



# Improving Livelihoods of Resettled Farmers Through Development of a Knowledge Base on Climate Change in Mhondoro – Ngezi District, Zimbabwe

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## To cite this article:

Tinashe Mitchell Mashizha<sup>1</sup>, Monica Monga, Munyaradzi Admire Dzvimbo. Improving Livelihoods of Resettled Farmers Through Development of a Knowledge Base on Climate Change in Mhondoro – Ngezi District, Zimbabwe. *International Journal of Sustainable Development Research*. Vol. 3, No. 2, 2017, pp. 18-26. doi: 10.11648/j.ijdsr.20170302.12

**Received:** May 30, 2017; **Accepted:** June 29, 2017; **Published:** August 3, 2017

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**Abstract:** Climate induced famine has had adverse effects and has been the worst disaster from which most resettled farmers experience and suffer from. It remains a topical agenda and a bone of contention in most countries of the global south. Despite remaining a challenge in most farming areas, the small holder farmers have struggled to come up with alternative livelihoods emanating from effective understanding of climate change. Hence using data from interviews, questionnaires and focused group discussions, this paper aimed at unravelling rural livelihoods which enhance local people's understanding and grasping of the effects of climate change induced disasters in Mhondoro- Ngezi district. The study noted that smallholder farmers are applying conservation farming (CF), small livestock production, irrigation schemes like gardening, agro-forestry, gold panning and fishing. The research also pointed out that 62% of the local farmers were not satisfied with the level knowledge base they have concerning climate change. The snail pace development of a knowledge base on climate change is being held back by challenges which include poor service delivery by government departments, lack of resources, unclear selection of beneficiaries, extreme reliance on Indigenous Knowledge Systems (IKS) and policy inconsistency. The study recommended that agricultural extension officers need to be capacitated so that they train farmers on the importance of seasonal climate change forecast information. There is need for increased participation in the realm of development agencies (NGOs and government) and be more sincere with the participation of communities through the development of a knowledge base on climate change adaptation programmes.

**Keywords:** Adaptation, Climate Change, Food Security, Livelihood, Resilience, Strategies

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## 1. Introduction

Climate change will always have far reaching impacts on the agricultural sector, and will actually affect smallholder farmers whose livelihoods are precisely dependent on rain fed agriculture and have a low capacity to adapt. Hence, it is imperative to note that; drought is one of the foremost common climate induced disasters which can undermine rural livelihoods and well- being despite the use of a myriad of strategies (Mogotsi et al, 2012). Lack of an understanding and development of a knowledge base on climate change continue to pose serious threat and negatively impact

economic, environmental and social spheres. This can result in reduction in food production and income for farmers which will in turn leads to increases in market prices of commodities (Dercon et al., 2005)

Realising policy framework gaps that have failed to cushion vulnerable farmers from livelihood threats posed by climate change, the government of Zimbabwe has of late made inroads to develop and better manage multiple climate change impacts. This has been seen through the lenses of the Ministry of Agriculture, Mechanisation and Irrigation development, comprehensive Agric policy framework 2012-2032. In addition, climate change office is leading the formulation of a comprehensive National Climate Change

Response Strategy (NCCRS), (GO Z, 2012). The Climate Change policy has goals, with the potential to benefit the local resettled farmers and strengthen their knowledge base on climate change which in future will result in increased food production.

Traditionally, climate change is perceived to have an effect on food security, water and ecosystems. However, climate change also comes with opportunities and constraints that have adverse effects on livelihoods of resettled farmers (Jiri et al 2016, Zoellick 2009). Considering that most governments in the countries of the global south, especially in sub-Saharan Africa focus on impacts of climate change on livelihoods and advancing human well-being, the case of establishing an oasis of knowledge base on climate change is often neglected and downplayed yet it is of paramount importance considering that development of a knowledge base is a firm footing on addressing climate change woes and catastrophe. Most farmers rely more on Indigenous Knowledge Systems to depict weather changes, pending disasters and rainfall patterns (Mapfumo et al., 2015; Roudier et al, 2014), but these predictions have been falsified. For example most farmers through IKS had little knowledge on the existence and impact of cyclone Dineo that destroyed crops and infrastructure during the 2016/17 farming season. Climate change is already affecting many livelihoods in Zimbabwe. The effects are undermining the nation's socio-economic development through compromised livelihood outcomes (UNDP, 2011; GOZ, 2012; Dzvimbo, Monga and Mashizha, 2017). This results from gradual and insidious changes in temperature and rainfall patterns including the increasing frequency and intensity of extreme events such as floods and droughts. Poorest communities in Zimbabwe such as Mhondoro-Ngezi district are being hardest hit as they are largely dependent on climate-sensitive natural resources and ecosystems such as agriculture (Unganai et al, 2012,). Most vulnerable communities also reside in areas that are prone to climate hazards and are less able to respond to climate change because of limited human, financial and institutional capacity. Therefore, the current global phenomenon in climate change trends requires the development of robust and resilient approaches that will actually increase the sustainability of livelihoods, knowledge base and upkeep of smallholder farmers (Madzvamuse 2010; World Bank, 2015).

This paper calls for the recognition of developing a solid knowledge base for climate change adaptation as a key development concept in Zimbabwe given the cross cutting nature of climate change impacts across all key sectors. Simply put without addressing current and future climate changes in Zimbabwe and integrating climate change awareness in development planning, climate change threatens to stall, derail and reverse progress of current gains and further compromise the sustainability of farmers livelihoods. Few studies have been done with a bias towards the development of a knowledge base on climate change (Zimbabwe in particular) and this paves way for the study which seeks to make lasting strides towards closing the gap with regards to climate change, development policy and

improving sustainable livelihoods in Southern Africa with specific reference to the experiences from Mhondoro-Ngezi. In Mhondoro-Ngezi District precipitation levels have decreased and the rainfall has become more variable decreasing food production in the area. Declining food production in the district has resulted in food crisis which becomes acute in January and February.

## 2. Literature Review

Climate change is no longer a myth but reality that is causing problems for most governments of the global south. In this regard, climate change is critical for Zimbabwe given that it is an agricultural based economy with agriculture sector contributing about 15% each year to the GDP, and the sector provides employment for some 70% (UNDP, 2012; EMA, 2012, Ministry of Foreign Affairs, 2015). For Africa and Zimbabwe in particular, climate change is critical in that not only does it erode the development gains achieved in terms of Human Development but it threatens the future development reality.

According to the IPCC (2012) there is an acute decrease in freshwater availability, compounded pressures on natural resources and the environment. This is associated with rapid urbanization, industrialization, economic development, endemic morbidity and mortality due to diarrheal disease primarily associated with floods and droughts due to changes in the hydrological cycle.

### 2.1. Climate Change and Livelihood

The threat of global climate change poses an unprecedented challenge to humanity and sustainable livelihoods. It is of paramount importance to note that climate change culminates in varying negative impacts on weather patterns and environment from which resettled farmers out rightly rely on for their livelihoods. In this regard, it is therefore important for stakeholder engagement, to develop a knowledge base on climate change which will counter vulnerability to drought and building resilience to climate change impacts in crop and livestock production systems (Manatsa et al, 2012). Resettled farmers who adopted crop mix included improved varieties of sorghum, pearl millet, cow peas, drought tolerant maize varieties, cassava and groundnuts. Equally the same with an effective knowledge base on climate change, resettled farmers' livelihoods improved drastically. Unganai et al (2012) affirms that 30% of farmers implemented infield rainwater harvesting and soil moisture conservation and dependence on rain fed agriculture as the sole source of livelihood decreased by more than 20%. Traditional crops are now complemented by small gardens, livestock production, nature of conservation and trading (Kalonga, 2011; UNDP, 2012). In this regard, resettled farmers' livelihoods can further be improved when farmers adopt soil moisture conservation techniques such as deep plough furrow or tied ridges. In livestock production, simple technologies such as urea treatment of crops to improve nutritional value, molasses

supplements and the production of browse trees made a huge difference in saving soil.

## 2.2. What Are Livelihoods

According to Chambers and Conway (1992), livelihoods comprise people, their capabilities, means of earning a living, including food, income and assets. Sustainable livelihoods are those that can cope and recover from stresses and shocks, maintain and enhance local and global assets, on which livelihoods depend, imparting bequests and opportunities for future generations (Carney, 2002). Shocks are sudden changes or disturbances in the economy which transform into trends or cycles when the events are prolonged or analysed over time. Integrating expectations of future generations in today's decision making processes is necessary for the achievement of sustainable livelihoods. Niehof (2004) singles out failure to identify sources of livelihoods as one of the weaknesses of this definition of sustainable livelihoods. Although agriculture is the core livelihood strategy in

Southern Africa, agricultural practices by farmers are unsustainable. Carney and Toner (2002) argue that CA could be a panacea to sustainable livelihoods for smallholder farmers amid poverty, vulnerability, political and economic instability and civil conflicts.

## 2.3. Theoretical Framework

The sustainable Livelihoods Framework is relevant to the study as it helps identify what farmers are already doing to cope with risks and uncertainty. Chambers and Conway (1992) states that a livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks maintain or enhance its capabilities and assets, while not undermining the natural resource base. Furthermore, the mix of activities may be changed to reduce the covariance among different sources of stress or shock.

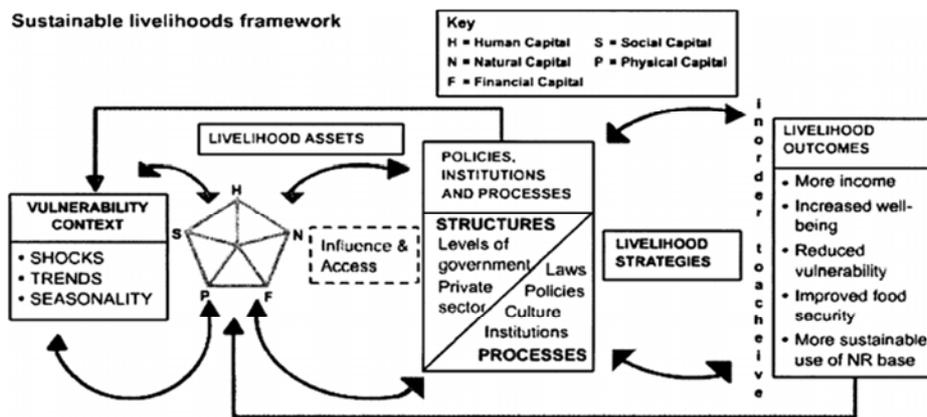


Figure 1. Sustainable Livelihood Framework.

### Principles of Sustainable Livelihood Approaches

The sustainable livelihood approach attempts to take a holistic perspective in determining problems and opportunities for programme activities. This holistic perspective involves taking into account:

- (1) *Context*: What are the social, political, economic, historical and demographic trends that influence livelihood options of a particular population and what are the risks they are exposed to?
- (2) *Resource*: What are the various assets that households and communities have access to (they can be physical, financial, social and natural) and how are they differentiated and disaggregated?
- (3) *Institutions and organizations*: Institutions that operate within a given context is critical to sustainable livelihoods outcome hence it is critical to identify which institution operate in a given livelihoods setting to determine their strength and weakness in delivering services to secure livelihoods.
- (4) *Livelihood strategies*: A holistic diagnosis attempts to identify the various strategies people use to make a living and how they cope with stress. These are also

referred to as adaptive and coping strategies. To tailor interventions appropriately, it is important to determine the variability that may exist across ethnic groups, households and individuals in the pursuit of different strategies.

- (5) *Livelihood outcomes*: Outcomes are measured to determine how successful households are in their livelihood strategies. These outcomes can be based on normative standards or on criteria identified by the communities.

## 3. Methodology

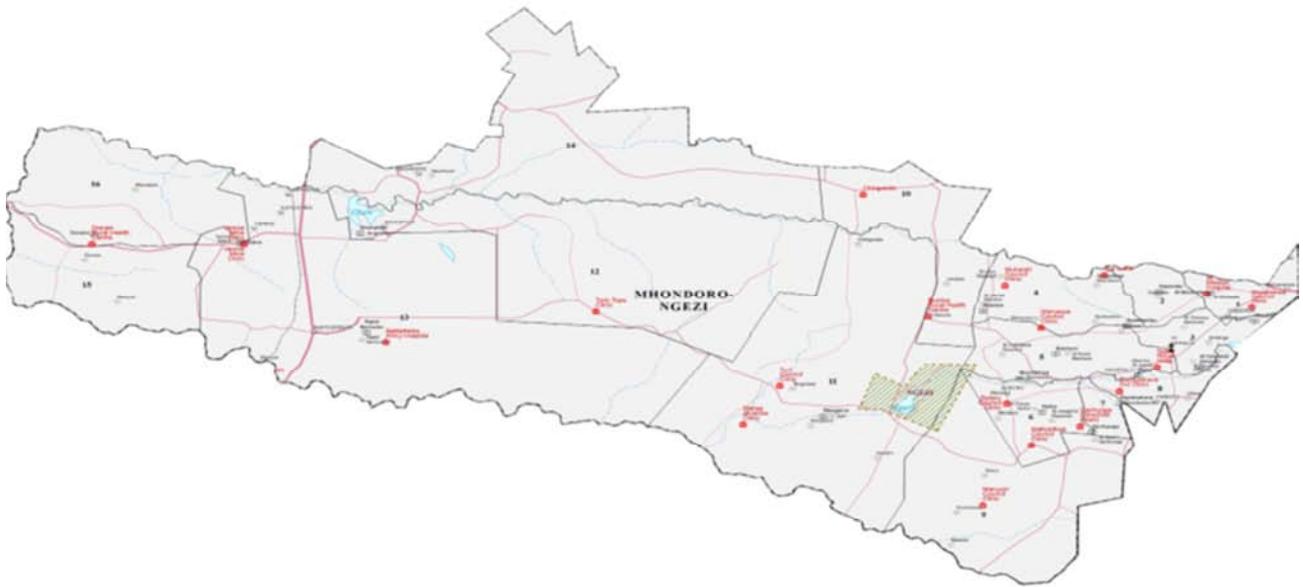
Data was collected from three villages which were chosen using purposive sampling method. The logic of a sample of subjects according to Musarurwa and Lunga (2012) is to make inferences about some larger population from a smaller one which is the sample. The primary data was collected using different tools namely focus group discussion, key informants interview and household interviews. Two focus group discussions were conducted in this research to get the qualitative in depth information which cannot be obtained on

one to one basis. These groups consisted of between 8- 13 people with ages varying from 25 to more than 70 years. A total of 6 key interviews were done, with four of the interviews done with Agricultural Extension (AREX) Department officers and two with village heads. The questionnaires were administered in order to gain vital information: whether the individual has any knowledge on Indigenous Knowledge System on weather forecasting, the type of forecast they find more reliable and the reason why, perceptions on climate change, past environmental change events, how they responded/adjust to them and what were the constraints encountered in responding to climate change. Key informants were asked if there was any external intervention during drought period and community level coping strategies. The AREX officers provided information on the implementation of coping mechanisms as well as accounts of

vulnerabilities of people on the ground to the effects of climate change. The secondary data information was collected from the district through annual reports. Qualitative data from questionnaires was analyzed using the MS excel software and data from interviews and FGD was analyzed using content analysis.

#### *Study Area*

The work was carried out in Mhondoro-Ngezi, its coordinates are -18.45 and 30.617 in decimal degrees. The area is a mining district with platinum being extracted by Zimplants and a farming village in the province of Mashonaland West, Zimbabwe. Mhondoro-Ngezi has got a total population of one hundred and four thousand, three hundred and forty two (104, 342) (Zimbabwe National Statistics Agency 2015).



*Figure 2. Map Showing Mhondoro-Ngezi District.*



*Figure 3. African Map Showing the Location of Zimbabwe.*

## 4. Results and Discussion

According to Gogo (2012) climate change poses a threat to food production as it induces variability in rainfall. In Mhondoro-Ngezi District precipitation levels have decreased and the rainfall has become more variable decreasing food production in the area. Declining food production in the district has resulted in food crisis which becomes acute in January and February. It is in this realisation that this study seeks to understand the impact of climate change on the livelihoods of the communities in the district, with the objective of study understanding how communities are being affected by climate change and the information they have to sustain their activities. The study also seeks to establish how the people are adapting to the changes as well as their perceptions about the gravity of the climate change situation in the area. The Intergovernmental Panel on Climate Change (IPCC) (2001, 2007, 2012) reports conclude not only that green-house gas emissions are already beginning to change the global climate, but also that Africa will experience increased water stress, decreased yields from rain-fed agriculture, increased food insecurity and malnutrition, sea level rise, and an increase in arid and semi-arid land as a result of this process. Social impacts of climate change include the prevalence of droughts which lead to higher likelihood of crop failure, increased diseases and mortality of livestock, indebtedness, outmigration and dependency on food relief (Mutasa; 2008).

The study on the impact of climate change on the local populations' livelihoods is increasingly forwarded as urgent researches need (Mapfumo, 2010). Bunce et al (2010) noted that the African continent is increasingly becoming a major global food crisis spot if there are no efforts to address climate change at the local level. Local assessment of vulnerability enables a better understanding of how and why communities respond to the same type of environmental stress in ways that are different (Nath and Behera; 2011). As such the impact of climate change across the globe also differs. With this in mind, it becomes imperative as Nath and Behera (2011) notes, to understand the actual dynamics of climate change impact at the lowest levels of the society, such as households, communities and districts so as to influence responsive relief interventions and adequate knowledge on mitigatory measures.

### 4.1. Local Awareness and Perceptions of Climate

Results from the study indicate that communities have a clear understanding of climate change. The concept "climate" is perceived differently at different levels of conceptualization. Discussion with stakeholders at village level in the study areas has shown that people understand climate as, among others, rainfall, drought, temperatures, winds and floods. At regional and district levels it is perceived as dynamics in weather conditions that cause changes and/or variability in rainfall patterns, temperature patterns, wind velocity, surface and ground water regimes. Such changes are perceived to lead to

years of prolonged drought or unpredictable excessive rainfall often associated with decreased agricultural productivity. The majority of the respondents (76%) had attained primary education as indicated by figure 3; hence they had a broad understanding of the linkages between climate change and various livelihood issues.

Drought and rainfall ranked the highest among the aspects mentioned to indicate the local understanding of climate, as reported by 91.9% and 91.7% of the respondents in the district. Concerns about drought were raised more in these districts because of the recurrent experiences of droughts, hence its local association with climate. Temperature was reported as the third aspect explaining climate change at local level, a concern raised by 75% of the respondents. Other aspects such as floods and humidity were mentioned by smaller proportion of the respondents, indicating that they are not a common occurrence.

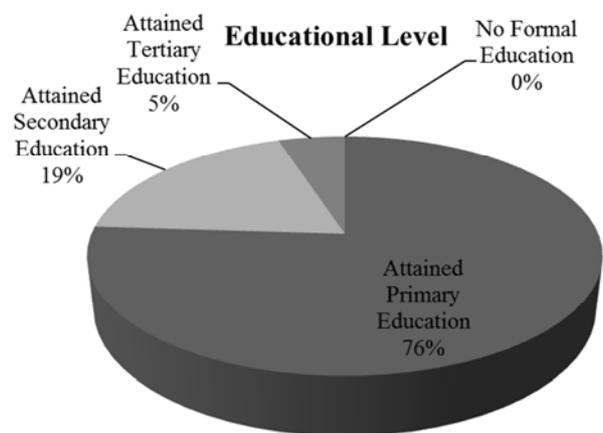


Figure 4. Educational Level of the respondents.

In all the study areas there was a general feeling that rainfall pattern has been decreasing during the last 20 years as expressed by 81.3% of the respondents, hence their concern about droughts. This is an indication that rainfall is one of the parameters that may be seriously affected by changing climate. At village level, the concept "climate change" was associated with the weather conditions particularly rainfall inconsistencies and unpredictability over years rather than actual change. Major concerns were related to indicators like reduced amounts of rainfall, rainfall coming late, increased temperatures and incidences of drought, variations in agricultural seasons and decreased crop productivity.

The remaining 18.7% of the respondents were of the opinion that rainfall patterns have not changed during the last few years. Their response could be associated with little experience of the long term rainfall patterns of these areas, especially for the inhabitants who have settled in the study area only recently.

### 4.2. Types of Crops and Livestock Produced in Mhondoro-Ngezi

The purpose of these results is to present crop and livestock

production undertaken at household level, noting that agriculture is main source of livelihood. Production of crops was undertaken by 92.7% of households, while 7.3% did not. 70.2% engaged in livestock production, while 29.8% did not. From those who undertook crop production, 97.6% engage in the production of maize, groundnuts 65%, round nuts 35.3% and beans 41.1% In addition, 65.9% engage in the production of tomatoes, 93.2% covo, 17% butternuts, 87.2% pumpkins and 54.6% water melon as indicated by table 1.

*Table 1. Types of crops produced.*

Crop Types	Household%
Maize	97.6
Groundnuts	65
Round nuts	35.3
Beans	41.1
Tomatoes	65.9
Covo	93.2
Butternuts	17
Pumpkins	87.2
Water melons	54.6

The study noted that under normal circumstances, families produce above average and even better, but during the droughts (2002 drought) they have little yields due to lack of rains. Hence, livelihoods are threatened, further exacerbating levels of poverty. In the events of droughts, households receive beans and food handouts from Non-governmental organizations. This is supported by Lewis and Kanji (2009) who argues that NGOs provide relief in the form of food parcels in the event of drought. However, it is worth noting that the distribution of food handouts is politicized, exacerbating the vulnerabilities of some families. Mechanisms must be put in place to protect and ensure a fair distribution of food in rural areas (especially in time of need). More to the above, it is critical to note that climate change has caused rampant loss of livestock in the studied area. 29.8% of the respondents who did not engage in livestock production reported that they don't keep livestock because of droughts which cause the loss of livestock. Interestingly, the study noted that this is compounded by the inability of households and community to prevent animals from dying.

#### **4.3. Traditional Adaptation Strategies - Mhondoro Ngezi**

Climate change is eroding traditional coping mechanisms by causing climatic extremes with a frequency and intensity that local people had never seen before. This has alerted the farmers the need to re-examine land use, management practices, and farm infrastructure leading to the adoption of additional coping strategies. The results of this research noted that every farmer, including those that claimed to have no knowledge about climate change, have adopted at least one strategy to cope with the current climatic trends. The most popular adaptation strategies in the district included planting short season varieties, crop diversification, and varying planting dates. The main thrust of these strategies is increased diversification and escaping sensitive growth stages through crop management practices that ensure that

critical crop growth stages do not coincide with harsh climatic conditions in the season, such as mid-season droughts (Nhemachena and Hassan, 2007). Crop diversification improves household food security since different crops are affected differently by the same climatic conditions. Also, given the high frequency of mid-season dry spells and shortening of the rain season, farmers grow short season and drought-resistant crop varieties, such as sorghum, rapoko, and finger millet. For a staple crop (maize) instead of planting local varieties, farmers have opted for hybrid maize that take a shorter period to mature and yield more than traditional varieties in good years. This appears logical and sustainable if seed producers continue to improve on these varieties. However, indigenous land races that were more adapted to the conditions in the area are being lost as farmers prefer high yielding hybrid varieties.

#### **4.4. Livelihood Diversification**

Livelihood diversification has increasingly become an important adaptation strategy in Mhondoro-Ngezi. Some young people are going as far as South Africa and Botswana resulting in their families and other close relatives depending on remittances to supplement agricultural incomes, as well as during periods of food shortages. Other activities, such as gold panning, fruit gathering and selling, are on the increase. The sustainability of these sources of income is quite questionable considering that since the early 1990s the job market has been shrinking as the government failed to foster positive economic growth while activities, such as gold panning are illegal and environmentally degrading.

Soil and water conservation strategies, such as water harvesting activities, which currently are practiced by about 38% of the resettled farmers, are being intensified as Agricultural Extension Officers and NGOs promote the activities. These institutions are enthusiastic about promoting these practices because they are building on farmers' indigenous knowledge, skills, and experience acquired over the years, as farmers were battling to survive the harsh climatic conditions that prevail in the area. If activities are properly promoted and adopted by farmers, they promise to address some of the climate change challenges among smallholder farmers considering their poor resources and marginal location which makes conventional irrigation impossible.

Other adaptation strategies include growing legumes (such as beans) towards the end of the rain season when cereals fail, mainly due to excessive rainfall, and application of more fertilizers when nutrients are heavily leached from the soils. Legumes mature fast and provide nutritious relish. They also fetch good prices on the market. Application of more fertilizers as an adaptation strategy has its own challenges. Chemical fertilizers are scarce and exorbitantly priced in Zimbabwe and most smallholder farmers cannot afford them as concurred by (Dzvimbo, Monga and Mashizha, 2017).

#### 4.5. Developing a Knowledge Base on Climate Change

Climate information appears to be particularly important as noted from the study pertaining the levels of education and in many cases prerequisite for coping and adapting to the negative impacts of climate variability and change, given that most of the rural livelihoods in Southern Africa depends on climate and environmental dynamics (Goddard *et al.*, 2010). A study that has been done concludes that smallholders farmers in rural areas tend to use climate information that they would have observed for crop management. Adaptation strategies used by key respondents from this study show that they are indigenously invented; hence, indigenous knowledge plays a critical role in climate change adaptation. Saitabau (2014) argues that most indigenous people are not strange to climate change and weather induced vulnerability as they have generations of experience coping with climate change. Saitabau (2014) further explained that indigenous communities have experts who are capable and have knowledge to undertake and maintain systematic long-term climate observation and analysis of this climate information. This study noted that indigenous knowledge offers valuable insights and compliments scientific data that is critical for developing effective adaptation measures. Therefore, there is need for a policy that enhances farmers and scientists to work together and to enable them devise adaptation strategies against climate change. This concurs with Akinbami *et al.* (2016) who stated that excluding local farmers from global process of decision and policymaking on climate change adaptation not only deny policy makers the insight from their local experience, it also contribute to their non-challant attitude towards effective adaptation measures proffered by scientist and policy makers. Conversely, indigenous people have a wealth of knowledge that is potentially useful in climate science and without this realization, indigenous knowledge would remain untapped and underutilized and cost of this passivity is obvious, communities' propensity to climate change risks would increase (Chanza and De Wit, 2013).

### 5. Conclusion and Recommendations

The current study examined the development of a knowledge base on climate change in Mhondoro-Ngezi District where rural livelihoods continue to be jeopardised due to climate change. Our study indicated that smallholder farmers are increasingly concerned about unfamiliar climate change dynamics, including uncertainty about planning, loss of crops and damage to infrastructure. The fact that the majority of resettled farmers are still ignorant about climate change means that farmers already operate in the marginal areas and most had already adopted some coping strategies to the harsh climatic conditions that have prevailed over the years. This can serve as useful entry points for intervention. Therefore, the old and new intervention strategies need to be intensified through participatory approaches, such as farmer field days and trips, which to a greater extent

increase the farmers' knowledge base.

Since there is no universal way to adapt to any challenges, let alone climate change, adaptation strategies need to be context-specific. This necessitates quantification of various thresholds, such as labour, household agricultural assets, knowledge and skills that determine the resettled farmers' adaptive capacity to climate change (Dzvimbo, Monga and Mashizha, 2017). The sustainability of adaptation strategies has to be prioritized. The adaptation strategies should, therefore, be considered in terms of the farmers' location, livelihood systems, and ecological setting so as to make them socially, economically, and ecologically sustainable.

In line with the foregoing discussion on improving livelihoods through the development of a knowledge base on climate change in Mhondoro-Ngezi District in Zimbabwe, we make the following recommendations:

- (1) There is need by the government and the donor community to enhance environmental and agrarian planning concern in the rural areas amid the effects and impact of climate change. The use of Remote Sensing and Geographical Information Systems (GIS) contribute to environmental planning. It is vital to note that environmental assessments which encompass areas such as land use, human settlements, air pollution, flood zones susceptibility and drainage system need to be prioritized. The ultimate aim is to achieve maximum benefits for the natural environment and agricultural production.
- (2) Develop and enforce policies that regulate change from land use to another especially the clearance of forests and woodlands to other land uses such as dam construction and erection of dip tanks. This may assist in reducing deforestation and siltation of water bodies and rivers.
- (3) Adopting the concept of climate smart techniques and resilient, is a new fast growing approach to sustainable agriculture. Mhondoro-Ngezi District should be remodeled along this modern concept. In this way smallholder farmers who fail to produce average produces can have alternative farming techniques to expedite.
- (4) Income diversification can enhance the effectiveness of climate change adaptation interventions. Smallholder farmers need to diversify their income strategies so as to avoid the risk of relying on agricultural activities alone, but non-farm activities (Jiri *et al.*, 2016). Hence, the provision of a credit support system, such as micro finance or investments and insurance, training in financial literacy, can also assist people in communal areas to diversify their income.
- (5) Increased participation in the realm of development agencies that is both the government and non-governmental, should be more sincere with regards to participation of communities through the development of a knowledge base on climate change adaptation programmes. In order for these strategies to be more

effective, smallholder farmers in Mhondoro-Ngezi District have to take lead in harnessing climate change knowledge and adaptation.

- (6) Increased innovation, both the government and civil society agencies should engage local communities to gain a better understanding of traditional of traditional climate change mitigation knowledge and practices. There has been limited research in indigenous knowledge systems (IKS) and incorporation of local knowledge has the prospective of the development more effective strategies.
- (7) Agricultural Extension Officers need to be capacitated so that they will be able to train farmers on the importance of seasonal climate forecast information and how they can use it to make efficient use of their limited resources through informed investment decisions.

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