew Tirivangasi 

Corresponding Author: University of Limpopo, South Africa
Email: happy.tirivangasi@ul.ac.za

Makhura Benjamin Rapanyane 

University of Limpopo, South Africa
Email: makhurabenjamin2@gmail.com

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Abstract

This study assesses climate change adaptation strategies employed by community members in Mutoko district of Zimbabwe. Adaptation strategies to climate change are responses to actual or expected climatic stimuli which are meant to moderate harm or exploit associated beneficial opportunities. Rural communities are prone to suffer more from the effects of climate change because they largely depend on natural resources and a subsistence economy for their survival. Hence, knowledge of climate change effects and adaptation strategies will ensure the realization of agenda 2063 and Sustainable Development Goals. Agenda 2063 focuses on, among other things, African development of modern agriculture for increased production and value addition to farmers and national prosperity as well as Africa's collective food security. This case study explores climate change knowledge and adaptation practices by communities in the Mutoko district. A qualitative research methodology and an exploratory design are employed to gather data. The study discovers that there are numerous strategies employed by community members to adapt to the effects of climate change.

Keywords: Climate Change, Sustainable Development, Adaptation Strategies, Climate Hazards, Mutoko District

1. Introduction

This study assesses climate change adaptation strategies employed by rural communities in the Mutoko rural community of Zimbabwe. Adaptation to climate change strategies are responses to actual or expected climatic stimuli which are meant to moderate harm or exploit associated beneficial opportunities (Tirivangasi *et al.* 2021; Nyahunda and Tirivangasi, 2021). The adjustments can be categorized either as responses to current occurrences in climate or planned

adaptation to long term changes in climate (Hisali et al. 2011). Adaptation to climate change embraces adjustments in behavior that reduce the vulnerability of society to climate hazards (Smith et al. 1996). Several lessons can be from sociology and anthropological perspectives on human adaptation to climate change. Scientific studies in the disciplines of Anthropology and Sociology explored the mechanisms of adaptation to changing living conditions as a result of climate change (Yohe and Tol, 2002; Brenkert and Malone, 2005; Brooks and Adger, 2005). Gyampoh et al. (2014) observe that rural communities vulnerable to climate change have strong adaptive capacities. Adaptation to drought, scarcity of rain, and decreased production of crops is accomplished through community-based measures to sustain human livelihoods.

The ability of individual households and communities to adapt to climate change depends on their adaptive capacity. "Adaptive capacity refers to the potential or ability of a system, region, or community to adapt to the effects or impacts of climate change. This capacity is dynamic and is influenced by economic and natural resources, social networks, institutions, governance, human resources and technology" (Eriksen et al. 2008, p. 21). In most cases, the poor and the marginalized have low adaptive capacity. While climatic changes are harmful to the poor, it is their vulnerability to the various elements of climate change that determines whether they survive and if they do, whether their livelihoods are destroyed or not". Climate variability risks have always been part of agricultural activities such that in most cases, African farmers have survived and coped with its impacts (Mano and Nhemachena, 2007; Ziervogel et al. 2008; Nyahunda et al. 2021).

Agricultural adaptation taking place in Africa is responding more to perceived climate variability rather than climate change, such that these responses are likely to be overwhelmed by climate change and its longer-term implications (Ziervogel et al. 2008). Adaptation measures in agricultural practices include crop and livestock diversification, community-based disaster risk reduction, famine early warning systems, water storage, supplementary irrigation, rainwater harvesting, water-conserving techniques and use of drought-resistant crop varieties. In Zimbabwe, rainfall projections point to a drying trend hence, adaptation strategies in the agricultural sector should focus on strategies to conserve moisture, particularly, adopting improved short-season seed varieties and drought resistant small grains (Ministry of Environment and Tourism, 2006).

In Zimbabwe, rural smallholder farmers and communities in semi-dry agroecological zones have adjusted their behaviour in response to past extreme hydrological events and climate-related changes (Chikozho, 2010). Correspondingly, Nhemachena and Hassan (2007), although farmers have a low capacity to adapt to such changes, they have, however, survived and coped in various ways over time. It is, therefore, highly likely that most of the farmers are now already grappling with the need to adapt to altered future climatic and rainfall conditions. In a study by Gwimbi (2009), more than 65% of cotton-producing farmers in Gokwe Rural District (GRD), Zimbabwe reported that to cope with climate change they depend on the use of irrigation, diversification into more drought-resistant crop varieties, diversifying into other crops, timing the planting period to coincide with the onset of the rains.

2. Climate change adaptation and sustainable development

Climate change has severe impacts on the development of communities around the world. The impacts are more severe in the developing world. For instance, due to global warming, the climate in Africa is expected to become enormously variable and extreme weather events are expected to be more frequent and severe posing an increasing risk to health and life. Consequently, this will trigger an increased risk of drought and flooding in new areas due to sea-level rise in the continent's coastal areas (Christensen et al. 2007). Developmental problems such as poverty have always been a visible feature in Africa. The continent is also vulnerable to several climate-sensitive diseases including malaria, tuberculosis and diarrhoea (Guernier et al. 2004). This implies that climate change will become an ultimate risk multiplier by exacerbating the other crises. Its impact severely affects the poor who are the least responsible for the problem. This constitutes the majority of communities in Africa. The continent is already under pressure from climate stresses and is highly vulnerable to its impacts. As a result, there is a need for

communities in Africa to craft sustainable climate change adaptation strategies. This is because a plethora of factors contribute to the current climate variability in Africa and will have negative effects on the continent's ability to cope with climate change. These factors include poverty, illiteracy and lack of skills, limited infrastructure, lack of technology and information, low levels of primary education and health care, poor access to resources, low management capabilities and armed conflicts (Boko et al. 2007). It is also important to note that women play an important role in the development of communities in Africa. This is because they take a leading role in farming activities such that a majority of smallholder farmers are women. Hence, possession of climate change adaptation knowledge by women is of significant importance with regard to issues of adaptation and sustainable development. Therefore, the current study seeks to assess strategies employed by Mutoko rural community members to adapt to the effects of climate change taking into cognizance issues of women empowerment and sustainable development. Table 1 shows the sustainable development goals (2030) and agenda 2063.

Table 1. Sustainable Development Goals (2030) and Agenda 2063

SDG- 2030	Agenda 2063
Goal 2: Zero hunger End hunger, achieve food security and improved nutrition and promote sustainable agriculture	Goal 5: Modern agriculture for increased productivity and production
Goal 13: Climate Action Take urgent action to combat climate change and its impacts	Goal 7: Environmentally sustainable climate-resilient economies and communities

Sustainable Development Goals (SDGs) and Agenda 2063 provide a perfect platform for 'leaving no one behind on matters related to climate change adaptation. This is because they address ending hunger and climate action that is SDG 2 and 13 respectively. Agenda 2063 addresses the need for modern agriculture for increased productivity and production and environmentally sustainable climate-resilient economies and communities. Having these in place is important in ensuring community involvement in climate change adaptation.

3. Theoretical framework

3.1. Sustainability theory

This study employed the sustainability theory. Jenkins (n.d.) asserts that the idea of sustainability came to public attention after a 1972 report, "Limits to Growth," issued by the international think tank Club of Rome. The term "sustainable development" attained international public prominence through the 1987 report of the World Commission on Environment and Development, Our Common Future. It brought about the famous definition which asserts that "Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987, p. 43). For this paper, "sustainability" stands apart from "sustainable development". Considering sustainability on its own is important in understanding how it has been adopted to define and modify other concepts and endeavours. Sustainability is an inclusive concept that precisely brings society's ecological dependency into moral relation with its economic and political systems. The 1974 Cocoyoc Declaration stated that sustainability relates the "inner limits" of human needs to the "outer limits" of Earth's resources. The 1975 program of the World Council of Churches (WCC) brought about one of the first uses of sustainability as a concept to help integrate response to related environmental and social problems (Jenkins, n.d.). The objectives of this study are to determine the community's knowledge of climate change and to assess the community's awareness of indicators of climate change. Hence, assessing these objectives should be related to bringing society's ecological dependency into moral relation with its economic and political systems, which is the core of sustainability theory.

Sustainability proposes to integrate responses to social and ecological problems. The problems include climate change effects and the knowledge of it. This is achieved by taking

account of feedback between human and biophysical systems and assuming that there are limiting conditions to those systems. Focusing on the ecological embeddedness of human social systems and concepts of sustainability mitigate perceived tensions between humanist and environmental goals. Noting that global environmental problems threaten prospects for the human future, the question of sustainability fundamentally amounts to a question about future generations that is what do we owe the future? This is because knowing the indicators of climate change will help communities combat the current and expected effects of climate change.

3.2. Models of sustainability

3.2.1. Economic model

The economic model proposes sustenance of opportunity, usually in the form of capital. The idea is that, as stipulated by Solow (2014), we should think of sustainability as an investment problem, in which we must use returns from the use of natural resources to create new opportunities of equal or greater value. Social spending on environmental protection, while perhaps justifiable on other grounds, takes away from this investment and so competes with a commitment to sustainability. Amartya's (1999) "development as freedom" asserts that we create options for the future by creating options for today's poor because more options will drive greater development.

3.2.2. Ecological model

The ecological model proposes the sustenance of biological diversity and ecological integrity. That is, rather than focusing on opportunity or capital as the key unit of sustainability, the focus must be directed on the health of the living world (Rolston, 1994). The model has two major ways of deciding which ecological goods should be sustained. First, essential natural resources should be sustained, as should those ecological systems and regenerative processes on which human systems rely. Second, species should be sustained for their intrinsic value, as should ecological systems as generators of creatures with intrinsic value.

3.2.3. Political model

The political model proposes sustain of social systems that realize human dignity. It is concerned with how environmental problems jeopardize human dignity. Environmental justice represents one strategy of this model (Agyeman, 2005). Other strategies within this model which include agrarianism or deep ecology involve more substantive visions of the human good. Ultimately, the models' acclaim sustains the cultural conditions required to realize ecological personhood or even personal faith through ecological membership (Wirzba, 2003). For the current study, the political model whereby community leaders such as chiefs provide community members with relevant knowledge on climate change adaptation and sustainable methods of agricultural methods among other activities that work towards the development of the community without leaving no one behind.

3.2.4. Leadership for sustainability

Leadership for sustainability is a new idea that represents a fundamentally expanded understanding of leadership that includes an enlarged base of everyday leaders in all walks of life. The leaders take up power and engage in actions with others to make a sustainable difference in their communities. Leaders recognize the root causes of unsustainability, seek to understand the social, cultural, economic, and ecological impacts of their work, and acknowledge and value the ecological and cultural diversity of natural systems. Shriberg and MacDonald (2013) assert that leadership for sustainability goes beyond transformational leadership. Leadership signifies cultivating a way of being that is embedded in sustainability values. Also, leadership is rooted in a living processes paradigm and it is an inclusive, collaborative and reflective process. Leadership for sustainability differs from a traditional knowledge of leadership which relies on traits, behaviors and situations to explain leadership.

4. Methodology

4.1. Study area

Mutoko is a district of Mashonaland East Province, Zimbabwe, in southern Africa. It is located in the eastern part of Zimbabwe, and it covers 4,092.5 square kilometres (Mvumi *et al.* 1988). According to the 2012 population census, Mutoko has 146,127 people (Moyo, 2016). The subsistence economy of the Mutoko rural community is based on Conservation Farming. Conservation farming makes use of natural ecological processes to conserve moisture, enhance soil fertility, and improve soil structure (Fanelli and Dumba, 2011). The most favourable crops in the area include maize, groundnuts, vegetables and sun flour, sorghum, cotton, pearl millet, and finger millet. The reason for the dominance of such crops in the area is due to the type of land and climatic conditions (Mvumi *et al.* 1988). The climate in the area is mild and generally warm and temperate (Fanelli and Dumba, 2011). Mutoko Rural District is divided into twenty-nine (29) wards, each consisting of six (6) villages with about one thousand (1000) people per village or eighty (80) to one hundred and twenty (120) households.

4.2. Research design and sampling

The researcher employed an exploratory research design. Hair *et al.* (2003) define exploratory research as research conducted to gain new insights and discover new ideas. Hence, a qualitative, exploratory study was designed to probe the adaptation strategies employed by Mutoko rural community members to adapt to the effects of climate change. The use of qualitative research design enabled the researcher to have full interaction with the study participants throughout the study. Thirty (30) samples were drawn from two (2) villages in Mutoko rural community to collect quality and reliable data. The study sample was composed of two (2) groups of participants; namely Matedza and Chibeta rural community members. Equal numbers of sample groupings were selected from the two (2) communities. Participants consisted of fifteen (15) individuals from each village. Out of the thirty participants sixteen (16) were male and fourteen (14) were female. A non-probability technique known as criterion purposive sampling was employed to select members of the study sample. Bryman (2012) points out that in criterion purposive sampling the sample units are selected because they have particular characteristics that will enhance the exploration and understanding of the aims and objectives of the study. Hence, criterion purposive sampling was used to select thirty (30) members from two (2) villages namely Chibeta and Matedza. Participants were either aged fifty (50) years and above had lived in the area for the previous ten (10) or had a general understanding of climate change. The reason for the age restriction was to engage people who were capable of giving a comparative explanation of climate change between the period they were young and currently. Nevertheless, the age variable together with the longevity of stay in the area (Chibeta or Matedza) was fundamental in selecting participants to become part of the study samples.

4.3. Data collection

The study employed the case study method. The case study approach is widely-used when there is a need to obtain an in-depth appreciation of an issue in its natural real-life context (Crowe *et al.* 2011). It is used to generate an in-depth, multi-faceted understanding of a complex issue in its real-life context. Data were collected using in-depth interviews. Data presented in this study are results of a cross-sectional study conducted for two weeks. The collection of data was informed by factors such as the age of the participants, period of stay in the area and a general understanding of climate change in the area. To comprehend the full adaptation strategies employed by Mutoko rural community members, a qualitative research method was employed to collect data and in-depth interviews were conducted. An in-depth interview is a method of qualitative research in which the researcher asks open-ended questions. It provides a platform for face to face interaction between an interviewer and the study participants. In-depth interviews help the researcher to achieve the same level of knowledge and understanding as to the study participants. The in-depth interview technique is generally used when detailed information is

needed from individuals in the study (Walter, 2006). In-depth interviewing was the methodological procedure applied to collect data for this study. The interviews aimed to explore adaptation strategies employed by the two villages of the Mutoko rural community. An interview schedule was developed to ask the same questions to all the participants from both villages. Open-ended questions were directed to the participants, though they were also allowed to discuss issues which they considered relevant. Throughout the interviews, the participants were asked for further explanations as new issues arise. A tape recorder was used to record responses from the participants. The interview schedule started with biographical information of the interviewees such as age, gender, educational level, and other social aspects. These were followed by open-ended questions, which focused mainly on participants' understanding of climate change, knowledge of indicators of climate change and their adaptation strategies.

4.4. Informed consent

Consent is the prospective participants' agreement to participate in a study as a participant. It is ethically compulsory for the researcher to obtain consent from the participants (Neumann, 2005). During the data collection process, the researcher ensured that all participants were properly briefed about the aim of the study and their rights and roles in the study. The participants were also made aware that participation in the study was voluntary, and that they were free to withdraw from the project at any time. They were also asked to give their written informed consent before the interviews commenced. To participate in the research study, the participants were asked to sign a consent form.

4.5. Data analysis

Data were analyzed through Thematic Content Analysis (TCA). Braun and Clarke (2006) define TCA as a method used for identifying, analyzing and reporting patterns in the data. TCA proceeds by breaking down the information collected into themes. The researcher identified trends and patterns developed from the data collected. The patterns were then coded and classified into different categories used to analyze the adaptation strategies employed by Mutoko rural community members.

5. Findings and discussion

5.1. Demographic information

Table 2 shows the demographic information of respondents who took part in the study. A total of thirty (30) study respondents were selected from two communities namely Chibeta and Matedza to facilitate data collection about climate change adaptation strategies employed by Mutoko rural community members. The sample was constituted of unequal numbers of males and females, which are sixteen (16) males and fourteen (14) females. The study respondents did not have any special positions such as chiefs, headmen, or councillors in the community.

Table 2. Demographic information

Gender	Age	Period of stay in the area	Level of education	Occupation
Male = 14	30-45 years = 03	15-30 years = 03	No formal education = 10	Unemployed = 10
Female = 16	46-74 years = 19	31-45 years = 20	Tertiary education = 0	Farmer = 15
	74 years+ = 06	46 years + = 02	Secondary education = 09	Retired = 05
	Unknown = 02	Since Birth = 05	Primary education = 11	

5.2. Knowledge of climate change

All the respondents expressed the same sentiments on their understanding of climate change. When asked to explain their understanding of climate change, they mentioned that they were noticing climate change. The researcher observed that all the participants did not understand the

meaning of the term 'climate change' but after the researcher had explained the meaning of the term in their indigenous language, they all seemed to be aware of the phenomenon. One respondent indicated that they used to receive rains on time, that is, around mid-October but in recent years, they have been receiving their first rains around mid-December and the weather has been very hot as compared to the old days. Furthermore, most respondents articulated that there is a serious problem with rainfall in the area as compared to previous years. They argued that the seasons were not the same anymore because some years they received rains on time and others later around the end of December while sometimes the rains were not sufficient enough to enable them to grow their crops. Some respondents mentioned that the rain they currently receive is not of the same quantity as in previous years. They indicated that the crops often die before harvesting because of a lack of enough water and extreme heat. One respondent articulated, "*The change we are witnessing in seasons is immensely visible in the sense that long back we used to receive more rains and reap more harvest but nowadays the rains are unpredictable sometimes our crops die of heat because of lack of sufficient rains.*"

[Age: 61; Gender: Male; Occupation: Farmer]

The respondents also indicated that in the 1970s and 1980s, they used to receive sufficient rainfall but starting from the early 1990s, the amount of rain they receive began to reduce. Another respondent indicated that when they came to the Matedza community in the 1980s, they used to receive sufficient rainfall, but, from around 1992 up to now, rainfall is not predictable anymore and it is becoming very hot in summer. Correspondingly, in a study conducted by Niles and Mueller (2016) in New Zealand, the majority of farmers believed that summer temperatures were consistent and annual rainfall was the same as before, yet others believe these had decreased, with a small number of farmers believing they had increased. In the same study, the largest group of farmers perceived winter temperatures as stable, while others thought they had increased, and very few felt that they had decreased. All these indicate that the farmers have an understanding of the changes occurring in climatic conditions.

5.3. Knowledge of indicators of climate change

Most of the respondents revealed that they are aware of the indicators of climate change. Some of them referred to specific plant species that indicate rainfall availability and scarcity, while others referred to clouds and mountains as well as the direction from which the rains will be coming. The respondents revealed that these indicators have consistently shown them that there will not be enough rain for a couple of years now. Most of them articulated that they have got trees that show them that there is no rain or that the rains they would receive are not sufficient enough for agricultural activities. They gave an example of the '*Nhunguru*' fruit tree which is found around the area that it usually tells them that they would probably receive more rains if it bears fruits around June/July, but if it bears fruits later during the year or never at all, it simply means there will not be enough rain that year. The respondents indicated that for the previous five years, the tree never bore fruits around the period mentioned earlier on. This implies that it is now unpredictable and it is a clear sign that there is a remarkable shift in weather conditions. The responses given by respondents are convincing enough to demonstrate that they know about climate changes. To illustrate the severity of the change in climate one participant indicated, "*Long back when the rain season comes the setting of clouds was always followed by heavy rains which is no longer the case nowadays. Today, if clouds set we can go for two to three days without rain and most often the clouds just disappear. And also there is a mountain around here where we could see fire probably from the ancestors and that fire was an indicator that there is going to be heavy rains but now there is no such. So what I am saying here is the failure of rains to come after the setting of clouds and the fact that we no longer see the fire in the nearby mountain is a sign to us that there is a climate change.*" [Age: 74; Gender: Male; Occupation: Retired]

Another respondent indicated that the clouds they now see before rains come indicate that there will not be sufficient rainfall because in the previous years they used to see a thick dark cloud that would tell them that they would receive heavy rains. But now they only see light clouds which may disperse before the rains come. Also, most respondents indicated that some trees have shifted from their known annual period of bearing fruits and there are trees such as the fig

tree which if they bear more fruits that year, means that there is no sufficient rain. However, in the communities under study, these fig trees which often grow on riverbanks had been constantly bearing fruits in large amounts for a couple of years. Hence, it is a sign that shows there is a significant change in weather patterns.

Some respondents commented on the direction from which we see rains come. They believed that it tells a lot about the amount of rain they would receive. For instance, in previous years if the clouds set and rains would come from the south it was a sign that the rain could be sufficient enough. However, in recent times according to participants, the rains come from any direction and that kind of rain is always short-lived. Therefore, such occurrences are a sign that there is a significant climate change. Most respondents indicated that they were aware of the indicators of climate change. These indicators were drawn from their observations of certain changes in rain patterns and wind direction among other aspects. These features gave the community a sign that climatic conditions were not the same as before and huge changes in the climate were approaching. In support of these findings, Nkomwaa et al. (2014) found that farmers in Malawi reported that a high occurrence of ants and termites indicates a good amount of rain for planting crops. They also stated that high temperatures between September and October predict good rain.

5.4. Adaptation strategies practiced by community members

5.4.1. Storage systems

Mutoko community members have developed large storage systems for their products as a way of adapting to climate change. This enables them to supplement their produce if they receive low rainfall or there is drought. One of the respondents suggested that *“we have developed storage systems where we keep our crops in large quantities. With these storage systems, we are supposed to go for a long time with our crops.”* [Age: 65; Gender: Female; Occupation: Farmer]

This finding supports the (FAO, 2007) idea that maintaining sufficient stocks of stored grain enables households to provide themselves with adequate food until the next harvest. These are significant post-harvest components of food availability and utilization.

5.4.2. Mulching (Mujogo)

Other adaptation strategies that community members provided include mulching. One respondent articulated that, *“since we now receive little rain which often comes late, we now use various strategies in our farming activities. These strategies include what we call “mujogo” in our local language. “Mujogo” is a process where we dig much deeper holes for our crops and when we drop the seed, it will be covered with dry grass and water to fast-track the growing process of the plant.”* [Age: 72; Gender: Male; Occupation: Retired]

The current study has discovered that dry grass enables the seed to germinate quickly and it prevents excessive heat from the sun and enables water storage in the deep whole. This is a strategy that the community developed to adapt to climate change. Mulching might be a common agricultural practice around the world but how it is practiced by Mutoko rural community members as Mujogo makes it unique to their community.

5.4.3. Changing crop types

There are numerous adaptation measures, which are used to sustain indigenous practices. Since they can no longer grow maize in large quantities, most of the respondents indicated that they have shifted to millet and sorghum to adapt to rainfall scarcity. With millet and sorghum, they continue brewing traditional beer, which forms the basis for all traditional functions in the Shona culture. Millet compensates maize in preparing ‘Sadza’ (thick porridge), which is their staple food. One of the respondents indicated that *“we have turned from growing maize to growing millet and sorghum because it is conducive in the current state of the climate. This is in line with what our forefathers used to do because they could be told by the ancestors that since there is not enough*

rainfall, they were supposed to grow millet or sorghum". [Age: 68; Gender: Male; Occupation: Farmer]

Community members have also tried irrigation as an adaptation measure but because of the shortages of water in the rivers and other water sources, the strategy could not materialize. Hence, the only alternative they have is crop change. One of the respondents added, "we have tried irrigation as an adaptation strategy but it has since failed because the rivers from which we fetch water dry up so early. Therefore, the only adaptation strategy we have at the moment is supplementing maize with drought-resistant crops such as millet and sorghum. Even our forefathers used to do the same and during their time, it was easy because they could be told what to grow by ancestors through spirit mediums." [Age: 70; Gender: Male; Occupation: Farmer]

The shift from maize to millet and sorghum by Mutoko community members supports the assertion that local communities have developed adaptation measures relevant to their cultural values to lessen the impacts of climate threats on their livelihood patterns (FAO, 2007; Jianchu et al. 2007). In the current study, most farmers reported that they changed crop types from maize to sorghum and millet to cope with climate change. This is in line with a study conducted in Pakistan by Abid et al. (2016), which shows that farmers implemented a method of changing crop types which were adopted against incidents of heavy pest and insect attacks, soil problems and extreme temperature events. Some farmers reported that they had replaced cotton crops with maize crops since 2010 due to their exposure to heavy pest attacks and changing weather conditions (Jianchu et al. 2007). Even though subsistence farmers have always adopted adaptive strategies to some of these changes over the years, effective adaptation strategies should be aimed at securing their well-being in the face of climatic changes.

6. Conclusion

The study has revealed that even though Mutoko community members have knowledge of climate change and are aware of its indicators, climate change adaptation is still a serious issue that needs to be addressed. The strategies employed by Mutoko rural community members have helped them cope in various ways. However, regardless of having these strategies, the community still struggles to cope with the effects of climate change. Some of the strategies they currently employ are not sustainable. For example, mulching and food storage cannot be practised continuously. Food storage only works out when farmers have enough produce to keep some. However, if there is no sufficient rainfall as reported by most participants, it will be difficult to attain a bumper harvest. The study has also revealed that a majority of community members have knowledge of climate change and its indicators and various strategies are employed to adapt to the effects of climate change. Knowledge of climate change and its indicators as well as the strategies to combat its effect is a positive development towards achieving sustainable development. This is because the only way to meet the needs of the present without compromising the ability of future generations to meet their own needs is when the community has in place strategies that are enormously effective to combat climate change.

Even though for this paper "sustainability" stands apart from "sustainable development", the concepts strongly interlink. However, considering sustainability on its own is of paramount importance in understanding how it has been adopted to define and modify other concepts. All the efforts employed by the community to adapt to the effects of climate change are aimed at sustainability. This is because changing crop types is done to replace the crop with ones that suit weather conditions and soil effectively. This is a strategy that goes on for years and will be effectively employed by many generations to come. Furthermore, strategies such as mulching will improve agricultural productivity which is one of the targets of agenda 2063 and lead to the elimination of hunger which is a goal of SDG 2. Hence, knowledge of climate change and its indicators, as well as strategies employed to eliminate its effects, are channeled in a way that involves the community which assumes what is referred to as leadership for sustainability. Leadership for sustainability implies that leaders recognize the root causes of unsustainability, seek to understand the social, economic and ecological impacts of their work, and acknowledge and value the ecological diversity of natural systems. Having such knowledge will help them disseminate knowledge on sustainability to the economy. As a result, no one will be left behind

on issues about climate change adaptation, the need for modern agriculture for increased productivity and production and environmentally sustainable climate-resilient economies and communities.

This study has the following recommendations. (i) Government support: The government through the Ministry of Agriculture, Mechanization and Irrigation Development (MAMID) should support rural communities with sustainable strategies such as biodiversity management strategy, energy and climate change strategy and environmental education and training to ensure sustainable resource use and management in rural communities. (ii) Promotion of the use of indigenous practices: There must be policy and public discourses on climate change and adaptation. This will help the communities in coping with increasing climate change and variability since rural communities often inhabit economically and politically marginal areas and they depend on natural resources which are directly affected by climate change and (iii) Involvement of private players: Private players such as non-governmental organizations, private companies and individuals should assist communities on matters about agricultural productivity, climate change adaptation and acquisition of knowledge on climate change. Hence, if the private player in specific fields intervenes, they will significantly help in realizing the mentioned agenda 2063 goals and the above-mentioned SDGs.

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