Davison Mugiya (South Africa), Costa Hofisi (South Africa)

Climate change adaptation challenges confronting small-scale farmers

Abstract

Climate change adaptation issues have recently gained attention for the past few years in Zimbabwe. However, little has been done to explore the challenges, associated with climate change in the country. Therefore, this article explores the challenges affecting small-scale farmers in the Zvishavane District of Zimbabwe in coping with climate change vulnerability. The qualitative research methodology encompassing semi-structured interviews was used to collect data from small-scale farmers and other key informants in the study area. The study portrays that small-scale farmers are struggling to cope with climate change due to resource constraints, lack of access to credit and inputs, aid bottlenecks coupled with contradiction of programs among other critical issues.

Keywords: adaptation, climate change, climate change adaptation, resource constraints, small-scale farmers.
JEL Classification: Q54, Q13.

Introduction

Climate change vulnerability is closely linked to uneven resource allocation with the poor at a disadvantaged position. Both vulnerability and adaptation processes to climate change are likely to consolidate unequal economic structures (Adger et al., 2003) and due to adverse losses from climate change, which are not compatible with the reserves, rural financial institutions often do not serve smallholder rain-fed farmers unless they attain collateral or insurance (Hansen et al., 2010). Worrisomely, agriculture is a dualistic sector in Zimbabwe, consisting of large and small-scale farmers (Mutekwa, 2009; Mukozho, 2011). However, small-scale farmers are mostly under resourced, marginalized, isolated and more vulnerable to climate change shocks than their counterparts (Mutekwa, 2009). The Zimbabwean government admits the seriousness of climate change, which was manifested through the signing and ratification of the UNFCCC in June 1992 and agreed to the Kyoto Protocol on Climate Change in June 2009. Yet, the country does not have a clear-cut policy to foster climate change adaptation (Tigere, 2010) despite the viability of political arm to trigger vigorous adaptation through institutions, which mediate the allocation and distribution of resources for the best interests of vulnerable groups (Ashely and Maxwell, 2001; Solesbury, 2003).

Recurrent climate change effects have led to shifts in agro-ecological regions, and high temperatures are anticipated to shorten the growing season of crop by 2 to 35 days, a situation which will reduce crop yields. The case of Zimbabwe's region iv has been evident, which is likely to be declared a non-maize producing zone due to climate change shocks, a situation, which promotes food insecurity in the area in question. However, this case can throw light to the susceptibility of rain-fed agriculture, especially in areas, which receive low rain fall coupled with high temperatures, which is typical in most small-scale farming zones (Mano and Nhemachena, 2006). Thus, if agriculture, which is a major rural livelihoods strategy is jeopardized, the lives of the majority might be at risk of food insecurity, which makes adaptation a necessity.

Poor infrastructure, and insufficient management, lack of savings and legal status are serious stumbling blocks for adaptation (Chigwada, 2005; Belder et al., 2007; Tigere, 2010) and apparently only 4% cropland in Africa is irrigated (IPCC, 2007; World Bank, 2008; Muller et al., 2011) issues, which undermine climate change adaptation in marginalized communities. Thus, poorly resourced farmers will not be able to adjust to climate change shocks unless they attain aid from elsewhere (World Bank, 2008).

Despite the significance of agriculture in Zimbabwe and its susceptibility to climate change, little has been documented on the impact of climate change on food security (Gregory et a.l, 2005) and factors, which are compromizing adaptation among small-scale-farmers. Whilst some studies have been conducted on climate change and agriculture in Zimbabwe (Makadho, 1996; Chigwada, 2005; Tigere, 2010; Jarie and Mugiya, 2011), particular attention has been paid to the impact of climate change on agricultural production and the impact of information and technology on climate change adaptation, neglecting factors affecting adaptation.

Davison Mugiya, University of Fort Hare, Department of Development Studies, South Africa.
Costa Hofisi, Ph.D, Associate Professor and Chair: Public Management and Administration, North-West University, Vaal Triangle Campus, Faculty of Humanities, School of Basic Sciences, South Africa.

Studies on climate change vulnerability have been biased towards quantitative methods (Makadho, 1996; Mano and Nhemachena, 2006; Mutekwa, 2009; Unganai and Murwira, 2010). However, interpretation and meaning that the subjects attach to the problem under investigation have been disregardedelements, which can only be addressed qualitatively (Schurink, 1998; Creswell, 2009). Qualitative research does not rely on numbers and statistics to express the information, which the participants have imparted during the study, but rather on words as expressions of their experiences and views (Creswell, 2009) and it takes a holistic nature (Denzin and Lincolin, 2003). This study seeks to embrace small-scale farmers' innermost perceptions in the context of climate change vulnerability and adaptation.

1. Description of the study area

The area is located in natural region 4, characterized by arid soils and very hot temperature during the summer months (Mupaza et al., 2010). Natural regions 4 and 5 are said to be the most appropriate for extensive grazing and the rainfall patterns are less reliable averaging less than 500 mm per year (Phillips et al., 2002). The area is characterized by savanna grassland and savanna woodland kinds of vegetation with dry deciduous woods in some parts. The woodlands and grasslands provide fuel wood, building poles, edible fruits, tubers and thatching grass (Maroyi, 2013).

Despite the hot climatic condition of the district, agriculture remains the main source of livelihoods. Crop and livestock production are central activities in the region and major crops cultivated are finger millet, pearl millet, sorghum, groundnuts, cowpeas and round-nuts. The majority of farmers employ ox drawn ploughing techniques for land cultivation together with small digging hand tools. Those that do not own oxen usually work for the ones with ox for ploughing in exchange for drought power. Natural methods like crop rotation are normally preferred for improving soil fertility. Farmers grow cash crops like cotton to improve their capacity to generate income and their purchasing power. Both men and women are actively involved in agriculture (Mupaza et al., 2010).

2. Research methods

The research employed an exploratory research design. The exploratory design is appropriate when problems have been identified, but understanding of them is very limited (Yegidis and Weinbach, 2002). Climate change and adaptation issues are poorly understood in Zimbabwe, which is a scenario making an exploratory research design appropriate to explore the issues under investigation. The study could not use quantitative scientific observation and experimentation to explore the issues under study because of its qualitative nature.

The data were obtained through semi-structured interview schedules, which gave participants a room to express their opinions and feelings on the issues in question. Focus groups and in-depth interviews were employed in this regard using a small and manageable sample of 13 participants small-scale farmers who were purposefully selected as key informants. Due to the qualitative nature of the study, the researcher could not use quantitative methods, which they often use, surveys, and statistics (Croswell, 2003).

3. Challenges affecting climate change adaptation

3.1. Draught power. Draught power was cited by most participants as a major stumbling block hindering climate change adaptation and food security. Small-scale farmers in Mtambi ward depend on the animal-drawn conventional plough tillage system. This usually delays land preparation posing serious setbacks on the implementation of both early planting and dry planting, as the animals would be too weak to pull the plough before and soon after the first rains. The challenge presents serious constraints for adaptation, as small grain crops perform fairly well when planted during the dry season or with the first rains. Given that small grain crops have the potential to survive heat stress in the context of climate change, it becomes apparent that the majority of farmers are likely to miss the appropriate planting season. One of the participants said that:

"Most of us use ox-drawn ploughs and this remains a challenge, as the animals would be too weak in summer to pull the plough and this is the time that we expect to plant holy crops, so, in most cases, we find it difficult to do this in time".

Similarly, Unganai and Murwira (2010) warn that animal draught power has been a hindrance to crop production and water harvesting in Chiredzi, mainly because the draught power tend to be too weak to pull the plough during the early stages of the rain season issues, which compromizes food security. ZimVAC (2012) observes a close link between draft ownership and production in Zimbabwe. Most households with less than five oxen tend to produce less than 200 kgs of cereals compared to 1000 kgs produced with farmers who owns more than five oxen ZimVAC (2012).

3.2. Lack of finance. Most farmers in Mtambi ward cite lack of funds to purchase seed, which is drought resistant, as a major barrier to foster climate change adaptation. Participants also revealed that small grain seeds are not accessible on the markets and, as a result, farmers are forced to purchase maize

varieties, which are accessible on the market despite the variety's sensitivity to high temperatures. Key informants from Mtambi ward also revealed that whilst nutritious crops like beans, cassava and tubers require low rainfall, which might make them a good alterative in the climate change vulnerable environment like Mtambi ward, the availability of seeds remains another stumbling block compromizing adaption.

Moreover, lack of access to farm inputs inaccessibility and credit are the other challenges compromizing food security in the context of climate change in Mtambi ward. Small-scale farmers in the ward have constrained financial resources, a situation, which hinders their capacity to purchase seeds on market. Participants also revealed that they are forced to plant the seed variety, which they have regardless of the crop's weak resistance to drought spells. Credit is not easily accessible among small-scale farmers in the ward and this has negative implications on small scale farmers, as they are left with limited options. Some of the participants disclosed that:

"The previous season we ended up planting sorghum seeds, which we saved from our yield, which did not germinate, because we did not have money to purchase seeds from the shops".

"As farmers we have many things that we want to do to improve production but our hands are tied due lack of loans".

"Of course, farmers might have the potential to adapt but poverty remains a problem as they do not have money to buy seed and other farm machinery on the market and mostly rely on aid from NGOs and the government that is unpredictable"

These findings concur with the findings by Progressio (2009), citing seed accessibility and utilisation as serious constrains impeding climate change adaptation in Murehwa and Uzumba Maramba Pfungwe districts in Zimbabwe. Likewise, Rahim (2011) echoes the same sentiment asserting that access to credit and hybrid seeds, among other incentives, are critical conditions for agricultural development. Climate change will further position small-scale farmers at a dilemma as they are least likely to attain credit due to lack of collateral (Hansen et al. 2010). Therefore, climate change funding for adaptation should be institutionalised by the Government of Zimbabwe to further enhance the capacity of these vulnerable groups (Hofisi et al., 2013).

3.3. Lack of irrigation equipment. A significant number of participants mention lack of irrigation as a critical issue fuelling food insecurity in the context of climate change exposure. Mtambi ward is surrounded by two major rivers, Runde and Ngezi. However, this comparative advantage is not utilized due to lack of irrigation equipment something, which deepens food insecurity in the ward. Key informants also confirmed that some small-scale farmers have constructed their own small dams in response to drought spells that destroy crops. Unfortunately, the dams have not been capturing much water due to siltation. It was also revealed that the government has been promising to assist with some irrigation schemes, but nothing has been set in motion to date.

In this respect, Lambrechtes and Barry (2003) maintain that policies intended to boost productive capacity receive low priority, a situation, which cripples food generating capacity in Southern Africa. Basing on his findings in Zimbabwe, Chigwada (2005) recommends the development of infrastructure, which resists climate change shocks like construction of standard dams and roads. Makadho (1996) and Chigwada (2005) also confirm that in Zimbabwe, options are there, though funding has been a major stumbling block.

Water stress remains a critical stumbling block culminating in compromized climate change adaptation and negatively affecting food security in Mtambi ward. Crops, livestock and people fail to get adequate water as a result of prolonged drought spell and erratic rainfall patterns, which also shifted small-scale farmers' traditional calendars. Rainfall unpredictability has complicated farmers' traditional timing. Water stress is said to have severe impacts on vegetables cooperatives, which rely heavily on small dams as sources of water. As a result of climate change, the dams fail to catch adequate water that can sustain the cooperatives, a situation which remains a major barrier for food security to be achieved amongst small-scale farmers. It has been cited in focus groups that people in Mtambi ward lack enough water even for drinking, as small scale-farmers from other areas are forced to walk to as far as Mtambi central cluster to fetch drinking water. Another participant said that:

"Water is a serious problem in this ward. Right now, we are left with only one dam with muddy water, we are watching our vegetables drying and, in other villages, people are walking for many kilometres to fetch drinking water".

Gregory et al. (2005) echo the same sentiment by asserting that in some regions, water scarcity has led to declining water tables, rising pumping costs and lack of drinking water. Ludi (2009) warns that the use of irrigation will further fuel water stress in

some regions. The World Bank (2008) also stresses that water stress has been a major obstacle for climate change adaptation in most African countries. This realization portrays that water stress in the context of climate change vulnerability is not a unique challenge.

3.4. Food preference. It has been observed that whilst small grain crops prove to be a viable option to boost production in the background of climate change vulnerability, today's majority is not adopting such varieties enthusiastically, as it threatens their food preference. The issue becomes more complex amongst small-scale farmers given that options, which are most likely to yield desirable results are expensive and, hence, incompatible with small-scale farmers with constrained resources. One of the respondents expressed that:

"Holy crops play a central role in the society as the community uses it for ritual purposes, but now children are no longer interested in consuming small grain crops, instead, they prefer maize".

Lobell et al. (2008) maintain that whilst switching to drought-resistant crops is a possible option to foster climate change adaptation, measures, which can give vigorous improvements, prove to be expensive. Ericksen (2007) and Jones (2011) cite food taste, media and education as influential to people' food preference.

3.5. Conflicting programs and priorities. Contradictions of programs and priorities have been cited as pressing issues impeding climate change adaptation in Mtambi ward. Some participants revealed that some NGOs are still providing small-scale farmers with vouchers that they normally use to purchase maize seeds undermining adoption of drought-resistant small grain crops. However, on the other hand, NGOs maintain that they provide farmers with vouchers, which they can use to purchase the kind of inputs, which they desire without restricting them. Participants further contemplate that NGOs are imposing programs on farmers without considering their immediate needs. In Mtambi ward, small-scale farmers' immediate needs like irrigation schemes have never been attended to, as NGOs bring ideas, which they assume to be suitable for farmers, disregarding their innermost feelings, a move, which compromizes production and, hence, food insecurity in the ward. In light of the relations, one of the participants said that:

"Extension officers have little to offer in the eyes of farmers, mainly because they are under resourced to foster effective climate change adaptation. As a result, despite being pregnant with ideas, the ground for implementation is severely compromized and NGOs tend to gain much popularity among small-scale farmers, particularly with constrained resources. Only better off farmers with resources can turn down some kind of aid, which can have negative effects on food security".

This idea tallies with Ashely and Maxewell (2001); and DFID (1999) who assert that conflict of interests is a key challenge compromizing development among vulnerable groups. Ashely and Maxwell (2001) lament over outsiders who pretend to be development partners, yet, pushing their own objectives and sweep the concerns of vulnerable groups under the carpet, a situation, which works firmly as a buffer for participatory development to prevail. Belder et al. (2007) share the same notion warning that NGOs are restricted with organizational objectives, which normally target specific groups like HIV, victims there by creating beneficiary-bottlenecks which hampers agricultural development.

3.6. Farmers' participation. The study reveals that farmers' participation in initiatives that affect them has been problematic in Mtambi ward. Whilst NGOs are allegedly accused of imposing programs on small-scale farmers, government officials like extension officers who spearheaded climate change adaptation initiatives are not immune from this trap. Extension officers believe that small-scale farmers are rigid and, on these basis, farmers are being forced by these extension officers to adopt small grain crops. One of the informants said that:

"Right now, we are lying to small scale farmers that maize seeds are inaccessible on market as a way of encouraging them to plant small grain crops first during summer".

This remains a challenge for food security, as small-scale farmers are not involved but rather twisted to suit the interests of other stakeholders. This implies that by forcing farmers to take certain decisions, the farmer`s innermost perceptions are disregarded and their fears are neglected, which poses a serious challenge for their climate change adaptation.

Similarly, Ashely and Maxwell (2001) warn that vulnerable groups are at a predicament of having programs imposed on them without considering their perceptions and inner feelings. In line with the argument, Chambers and Conwey (1992), and DIFD (1999) caution that development should be people centred as a critical condition for sustainability.

3.7. Market failure. Whilst small-scale farmers in Mtambi ward have been growing cash crops like cotton to strengthen food purchasing power in the background of climate change induced low yields, market failure has been a major setback, which is

anticipated to further fuel food insecurity in Mtambi ward. Participants also pointed out that the government's Grain Marketing Board normally delays to pay farmers, a situation, which further complicates their adaptation, as their purchasing power remains poor. One of the participants revealed that:

"Small-scale farmers used to grow cash crops like cotton to increase their income, but the situation seems to be pathetic, as climate change threatens to decrease yields and the market has been declining, especially in the previous season".

Philips et al. (2002) also mention that smallholder farmers in Zimbabwe are growing cash crops like cotton, tobacco, sun-flour and brew beer to increase their purchasing power. Thus, whilst people are not passive victims of climate change, they are facing serious constrains in an attempt to adapt (Adger et al., 2003). Likewise, in its climate change and food security framework (FAO, 2008) maintains that small-scale farmers cannot solely depend on farm produce, instead, they need income to purchase some essentials that they cannot produce.

3.8. Cultural factors. The adoption of drought tolerant varieties has been compromized due to cultural differences. A number of farmers indicate that children prefer maize to millet and sorghum. Participants also highlight that manually processed small grain crops are labor intensive as compared to maize. Farmers feel ashamed to grow cassava and tubers on big potions of their farms, mainly because people would laugh at them. Another participant revealed that:

"Whilst tubers promise abundant harvests, it is unacceptable to have a big portion of sweat potatoes or cassava, because people would laugh at you as the crops are not common in our culture".

Belder et al. (2007) cite culture as a serious threat to climate change adaptation, as some farmers would prefer to use the traditional bucket system to irrigate their vegetables to drip irrigation. Lobell et al. (2008) argue that some of the varieties that are adopted by farmers in the context of climate change vulnerability might compromize consumption of preferred food.

3.9. Politicization of programs. Politicization of programs geared to boost productivity among small scale farmers has been cited as an issue compromizing climate change adaptation and food insecurity eradication in Mtambi ward. Participants reveal that farm inputs, which are meant to benefit small-scale farmers are usually diverted for political persuasion and initiatives, which are supposed to benefit farmers are distorted to suit political interests by prominent politicians, a situation, which severely compromizes food security. In some instances, qualification to attain food hand-outs or farm inputs from the NGOs and other government initiatives is aligned to political affiliation. One of the participants said that:

"We were once assisted with irrigation machinery, but we were surprised to see the machinery taken to another ward, a move, which, in our eyes, was political. It is sad that some areas are becoming more superior than others and the needs of certain individuals are becoming more important and prioritized over the needs of others".

These findings validate the view that the farming system's capacity to cope with climate change depends on the political situation and climate change intensification will consolidate unequal economic structures coupled with conflicts in affected communities (Ashely and Maxwell, 2001; Adger, 2003; Wall and Smit, 2003; Shepherd, 2012).

3.10. Compromized adoption of technologies. Compromized adoption of technologies, which were geared towards production increment, culminated in food insecurity in Mtambi ward. Participants disclosed that a number of initiatives have been introduced in the ward like conservation farming and mechanized agriculture initiatives. The initiatives gave birth to the basins tillage system and the introduction of rippers in the ward. However, adoption of the basin system was severely compromized due to transport complications to carry the stover (stocks, grass or crop leaves), which is used for mulching, the stover is over contested, as it is critical food for livestock; labor shortage; and the technology promotes pests and weeds. On the other hand, rippers were adopted enthusiastically, their contribution to food production in the ward is not known, as the technology was being introduced during data collection. Currently, rippers are inaccessible on market and farmers in Mtambi ward were given only one reipper, which is anticipated to be circulated to all four clusters of the ward, which remains a challenge. Some of the participants revealed that:

"The issue of labor is not only limited to this ward, it seems to be the challenge for the nation, as farmers consist of the elderly and HIV patients, a situation, which makes the implementation of the labor intensive basin technology a serious challenge".

"We cannot watch our livestock dying whilst preserving stover for mulching".

"I think rippers can improve our production, as the technology does preserve moisture, reduces soil erosion, animal drawn unlike the basins, which

demand more labor. The rippers are also lighter than the traditional conventional plough such that even with donkeys you can still use it. We do not have enough rippers for now".

Progressio (2009) warns that the basin technology depends on the contested stover, which is fundamental food for livestock. Weiss (2007) argues that small-scale farmers cannot feed the nation, as they are confronted with severe transport constrains. However, despite constrains associated with the basin tillage system, results in Dayataya ward in Zvishavane District reveal increased production among small scale farmers who implemented the technology (Jarie and Mugiya, 2011). Climate change is believed to be playing a pivotal role to a sharp increase of pests and diseases (Gregory et al., 2009). Such supporting views validate the challenges associated with above mentioned technologies.

Conclusions

While climate change issues are poorly understood in Zimbabwe, this explorative study is an attempt to explore the experiences of small-scale farmers in trying to curb the impact of climate change shocks to shield against food insecurity. In light of this, the results might not be sufficient enough for generalization, but will rather candle better understanding on the phenomenon under investigation and trigger further research in this domain. This study maintains that resource constraints have posed detrimental effects to climate change adaptation. Issues like lack of draught power, lack of finance, lack of irrigation equipment have been prevalent in Mtambi ward mainly attributed to severely compromized resource accessibility. However, in some cases, famers show some reluctance to adopt some technologies, which are geared to boost crop production in the context of climate change exposure due to complexities associated with implementation of the ideas. Worrisomely, small-scale farmers seem to be failing to acquire effective governmental support, which is particularly geared towards climate change adaptation and whenever such support is availed weather by the government or NGOs, it tends to be manipulated by politicians to fulfill political agendas. It has been noted that building climate change resilience has been thwarted by conflicting programs and priorities, which tend to be imposed on vulnerable small-scale farmers with negative implications on climate change adaptation. Small-scale farmers are playing a passive role in programs, which are meant to benefit them and, consequently, their innermost concerns and immediate needs are not addressed and this has further sparked misplaced priorities, compromized sense of ownership among farmers with adverse impacts on climate change adaptation.

As poorly resourced small-scale farmers attempt to employ low cost strategies to cushion themselves against climate change shocks, they tend to create other additional challenges. Some seemingly viable options face resistance from consumers for cultural reasons, some of the alternatives tend to threaten food preference, while other options remain trapped by destabilized market systems. The said scenarios have always been causing severely complicated adaptation among small-scale farmers leading to acute hunger and starvation among these marginalized and financially strapped farmers.

In light of the above realization, we argue that climate change adaptation among small-scale farmers is a complex issue, which can never be understood in isolation. The phenomenon in question is also multifaceted in appearance and consequently successful adaptation requires a collaborative approach among various and yet complementary role players. Thus, the government of Zimbabwe needs to merge its efforts with other supporting institutions to promote climate change adaptation among small-scale farmers, where poverty and vulnerability is concentrated. Initiatives rendered towards climate change adaptation needs to be people centered and imposition of programs and initiatives on beneficiaries should be averted if the battle against climate change is to be won by small-scale farmers and the government of Zimbabwe and other partners should capacitate vulnerable farmers, to be able to respond to climate change, which threatens further intensification.

References

1. Adger, W.N., Huq, S., Brown, K., Conway, D. and Hulme, M. (2003). Adaptation to climate change in the developing world, *Progress in Development Studies*, 3, p. 179.
2. Alston, M., and Bowles, W. (2003). *Research for Social Workers: An introduction to methods*, Australia: Allen & Unwin.
3. Anseeuw, A., Kapuya, T., and Saruchera, D. (2012). *Zimbabwe`s agricultural reconstruction: Present state, ongoing projects and prospects for reinvestment*, Development Planning Division Working Paper Series No. 32. South Africa: Halfway House.

4. Ashley, C., and Maxwell, S. (2001). Rethinking Rural Development, *Development Policy Review*, 19(4), pp. 395-425.
5. Babbie, E.R. (2007). *The practice of social research*, Belmont: Thomson Wardsworth.
6. Babbie, E.R. (2008). *Introduction to Social Research, Fifth Edition*, Belmont: Wadsworth.
7. Babbie, E.R., and Rubin, A. (2011). *Research Methods for Social Work*, Belmont: Brooks/Cole.
8. Belder, P., Rohrbach, D., Twomlow, S., and Senzanje, A. (2007). *Can drip irrigation improve the livelihoods of smallholders?* Lessons learned from Zimbabwe. Global Theme on Agro eco systems Report no. 33. Bulawayo, Zimbabwe: International Crops Research Institute for the Semi-Arid Tropics.
9. Below, T., Artner, A., Siebert, R., and Sieber, S. (2010). *Micro-Level Practices to Adapt to Climate Change for African Small- scale Farmers*, IFPRI. Discussion Paper 00953.
10. Brown, M.E., and Funk, C.C. (2008). Food Security under Climate Change, *Science*, pp. 319-580.
11. Burney, J., Woltering, L., Burke, M., Naylor, R. and Pasternak, D. (2010). *Solar-Powered drip irrigation enhances food security in the Sudano-Sahel*, Vol. 107. Stanford University, and University of California: Gianni Hal, Berkeley.
12. Chambers, R., and Conway, G.R. (1992). *Sustainable Livelihoods: Practical Concepts for the 21st Century*, Institute of development studies.
13. Chigwada, J. (2005). Climate Proofing Infrastructure and Diversifying livelihoods in Zimbabwe, *IDS bulletin*, 36, p. 4.
14. Chishakwe, E.N. (2010). *Southern Africa Sub-Regional Framework on Climate Change Programmes Repor*, SADC.
15. Cooper, P.J.M., Dimes, J., Rao, K.P.C.,Shapiro, B., Shiferaw, B., and Twomlow, S. (2008). Coping better with current climatic variability in the rain-fed farming systems of sub-Saharan Africa: An essential first step in adapting to future climate change? *Science Direct. Agriculture, Ecosystems and Environment*, 126, pp. 21-24.
16. Creswell, J., and Miller, D.L. (2000). Determining validity in qualitative inquiry, *Theory into Practice*, 39(3), pp. 124-131.
17. Creswell, J.W. (2003). *Research Design: Qualitative and Mixed Methods Approaches*, Califonia: SAGE Publications.
18. Dawson, C. (2002). *Practical research methods*, New Delhi: UBS Publishers' Distributors.
19. De Vos, A.S., Delport, C.S.L., Fouche, C.B., and Strydom, H. (2011). *Research at grass roots for the social sciences and human service professions*, Pretoria: Van Schaik.
20. Denzin, N.K. and Lincolin, Y.S. (2008). *Collecting and interpreting qualitative materials*, London: SAGE.
21. Department for International Development. (1999). *Sustainable Livelihoods, Guidance Sheets.* Available at: https://www.odi.org/resources/doc/3219.pdf. Accessed on 16.04.2012.
22. Ericksen, P.J. (2007). Conceptualizing food systems for global environmental change research, *Global Environmental Change*. Doi:10.1016/j.gloenvcha.09.002/
23. Famine Early Warning Systems Network. (FEWSNET). (2010). Zimbabwe Food Security Outlook. Harare, Zimbabwe: United States Agency Intervention Development (USAID).
24. FFSSA. (2004). *Achieving Food Security in Southern Africa: Policy Issues and Options*, FFSSA Synthesis Paper, Forum for Food Security in Southern Africa. Available at: http://www.ordi.org.uk/food-security-forum. Accessed on 23.08.2012.
25. Food and Agriculture Organization of the United Nations. (FAO). (2008a). *Climate change, water and food security*, Climate change, energy and food. Rome.
26. Food and Agriculture Organization of the United Nations. (FAO). (2008b). *Climate Change and Food Security: A framework document*. Rome
27. Fouche, C.B. (2005). Writing the Research Proposal in De Vos, A.S.(ed), *Research at Grassroots: For the Social Sciences and Human Service professions*, Pretoria: Van Schaik Publishers.
28. Gbetibouo, G.A., Hassan, R.M., Ringler, C. (2010). Modelling farmers` adaptation strategies for climate change and variability: the case of the Limpopo basin, South Africa, *Agriculture Economics Research, Policy and Practice* in *Southern Africa*, 49(2), pp. 217-234.
29. Gray, D.E. (2005). *Doing Research in the Real World*, London: Sage Publications.
30. Gregory, P.J., Ingram, J.S.I., and Barklacich, M. (2005). *Phil. Trans. R. Soc*., 360, pp. 2139-2148.
31. Gregory, P.J., Johnson, S.N., Newton, A.C. and Ingram, J.S.I. (2009). Integrating pests and pathogens into the climate change/food security debate, *Journal of Experimental Botany*, 60(10), pp. 2827-2838.
32. Hansen, W, Mason, J., Sun, L. and Tall, A. (2010). Review Of Seasonal Climate Forecasting For Agriculture In Sub-Saharan Africa: *Challenge Program on Climate Change, Agriculture and Food Security (CCAFS), International Research Institute for Climate Society, The Earth Institute, Columbia University, Palisades, NY, USA and African Studies/ SAIS.* Baltimore, MD,USA: John Hopkins University.
33. Hazell, P.B.R. (2003). *Is there a future for small farms?* International Food Policy Research Institute. Proceedings of the 25th International Conference of Agriculture Economics (IAAE). ISBN Number 0-958-46098-1. Durban, South Africa.
34. Hofisi, C., Chigavazira, B., Mago, S., & Hofisi, M. (2013). Climate Finance Issues: Implications for Climate Change Adaptation for Food Security in Southern Africa, *Mediterranean Journal of Social Sciences*, 4(6), p. 47.
35. Hollander, J.A. (2004). The social context of focus groups, *Journal of contemporary ethnography.* SAGE Publications.
36. Huq, S., Rahman, A., Konate, M., Sokona, Y., and Reid, H. (2003). *Mainstreaming adaptation to climate change in least developed countries (LDCS)*, International Institute for Environmental and Development, London.

37. Intergovernmental Panel on Climate Change. (2007). *An Assessment of the Intergovernmental Panel on Climate Change Climate*, Change Synthesis Report, Valencia, Spain.
38. Jones, S. (2011). *How does a food systems approach elucidate the food insecurity of Inuit in Canada? Global Environmental Change and Food Systems*, GECAFS Working Paper 7. University of Oxford.
39. Kollmair, M., and Gamper. S.J. (2002). Input Paper for the integrated Training course of Aeschiried, Switzerland. Development Study Group University of Zurich.
40. Krueger, R.A. and Casey, A. (2000). *Focus Groups: A Practical Guide for Applied Research*, 3rd ed. Thousand Oaks: SAGE Publications.
41. Lalthapersad-Pillay, P., and Oosthuizen, A.G. (2011). Perspectives on climate change and adaptation funding in developing countries, *Journal for Trans-disciplinary Research in Southern Africa*, 7(2), pp. 351-366.
42. Lipton, M. (2005). *The family farm in a globalizing world: The role of crop science in alleviating poverty. 2020 Vision for Food, Agriculture, and the Environment Initiative Discussion Paper* No. 40. Washington, D.C.: International Food Policy Research Institute.
43. Lobell, B.D., Burke, B.M., Tebaldi, C., Mastrandrea, D.M., Falcon, P.W., and Naylor, L.R. (2008). Prioritizing Climate Change Adaptation Needs for Food Security in 2030, *Science*, 319, p. 607.
44. Ludi, E. (2009). *Background notes: Climate change, water and food*, Overseas Development Institute: London
45. Madzwamuse, M. (2010). Drowning Voices: The Climate Change Discourse in South Africa, *Heinrich Boell Stiftung*, Cape Town.
46. Makadho, J.M. (1996). *Potential effects of Climate change on corn production in Zimbabwe*, Department of Agriculture, Technical and Extension Services (AGRITEX) Zimbabwe.
47. Mano, R., and Nhemachena, C. (2007). *Assessment of the Economic Impacts of Climate change on Agriculture in Zimbabwe.* A Ricadian Approach CEEPA discussion paper 11. Available at: http://www.up.ac.za/ceepa-the-centre-for-environmental-economics-and-policy-in-african/docs/cdp11pdf. . Accessed on 16/06/2012.
48. Mano, R., and Nhemachena, C. (2006). *Assessment of the economic impacts of climate change on agriculture in Zimbabwe: a Ricardian approach*. CEEPA Discussion Paper No. 11, Centre for Environmental Economics and Policy in Africa, University of Pretoria.
49. Maroyi, A. (2013). Use and management of home garden plants in Zvishavane district, Zimbabwe, *Tropical Ecology*, 54(2), pp. 191-203.
50. Matshe, I. (2009). *Boosting smallholder production for food security: some approaches and evidence from studies in sub-Saharan Africa*. *Adgrekon,* 48: 4Centre for Poverty and Growth, Human Sciences Research Council, South Africa.
51. Mubaya, C.P. (2010). *Farmers Strategies towards climate variability and change in Zimbabwe and Zambia*. Unpublished PhD Thesis University of the Free State.
52. Muchineripi, J.P. (2010). Together we grow, *Management Today*, 28(2), pp. 39-41.
53. Mudombi, S., and Muchie, M. (2011). *Analyzis of the role of information and communication technologies in climate change awareness in Seke and Murewa Districts of Zimbabwe*, Pretoria: Institute for Economic Research on Innovation Tshwane University of Technology.
54. Mukozho, D. (2011). *The Prospects and Challenges of Rural Non-Farm Economy in Zimbabwe: A Case of Seke Rural District*, Unpublished MSc Thesis, UFH, Alice.
55. Muller, C., Cramer, W., Hare, L., and Campen, L. (2011). *Climate change risks for African agriculture*, Potsdam Germany.
56. Mupaza, L., Zvarevashe E., Gavhera, S., & Shumba, T. (2010). *Understanding Rural Livelihoods in Zimbabwe An Insight from Zvishavane PRP LIME Baseline*, HELPAGE Zimbabwe. Unpublished.
57. Mushai, A. (2008). *Innovations in agricultural insurance: Implications for food security and development in poor countries of the south*, Africanus: Unisa Press.
58. Mutekwa, V., and Kusangaya, S. (2006). Contribution of water harvesting technologies to rural livelihoods in Zimbabwe: The case of Ngundu ward in Chivi District, *Water SA*, Vol. 32.
59. Mutekwa, V.T. (2009). Climate change impacts and adaptation in the agricultural sector: the case of smallholder farmers in Zimbabwe, *Journal of Sustainable Development in Africa*, 11(2), pp. 1520-5509.
60. Mwando, M. (2012). *Zimbabwe ill-prepared for climate changes-experts*, AlertNet news. Available at: http://www.trust.org/alertnet/news. Accessed on 24.05.2012
61. Mwotowanyuka, T., and Nhutsve, T. (2010). *Baseline Report. Baseline Survey Report for the smallholder Agricultural Support Project (SASP) being implemented by Africare Zimbabwe*, Unpublished Report.
62. Narayanan, S., and Gulati, A. (2002). *Globalisation and the smallholders: A review of issues, approaches, and implications. Markets and Structural Studies Division Discussion Paper* No. 50. Washington, D.C: International Food Policy Research Institute.
63. Nelson, G.C., Rosgrant, M.W., Koo, J., Robertson, R., Sulser, T., Zhu, T., Ringler, C., Msangi, S., Palazzo, A., Batka, M., Magalhaes, M., Valmonte-Santos, R., Ewing, M., and Lee, D. (2009). *Climate change: Impact on Agriculture and Costs of Adaptation*, Washington, D.C: International Food Policy Research Institute.
64. Neuman, W.L. (2006). *Social Research Methods: Qualitative and Quantitative Approaches,* 6th Ed. Boston New York.
65. Nyong, A., Adesina, B., and Elasha, B. O. (2007). *The value of indigenous knowledge in climate change mitigation and adaptation strategies in the Africa Sahel*. DOI 10.1007/s 11027-007-9099- 0. SpringerScience+Business Media B.V. Climate change Adaptation in Africa Programme Centre. Nirobi, Kenya: International Development Research

66. Opareh-Obirih, N. (2008). Strategies of Poverty Reduction in Africa: The case of irrigated Agriculture in Ghana, *African Renaissance*, 5(2), pp. 58-68.
67. Pavelic, P., Smakhtin, V., Favreau, G., and Villholth, K.G. (2012). *Water-balanced approach for assessing potential for smallholder groundwater irrigation in Sub-Saharan Africa*. ISSN 0378-4738(Print). Water SA, (38)3, International Conference on Groundwater Special Edition.
68. Phillips, J.G., Deane, D., Unganai, L. And Chimeli, A. (2002). *Implications of farm-level response to seasonal climate forecast for aggregate grain production in Zimbabwe. Agricultural Systems*, pp. 351-369. International Research Institute for Climate Prediction, Palisades, New York, USA London School of Economics, London, UK; Zimbabwe National Meteorological Service, Harare, Zimbabwe.
69. Piknse, J., and Kolk, A. (2012). Addressing the Climate Change-Sustainable Development Nexus: The Role of Multi stakeholder Partnerships, *Business and Society*, 51(1), pp. 176-210.
70. Pimentel, A., Marklein, M.A., Toth, M.N., Karpoff, G.S., Paul, R., McCormack, J., Kyriazis, T., and Kruger. (2009). *Food versus Biofuels: Environmental and Economic Costs,* Cornell University New York, USA.
71. Practical Action. (2012). *Mainstreaming climate change adaptation in Zimbabwe`s extension system*, The Schumacher Centre, Bourton on Dunsmore, Rugby, CV239QZ, UK.
72. Pretty, J., Toulmin, S., and Williams, B. (2011).Sustainable intensification in African agriculture, *International Journal of Agriculture Sustainability*, Earthscan. London. Available at: https://www.routledge.com/sustainability. Accessed on 13/09/2012.
73. Progressio Zimbabwe. (2009). *Seed saving and climate change in Zimbabwe*, Harare, Zimbabwe.
74. Rahim, A. (2011). Rights to Food with a Human Face in the Global South, *Journal of Asian and African Studies*, 46(3), pp. 237-249.
75. Rashid, M.H. and Islam, M.S. (2007). *Adaptation to Climate Change for Sustainable Development of Bangladesh Agriculture*, Bangladesh Country paper. Bangladesh Research Institute Joydebpur, Gazipur-1701.
76. Reilly, J., Schimmelpfenning, D., and Lewandrowski, J. (2003). *Global, Regional and Local Food Production and Trade in a Changing Environment*, MIT Joint Program on the Science and Policy of Global Change, Cambridge, USA: Department of Agriculture, Economics Research Service.
77. Robson, C. (2002). *Real World Research: A Resource for Social Scientists and Practitioner-Researche*, USA: Blackwell Publishing.
78. Solesbury, W. (2003). *Sustainable Livelihoods: A case Study of the Evolution of DFID Policy*, London: Overseas Development Institute.
79. Stenbacka, C. (2001). Qualitative research requires quality concepts of its own, *Management Decision*, 39(7), pp. 551-555.
80. Tadesse, D. (2010). *The impact of climate change in Africa*, Make Peace Happen. Institute for Security Studies (ISS) Paper 220. Available at: http://www1.makepeacehappen.net/?kw=blog. Accessed on 17/10/2012.
81. Tashakhori, A., and Teddle, C. (2003). *Handbook of mixed methods in social research and behavioural research*, London: SAGE Publications.
82. Tigere, C. (2010). *Climate Change Vulnerability and Adaptation Preparedness in Southern Africa. Zimbabwe,* Country Report.
83. Tongco, M.D.C. (2007). Purposive Sampling as a Tool for Informant Selection, *A Journal of Plant, People, and Applied Research.* Available at: http://hdl.handle.net/10125/227. Accessed on 16/03/2013.
84. Todaro, M. and Smith, S. (2009). *Economic Development*, Harlow, England: Addison-Wesley.
85. Unganai, L.S., and Murwira, A. (2010). *Challenges and opportunities for climate change adaptation among small-holder farmers in southeast Zimbabwe*, 2nd International Conference: Climate change, Sustainable and Development in Semi-arid Regions Fortaleza-Ceara, Brazil.
86. Vermeulen, S.J., Aggarwal, P.K., Ailoneslie, A., Angelone, C., Campbell, B.M., Challinor, A.J., Hansen, J., Ingram, J.S.I., Jarvis, A., Kristjanson, P., Lau, C., Thornton, P.K., and Wollenberg, E. (2010). *Agriculture, Food Security and climate change: Outlook for Knowledge, Tools and Action*, CCAFS Report 3. Copenhagen, Denmark.
87. Wall, E. and Smit, B. (2005). Climate change Adaptation in Light of Sustainable Agriculture, *Journal of Sustainable Agriculture*, 27(1).
88. Weiss, R. (2007). Small Talk: Who will fight for food security? *The Dairy Mail*, 14(7), pp. 127-128. Available at: http://www.parlzim.gov.zw/attachments/article/76/zvishavane.pdf/%20Accessed%20on%2003/12/12. Accessed on 03/12/12.
89. Yegidis, B.L. and Weinbach, R.W. (2002). *Research methods for social workers*, Boston: Allyn and Bacon.
90. Zimbabwe Vulnerable Assessment Committee. (ZimVAC). (2012). *Rural Livelihoods Assessment May 2012. National Report*, Harare.
91. Zvomunya, F. (2008). Seeds For Sekhukhune, *NAFU FARMER FOCUS ON GRAIN 33.*