

**THE ASSESSMENT OF THE ROLE OF SOCIAL ASSETS IN BUILDING CLIMATE
CHANGE ADAPTATION: IMPLICATIONS FOR HOUSEHOLD FOOD SECURITY
AND LIVELIHOODS**

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ABSTRACT

Rural livelihoods are diverse and dynamic, often aimed at managing risk, reducing vulnerability and enhancing food security. In South Africa, rural households pursue different livelihood strategies based on available capital. Household asset endowment consists of physical capital (land, equipment, cattle, etc.), human capital (years of schooling and work experience) and social capital (membership of associations). A household combines these capitals to engage in productive activities. However, climate change remains a threat worldwide. Hence, the household engages in several activities and strategies to earn a living. Climate change affects natural capitals, such as water and land, on which certain livelihoods depend directly. South Africa is predominantly vulnerable to climate change because of its high dependence on climate-sensitive economic sectors: agriculture, fisheries, forestry, and mining. Agriculture is a core sector that ensures food security and provides households with food, employment and other components of livelihood. Smallholder farmers are highly affected by climate change. Thus, adaptation and coping strategies are essential for building resilience. This study seeks to assess the role of social capital, in climate change adaptation of smallholder farmers in Appelsbosch, to improve their food security and livelihoods.

The study was conducted in Appelsbosch, under *uMshwathi* local municipality in Kwa-Zulu Natal province. Random sampling was used to select a sample of 135 active and long-term smallholder farmers. The participants were interviewed using questionnaires and through focus group discussions. The key informant interviews were held with group representatives and extension officers to gather the in-depth of social capital structure among the farmers and its uses to cope and adaptation strategies against climate change. A Chi-square test was used to analyse the relationships between social capital dimensions, adaptation and coping strategies against climate change. More relationships were tested between social capital and coping strategies used by smallholder farmers to cope with food insecurity. The chi-square test indicated that the relationship between the social group and food insecurity coping strategies employed by the farmer were statistically significant at the 5 % level. Furthermore, the Chi-square test revealed a significant relationship between the social capital and the strategies employed by the household, such as avoiding & limiting soil

erosion and water harvesting strategies. Furthermore, there was a significant relationship at the 5 % level between the social capital, crop choice and planting schedules.

The study revealed that in Appelsbosch, social capital acts as a conduit for financial transfers and provides information about new skills. An effective system facilitates cooperation among farmers and the sharing of the costs and benefits of adaptation. Effective information dissemination is important. However, participation in these social groups is challenged by factors such as finances, lack of trust and poor leadership among farmers. The results showed that there are more respondents that are highly engaged in farmers' groups only, compared to those engaged in farmer's groups and burial societies or grocery *stokvels* simultaneously. Many explained that this behaviour is a result of members' dependence on social grants or farm harvests, as their livelihood strategy. Thus, the insufficient monthly income restricts their participation in other kinds of social groups. Therefore, they focus on farming, to sustain their livelihood and food security.

KEYWORDS: Social capital, food security, rural livelihood, climate change adaptation, and resilience.

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DECLARATION- PLAGIARISM

I, **Tamako Nthabeleng** declare that:

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DECLARATION 2- DRAFT PUBLICATION MANUSCRIPT

Details of contribution to draft publication manuscript that form part and/or includes research presented in this dissertation.

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Dr J.M Chitja

Signature

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Table of Contents

ABSTRACT	i
COLLEGE OF AGRICULTURE, ENGINEERING, AND SCIENCE	iii
DECLARATION- PLAGIARISM	iii
COLLEGE OF AGRICULTURE, ENGINEERING, AND SCIENCE:	iv
DECLARATION 2- DRAFT PUBLICATION MANUSCRIPT.....	iv
ACKNOWLEDGEMENT	v
LIST OF FIGURES.....	xi
CHAPTER ONE: THE PROBLEM AND SETTING.....	1
1.1 Introduction to the Research Problem	1
1.2 Problem Statement	3
1.3 General Research Objective.....	4
1.3.1. Specific objectives:.....	4
1.4. Hypothesis	4
1.5 Importance of the Study.....	4
1.6. Definition of terms.....	5
1.7. Study Limits	6
1.8. Organisation of the Thesis	6
CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK.....	7
2.1 Introduction	7
2.2 Overview of Climate Change	7
2.3 Climate Change and its Impact on SH Farmers in South Africa	8
2.3.1 Sustainable Livelihoods Framework	10

2.3.2. Institutions and Policies	11
2.3.3 Livelihoods Capitals.....	12
2.4 The use of Social capital for food security in face of climate change by Farmers	12
2.4.1 Accessibility of Food.....	14
2.4.2 Availability of food	15
2.4.3 Utilisation of Food.....	16
2.5 Farmer's Awareness, Coping, and Adaptation to Climate Change	16
2.5.1 Farmers Awareness of Climate Change	16
2.5.2 Coping and Adaptation Strategies by SH Farmers	17
2.6 Farmers' Social Capitals in Building Resilience Against Climate Change	18
2.7 Theoretical Framework	19
2.7.1 Social Capital	20
2.7.2 Structural and Cognitive Social Capital	20
2.7.3 Forms of Social Capital	20
2.7.4 Purpose and Effect of Social Capital in Societies	21
2.8 Conclusion.....	22
CHAPTER THREE: RESEARCH METHODOLOGY	23
3.1 Introduction	23
3.2 Geographical Location of the Study Area and Demographic Information	23
3.2.1. Climate Condition of the Region.....	24
3.2.2. The Location of the Study Site	24
3.3 Research Design	25

3.4 Sampling Method.....	26
3.5 Data Collection Tools.....	26
3.5.1 Structured Questionnaire	26
3.5.2 Focus Group Discussion	27
3.5.3 Key Informants.....	27
3.6 Data Analysis.....	27
3.6.1 Descriptive Statistics	27
3.7 Summary	28
CHAPTER FOUR: DOES SOCIAL CAPITAL PLAY A ROLE IN CLIMATE CHANGE ADAPTATION AMONG SMALLHOLDER FARMERS FOR IMPROVING FOOD SECURITY AND LIVELIHOODS?	29
ABSTRACT	29
4.1 Introduction and background of the study.....	30
4.2 Material and Methods	32
4.2.1 Study site and sampling procedures.....	32
4.2.2 Social capital measures.....	33
4.2.3 Data analysis	33
4.3 Results and discussion	34
4.3.1 Demographic characteristics.....	34
4.3.2 Farmers perception of climate change and its impact on food security	35
4.3.3 Food security and coping strategies used by smallholder farmers	36
4.3.3.1 Participation and coping strategies used by smallholder farmers	36
4.3.3.2 Number of meetings attended in a month and food insecurity coping strategies	37

4.3.3.3 Community meeting attendance and food insecurity coping strategies.....	37
4.3.4 SOCIAL CAPITAL AND ADAPTATION STRATEGIES ON CLIMATE CHANGE	37
4.3.4.1 Participation in social groups and adaptation strategies.....	38
4.3.4.2 Community meeting attendance and adaptation strategies.....	39
4.3.4.3 Number of meetings per month and adaptation strategies.....	40
4.4 Conclusions and Recommendations	43
CHAPTER FIVE: DOES SOCIAL CAPITAL AFFECT THE CHOICE OF CROPPING SYSTEM TO IMPROVE FOOD SECURITY AND LIVELIHOODS?.....	45
ABSTRACT	45
5.1 BACKGROUND OF THE STUDY	46
5.2 MATERIAL AND METHODS	48
5.2.1 Site selection	48
5.2.2 Sampling Procedure and Method	49
5.2.3 Data collection and Analysis	49
5.3 RESULTS AND DISCUSSION	50
5.3.2 GROUP DISCUSSION ON SOCIAL GROUPS AND MEMBERSHIP AND ITS BENEFITS	53
5.3.4 FARMING SYSTEM AND SOCIAL CAPITALS BY RESPONDENTS.....	55
5.3.4.1 Composition of cropping systems for crop species	55
5.3.4.2 Crop planting schedule and social capital.....	57
5.3.5.1 Number of meetings attended within a month and crop farming strategies	61
5.3.5.2 Attendance of community meetings by farmers and crop farming strategies.....	62
5.4 Conclusion.....	62

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS	64
6.1 Introduction	64
6.2 Conclusions	65
6.3 Policy Recommendations	68
REFERENCES.....	69
Appendix.....	76
Tables.....	76
Table 1a: The demographics characteristics of smallholder farmers	76
Table 2a: The relationship between the household member's attendance of community meetings and adaptation strategies employed	77
Table 3a: The relationship between the number of meetings a farmer participating on and coping strategies employed	78
Questionnaire	79
Ethical clearance	84

LIST OF FIGURES

Figure 1The Sustainable livelihood framework.....	10
Figure 2: The study site (Appelsbosch location).....	24
Figure 3: The map of Group farmers at Appelsbosch.....	53

LIST OF TABLES

Table 2: Social participation and climate change adaptation strategies used by SH farmers	Error! Bookmark not defined.
Table 3: Focus Group Discussion (FGD) on social capital at Appelsbosch.....	42
Table 4: Rural livelihoods strategies.....	Error! Bookmark not defined.
Table 5: The types of active associations (Social capital) at Appelsbosch.....	Error! Bookmark not defined.
Table 6: The farming systems used at Appelsbosch...	Error! Bookmark not defined.
Table 7: The types of crops grown by SH farmers at Appelsbosch	Error! Bookmark not defined.
Table 8: The agricultural adjustment calendar by SH farmers.....	57
Table 9: The number of social groups and crop planting schedule by farmers	58
Table 10: The number of meetings attendant and crop planting schedule by farmers	59
Table 11: Social participation and agricultural inputs and soil management strategies used by farmers	60

CHAPTER ONE: THE PROBLEM AND SETTING

1.1 INTRODUCTION TO THE RESEARCH PROBLEM

The Sub-Saharan African (SSA) populace is highly dependent on farming for their livelihoods (FAO, 2012; Copper et al., 2008). The latter is dominated by smallholder (SH) farming, which is characterised by lowland holding, infertile soil and low mechanization (FAO, 2011). Because of these challenges, farmers tend to diversify their livelihood source into non-farm activities, although farming is still their primary source (Wood et al., 2014). SSA is faced with problems of ensuring food and nutrition security, alleviating poverty and climate change (FAO, 2011: 2012). Strong reliance on farming, especially rain-fed agriculture causes food insecurity and poverty to be worse in the face of climate change. (FAO, 2011; IPCC, 2014).

It has been noted that climate change has a negative impact on farming activities and food insecurity, and this is expected to continue, thereby threaten livelihoods (FAO, 2011: Twomlow et al., 2008). The Intergovernmental Panel on Climate Change (IPCC) report (2014) defines climate as characteristic conditions of the earth's lower surface atmosphere at a specific location. Climate models suggested that SSA will experience a temperature rise of 2–4 °C by 2100. This represents an increase of about 1.5 times higher than the projected mean global temperature increase (IPCC 2014 Report). Climate change is therefore recognized, as a major issue to have negative consequences on food security and livelihoods in the region (Connolly-Boutin and Smit, 2015). This will affect all dimensions of food security and aggravate mal-nutrition in affected regions. Climate change also affects the quantities and types of food produced by farmers. FAO (2009, 2011) studies have shown the impact of climate change on decreased crop production in terms of varieties and reduced and unstable yields. Climate change further has an impact on non-agricultural aspects of the food system physical and human livelihoods assets i.e. roads, storage and marketing infrastructure, houses, productive assets and human health which have direct and indirect impact on socio-political and economic factors which govern accessibility, utilization of food security and the system that delivers food (FAO, 2011). The changes in climate affect planting seasons, times and date of the year. At a household level,

planting less preferred crops and reducing the amount and daily intake of food by household members becomes. This may lead to nutrition insecurity in a household.

According to Connolly-Boutin and Smit (2015), about 70% of the livelihoods of Africans depend on rain-fed agriculture, which is characterized by small-scale farmers. SSA has been reported to be the most vulnerable region to climate change, due to low adaptive capacity; intense poverty, insufficient safety nets; and rain-fed agriculture (FAO, 2011: 2012). Climate change affects natural capitals, such as water and land, on which certain livelihoods depend.

Approximately 2.5 billion people live on agricultural production systems, as members of households that engage in farming activities (Schiermeier, 2007; FAO, 2011). It is also reported that rain-fed agriculture employs about 60% of the workforce, thus constituting the backbone of the economy, of most African countries (Vermeulen et al., 2012). Therefore, climate change impacts SH farmers, especially those located in marginal environments, areas with highly variable rainfall and with high risks characterized by evolved livelihood strategies (Copper et al., 2008). Farmers are vulnerable to environmental change especially climate change (Deressa et al., 2011).

In South Africa, approximately 20.7% of all households (about three million) engage in agriculture (STAT SA, 2012; RSA, 2014). Since farming is main livelihood strategy, in rural areas, the adverse effects of climate change on agricultural output, causes low income and unemployment (Morton, 2007). In turn, this impacts the rural economy and food security. However, to adapt to such changes in their surroundings, people change their livelihood strategies over time. The FAO report (2012) outlined that livelihood is an input-output process in continuous interaction with its surrounding.

Rural livelihood depends on a mix of agricultural and non-agricultural activities to sustain their households. The FAO (2011) report argues that there are various ways in which households partake in agricultural activities, which could be classified as formal or informal. A study by Gbetibouo et al., (2010) suggests that about 35.6% of South Africa's households live in rural areas and depend on agricultural activities for livelihood. This study seeks to assess the impact of climate change on smallholder farmers with a focus on food security and livelihoods and the role of social capitals on building resilience and adaptation.

SH farmers play an important role in creating livelihoods and ensuring food security for the rural poor (Thamaga-Chitja and Morojele, 2014). The FAO (2011) and IPCC (2014) and reports highlight that climate has been changing in the past years and is expected to continue to change. Therefore, there is a need to adapt and build resilience. Understanding of climate change is essential for farmers to make informed decisions on local adaptation. While some studies (Deressa et al., 2011; Vermeulen et al., 2012) have indicated that farmers have adapted to climate change to reduce the negative impact posed by these changes, Wood et al. (2014) argue that the success of adaptation depends on availability of necessary resources, such as finances, knowledge and natural resources. Vermeulen et al. (2012) support this notion with a similar comment, stating that the capacity to adapt and cope depends on capitals that households have access to and utilise. Generally, social capitals have been the most used capitals by the rural farmer to cope and adapt to the changes. Social capital is one of many kinds of resources available to individuals within the context of community. Rural people enjoy informal networks with family and friends, which develop into different types of social capital (i.e. bonding social capital, bridging and linking social capital), and these have served as a means of boosting economic welfare.

1.2 PROBLEM STATEMENT

Climate change has resulted in seasonal shifts, which many farmers have not yet fully responded to. These changes threaten land-based livelihoods of SH farmers. The IPCC (2014) report emphasizes that Africa is one of the regions that will be hard hit by the impact of changes in climate, such as an increase in temperature and reduced rainfall. Agricultural production and food security in many African countries will be affected by climate change and variability (IPCC, 2014). By 2020 the countries that depend on rain-fed agriculture will experience approximately 50% reduction in production, and SH farmers in those regions will be highly affected (Hulme et al., 2010). However, adaptation is an essential strategy to enable farmers to cope with the adverse effect of climate change and variability, thereby increasing the agricultural production of the poor farming households. Most SH farmers in South Africa are based in the former homelands mainly occupied by black people (Wood et al., 2014). SH farmers cultivate on farm sizes of less than 5ha, although there are a few exceptions.

At the same time, agricultural practices are traditional, leading to very low productivity. Farmers are increasingly concerned about the impact of climate change on agriculture and food security. Therefore, it is important to explore the role of social capital in adaptation and building resilience for land-based livelihoods. Social networks act as platforms for financial transfers, which may reduce farmers' credit constraints, while also encouraging information transfer among members (Aldrich and Meyer 2014).

1.3 GENERAL RESEARCH OBJECTIVE

The main objective of the study is to assess the impact of climate change on SH farming, and how social capital can be employed by SH farmers, to mitigate this impact, for sustained livelihoods and food security.

1.3.1. Specific objectives:

- To explore the role of social capital in climate change adaptation strategies employed by smallholder farmers in Appelsbosch area under *uMshwathi* Local municipality.
- To explore the role of social capital in choices of cropping system used by smallholder farmers at Appelsbosch (under *uMshwathi* local municipality) to improve the food security and livelihoods.
- Recommend a program to mitigate climate change impact and livelihood resilience, using social capital.

1.4. HYPOTHESIS

- Social capital has a positive role in climate change adaptation strategies which are used by smallholder farmers in Appelsbosch.
- Social capital has an impact on choices of cropping system used by smallholder farmers to improve food security and livelihoods.

1.5 IMPORTANCE OF THE STUDY

According to the IPCC (2014) report, there is an increasing evidence that climate change will strongly affect the African continent and will be one of the challenges of development, particularly in the drier regions. The report further shows that climate is

changing and that many sectors, including agriculture, will be affected under future climates. In African countries, the negative impacts are expected to affect rural communities the most. Poor people in developing countries are most vulnerable to the impacts of climate change, due to their limited capacity to cope with climate shocks and stresses, as well as their reliance on natural resources and the environment (Deressa et al., 2011). As climate change impact increases, the impact is highly felt by SH farmers. Therefore, there is a need to identify approaches which strengthen ongoing development efforts and enhance the adaptive capacity of farmers (Hulme et al., 2010).

Climate change threatens food security in the sub-Saharan region. Besides possibly shocking effects on food production capacity, agriculture is extremely vulnerable to climate change (Hulme et al., 2010). The (IPCC report 2014) states that majority of Sub-Saharan Africa's population (96%) is dependent on rain-fed agriculture. Predictions forecast a 50% yield deficit by 2050 while arable land is expected to decline by 6%. Climate change has already affected food security and access to food in poor rural communities (Morton, 2007). Therefore, adaptation can greatly reduce vulnerability to climate change by making rural communities better able to adjust to climate change and variability, moderating potential damages, and helping them cope with adverse consequences. However, it has been suggested that current coping strategies may not be adequate to deal with the impacts of future climate.

1.6. DEFINITION OF TERMS

Food security is a trans-disciplinary concept which is defined as physical and economic access to sufficient, safe and nutritious food, which meet an individual's dietary needs and preferences, for an active and healthy life (FAO, 2012)

Livelihood is defined as capabilities, activities, and capital, which are required for a means of living (FAO, 2012). Livelihood includes the range and combination of activities undertaken and choices made to survive and sustain their lives.

Adaptation refers to actions that people take in response to or in anticipation of changes in climate, either to reduce the adverse impacts or to take advantage of opportunities offered by such changes (IPCC report 2014).

Climate change The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as a change in the composition of the global atmosphere, attributed directly or indirectly to human activities. This change is observed to be greater than natural climate variability over comparable time periods.

Social capital Putnam (1993) defined social capital as the feature of social organization including trust, norms, and networks that improve the effectiveness of community, by helping its actions.

1.7. STUDY LIMITS

The findings of this study will not generalise to the whole community but seek to contribute to the knowledge of climate change adaptation and SH farmer's food security.

1.8. ORGANISATION OF THE THESIS

This dissertation comprises seven chapters. The second chapter presents a review of the literature on SH farmers, their livelihoods, the impact of climate change and the role of social capital in building resilience and adaptation. The third chapter presents the methodology adopted in the study. It explains the procedure for data collection and analysis. In chapters four and five, the research results are presented. Finally, chapter six presents the conclusion and recommendations.

CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 INTRODUCTION

This chapter presents an overview of literature and themes that are relevant to the study. It starts with the concept of rural livelihoods, followed by a review of different forms of capital, and the concepts of social capital, food security, and climate change, in relation to rural SH farmers. These are all important concepts in the framework for analysing the relevance of social capital in building resilience and adaptation by SH farmers. The concept of rural livelihood is useful in understanding opportunities and constraints for the farmers, which may influence their participation.

2.2 OVERVIEW OF CLIMATE CHANGE

The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as a change, attributed directly or indirectly to human activity, that alters the composition of the global atmosphere and that is greater than natural climate variability observed over comparable time periods (IPCC, 2014). The African continent is highly stressed, with low adaptive capacity and easily vulnerable to climate change. This impact of climate change presents a significant challenge to regional agricultural development (Wood et al., 2014). Sub-Saharan Africa (SSA) countries have low adaptation mechanism and are vulnerable to the widespread effect of climate change (FAO, 2011). Climate affects low-income rural communities whose livelihoods heavily depend on rain-fed subsistence agriculture (Cooper et al., 2008).

Climate change models for southern Africa indicate that the region will face increased challenges in the future, due to projected changes in climate (FAO, 2011). Further evidence (Warr, 2011) predicts reduced rainfall reduction with increased rainfall variability, for most parts of southern Africa. In addition, southern Africa has recently been experiencing recurrent droughts (including mid-season droughts). These experiences, together with other extreme climatic events, are expected to continue. The region is generally projected to face further warming, drying, and extreme climatic conditions, although these will vary spatially across the region (Thomas et al., 2007). However, the argument is that evidence from climate change projections in southern

Africa, such as increased intensity and frequency of extreme events, is supported by recent trends in climate in the region (Hulme et al., 2010; FAO, 2011).

2.3 CLIMATE CHANGE AND ITS IMPACT ON SH FARMERS IN SOUTH AFRICA

South Africa is predominantly vulnerable to climate change because of its high dependence on climate-sensitive economic sectors, high levels of poverty and the inter-related impacts of HIV/AIDS (FAO, 2009). Evidence shows that climate change will highly affect more of those sectors which poor people directly depend on, such as agriculture, water supplies, and ecosystem. Agriculture, a key sector of the South African economy (Perret et al., 2005), is one of the most vulnerable to climate change because it is highly dependent on climate variables like rainfall, moisture, and light (Gbetibouo et al., 2010). Evidence suggests that climate change could lead to a fall of about 1.5% in the country's GDP by 2050 (FAO, 2011; FAO, 2012). Climate change has severe consequences on other economic sectors that are either directly or indirectly linked to the agricultural sector. Supporting this notion is the work of Deressa et al. (2011) which shows that the impacts of climate change on agricultural activities are significant for low-input farming systems in developing countries in Africa. Thus, climate change could lead to severe reductions in agricultural productivity, if no adaptation measures are taken.

Agriculture is the main source of food and a means of rural livelihood. In other words, it is the core sector for food security, as it provides households with food and employment (Morton, 2007). This is particularly true in South Africa (Perret et al., 2005). Agricultural activities contribute immensely to the country's GDP and household nutrition (FAO, 2011).

The FAO (2011) defines livelihood as an input-output process in continuous interaction with its surrounding. Furthermore, it states that people change their livelihood strategies over time, as they adjust to changes in their surroundings. A rural livelihood depends on a mix of agriculture and non-agricultural activities to sustain their households (Thamaga-Chitja and Morojele, 2014). The access to, and availability of capitals, and the associated livelihood strategies are influenced by shocks and trends, which are beyond their control. With regards to farming, climate change does not merely create the need for more water supply on farms, rather it is also associated

with significant land use changes that will introduce social and generational issues which are expected to dramatically change farming communities (Beddington et al., 2012).

2.3 LIVELIHOODS OF SH FARMERS

The Food and Agricultural Organisation (2011) defines livelihood as various ways in which households acquire the necessities of the life. An essential necessity of life includes food, shelter, clothing, education, water, and health care (FAO, 2009). However, many authors define livelihood for rural dwellers as the structure of one group staying in sparsely populated areas, in which most people depend on farming and natural resources to sustain their lives. These areas are made up of large settlements in former homelands that are highly dependent on migratory labour and social grants (Thamaga-Chitja and Morojele, 2014). Rural households adopt a range of livelihood strategies, draw from diverse sources of income and invest in a variety of assets to achieve their livelihood outcomes and to provide a buffer to shocks and risks (Thamaga-Chitja and Morojele, 2014). The range of livelihood strategies includes off-farm, land-based livelihood strategies. The study by Deressa et al. (2009) indicates that the household members depend on informal and formal strategies to manage risks and shocks in a household. Informal strategies include arrangements that involve household and individual self-insurance and a group-insurance, while formal strategies include market-based activities i.e. credits and savings.

Alemu (2012) classifies activities of most rural areas into three: on-farm, off-farm, and non-farm activities. Moreover, livelihood activities depend on different forms of capital, in contrast to the more traditional production-based approach, required access to credit and the required skills. Households often implement more than one livelihood strategy. They may engage in different non-agricultural activities simultaneously throughout the year (Morton, 2007). South African households are engaged in several dynamic livelihood strategies. These livelihood strategies differ based on daily, monthly and annual variations in terms of timing and factors such as rainfall, labour availability, input costs, access to public services, markets and credit, migration opportunities, remittance income and transport costs (Perret et al., 2005; Morton, 2007). Other determinants of livelihood strategies are age, gender, wealth and

ethnicity, as different categories can draw on differing material and social capital, political connections, experience and expertise (FAO, 2011). Rural livelihoods provide a detailed view of how the poor reduce (ex-ante) and cope with (ex-post) a variety of risks, to meet their basic needs for life. A variety of on-farm and off-farm activities, which together provide a variety of exchange entitlements for food and income, maintain livelihood systems.

2.3.1 Sustainable Livelihoods Framework

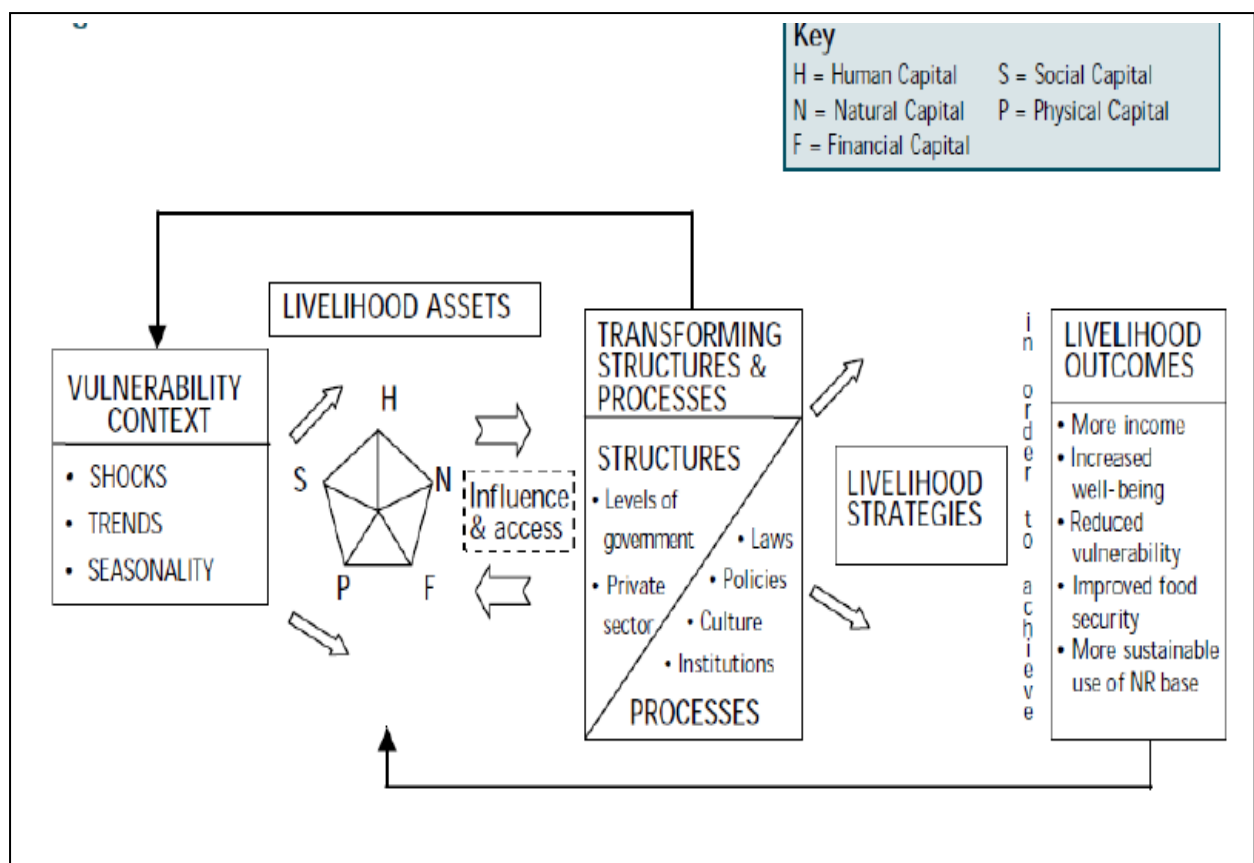


Figure 1 The Sustainable livelihood framework (1999)

Sustainable livelihoods framework (SLF) is an investigation framework which enables understanding interacting factors that shape community behaviour in response to risk or stress (Morton, 2007). The SLF is mainly based on people and how their capitals

enable them to achieve and improve their livelihood outcomes. The framework focuses on the main key factors that configure livelihoods in an area and identifies factors that constrain and enhance access to other capitals (Morton, 2007). The research assesses how livelihood activities may build resilience in the face of climate change. The livelihood capitals determine how livelihood works and understand how people will respond to climate change and vulnerability. Livelihood capitals are the basis for the development of adaptation strategies. Gbetibouo et al. (2010) explain that natural resources are significant for livelihoods of the poor and vulnerable in rural communities. The rural people directly depend on natural resources from livestock, cultivation and collecting for their livelihoods. Thus, any change in climate (such as the amount of rainfall and high temperatures) will directly affect crop yield and produce changes in ecosystem distribution. This will then affect their livelihood through a decline in food security, and constrain other livelihood activities.

2.3.2. Institutions and Policies

The sustainable livelihoods framework guides this study and is essential in understanding various livelihood activities pursued in response to climate change, in both long and short term (Perret et al., 2005). Moreover, it has been emphasized that resilience of peoples' livelihoods depends on their capability to cope with changes and adapt to external and internal shocks (Morton, 2007). The capacity to adapt and cope depends directly on the livelihood capitals that an individual or household has can access and utilise. However, institutional forces and processes also determine the individual's or household's access to capital and livelihood options, thus creating vulnerability to climate change. The legislation, policy implementation, and service delivery might affect livelihoods by reducing or increasing the impact of climate change (Perret et al., 2005).

There are many ways in which sustainable livelihoods approach can be used for climate change adaptation. The framework provides the understanding of how livelihood strategies build adaptive capacity to enable farmers to better cope with changes. It helps to identify ways in which capitals are used to cope in both short and long term (Gbetibouo et al., 2010). Moreover, the framework recognises that different

people and sectors are affected differently by climate change and have different capacity to build adaptation, which in turn depends on access to capital.

2.3.3 Livelihoods Capitals

Natural capital refers to natural resource stock that is valuable for livelihoods. Deressa et al. (2011) argue that most of the shocks that are detrimental to livelihoods are also natural processes which destroy natural capitals like land, water, biodiversity and erosion protection. The human asset is another livelihood capital, which includes, education, skills, and health, that enable an individual to perform livelihood activities effectively. When enhanced through training and other skills, human capital or labour becomes a powerful tool for households to gain a livelihood (Thomas et al., 2007).

Financial capital and financial resources are used by people to sustain their livelihoods. Financial capital is the livelihood capitals component which exposes people to various livelihood options through savings, capitals, grants, credit, regular remittances or pensions (FAO, 2011). Financial assets are categorised into on-farm income, off-farm income, and stock of resources (FAO, 2011; 2012). Physical capitals are made up of basic infrastructure and producer goods which are needed to support people's livelihoods. Producer goods include equipment and tools needed to function more productively (FAO, 2011). Social capitals are defined as social resources which people use to pursue livelihood activities. Such social resources include networks and connectedness, memberships of formalised groups, relationships of trust and exchange. Social capitals can be a link between individuals, close group of individuals, or household which comes together to achieve goals about their livelihoods capitals. The FAO (2009) explains social asset as an informal type of institution and organisations based on social relationships, networks, and associations that create shared knowledge, mutual trust, social norms and unwritten rules.

2.4 THE USE OF SOCIAL CAPITAL FOR FOOD SECURITY IN FACE OF CLIMATE CHANGE BY FARMERS

It is anticipated that climate change will result in a range of direct and indirect impacts on food security (FAO, 2011). High temperatures and increased water stress may lead to a decrease in the extent of agricultural land in the region (Wood et al., 2014). Lower

rainfall may contribute to shorter growing periods, decrease the possibility of a second, and potentially even a single, crop per season in some areas. However, the impacts of these stressors are anticipated to vary across the region, and adaptation measures can help to mitigate the negative impacts of climate change on agriculture and food security (FAO, 2011; IPCC, 2014).

The link between food security and climate change is complex because food security involves many processes from the starting point (production), trade, nutrition and consumers (how people maintain access to food over time) (FAO, 2011). The components of food security include adequate food production and socioeconomic issues surrounding food availability. Thus, understanding the food process from the supply side (production) and the demand side (consumer), is crucial to study the impact caused by climate change (Deressa *et al.*, 2011). To understand the impact of climate change on food security, it is important to understand the linkages between climate change and food security.

The study of Lang and Roessler (2009), explained that the social capital of rural people and farmers include family, friends, trust, norms, gatherings and networks of farmer associations, as well as other factors, such as agricultural extension officers. Social capital has the potential to enhance people's livelihoods and transfers knowledge and information among people (Tenzin *et al.*, 2015). Social capital is very important in rural communities and where people rely on cooperatives for alternative responses to external shocks (Nieman, 2006). A study by Gbetibouo *et al.* (2010), describes social capital as important for a communities' adaptation to climate change. A high degree of social capital promotes self-organisation and a capacity for learning and adaptation among smallholder farmers (Thomas *et al.*, 2007). Strong social capital benefits groups by enabling the flow of information and resources (Nieman, 2006; Tenzin *et al.*, 2015). Strong social capital is enhanced by leadership. However, leaders also benefit from social capital through their ability to influence others, to collect information that is essential to the group, and to create communication on association barriers.

The contribution of agriculture to the gross domestic product (GDP) is about 2.5%, and the contribution to formal employment is about 5% (STATS SA, 2012). With the current level of production, South Africa is a net exporter of food, and thus climate

change would affect food security in the Southern African regions. About four million South Africans are engaged in smallholder agriculture, and most of these farmers are situated in the rural areas (Jacobs and Baiphethi, 2009). Agriculture is a core sector in ensuring food security as it provides households with food, employment and a livelihood (Baird and Gray, 2014). Most smallholder farmers are affected by a total reliance on rainfall. Tibesigwa and Visser (2015) study indicated that, in South Africa, about 20.7% of households participate in agriculture and 65% of these households use agriculture to mainly meet the household's food demand. The National Income Dynamics Study (NIDS, 2009) showed that about 4.6% of the adult population participate in the agricultural production.

2.4.1 Accessibility of Food

Food accessibility refers to the affordability and allocation mechanisms (FAO, 2011). The IFAD report argues that poverty and vulnerability play major roles in food accessibility, as it is based on the purchasing power of individuals and social dynamic access. Moreover, food accessibility is linked to food distribution and the location where food arrives (market) for purchasing (Copper et al., 2008). In Sub-Saharan countries, people fail to access food because high prices, access to markets, high unemployment rate and the level of poverty. Markets are a secondary source of food; however, different seasons (seasonal demand from June to August) and extreme climate events affect production, crop yield and food supply to the markets. These often lead to increases in price which highly affect people with low-income.

Food access depends on the ability of households to obtain food from purchases, gathering and current production (FAO, 2012). Poor access to food by households in SSA regions has been caused by the inability of the country to generate enough food, using available resources. The FAO (2011) states that alleviating food security crises in SSA requires support from economic growth and better income. Immediate measures to ensure access to food for the poor people are integrated with the twin-track approach used by the Food and Agriculture Organisation of the United Nations (FAO), the World Food Programme (WFP) and International Fund for Agricultural Development (IFAD).

Access to food is determined by physical and financial resources, as well as by social and political factors. Accessibility to food can be affected by many events related to weather and climate change, such as drought or floods (FAO, 2012). Also, damaged infrastructure delays the distribution of food to the targeted destination. Factors that determine whether people will have access to sufficient food through markets are considered to include income-generating capacity, the amount of remuneration received for products and goods sold or labour and services rendered, and the ratio of the cost of a minimum daily food basket to the average daily income (FAO, 2011; 2012).

2.4.2 Availability of food

Food availability is based on food supply and productive capacity. Most food insecure people dwell in rural areas. For many, food production is also buying power (FAO, 2011). Rural people sell the food they grow to obtain other types of food and resources, to supplement their low income (FAO, 2012). Many South African households have need of secondary sources of survival due to the high poverty. Some even depend on government grants such as child and disability grants and old age pensions (Stats SA, 2012). At household and community level, the majority of people lack the money to buy staple foods, thus, there is an increase in the number of undernourished people, especially young children. FAO (2011) states that the poorer the household is, the more the insufficient money is spent on buying food.

Food availability mainly depends on the production, exchange, and distribution of food. The determining factors also include the production of the adequate crop, a collection of wild foods and resources, livestock and indigenous communities (Vermeulen et al., 2012). Climate variability directly affects agricultural production, as agriculture is inherently sensitive to climate conditions and is one of the most vulnerable sectors of the risks and impacts of global climate change (FAO, 2012). Food availability in Sub-Saharan Africa is directly affected by changes in rainfall amount and patterns, extreme weather events, increase in temperature and rising atmospheric concentrations of CO₂. Studies (FAO, 2009, 2012) have shown that climate change has the potential to shift suitability of land which leads to increase and decrease in potential cropland in different regions of latitudes. Therefore, increases in temperatures can benefit crop

yield in temperate regions, while negatively affecting the crops in tropical and seasonal dry regions.

2.4.3 Utilisation of Food

Adequate food utilization is realized when food is properly used, and suitable food processing and storage techniques are employed with adequate knowledge of nutrition (Beddington et al., 2012; Vermeulen et al., 2012). The FAO (2012) report stated that the health status of an individual is the main factor affecting food utilization. However, illness and other diseases can decrease an individual's appetite and intake of nutrients. The constraints to food utilization include loss of nutrients during food processing, inadequate sanitation, improper care and storage (FAO, 2011).

Factors which influence the appropriate intake of food include age, health status, and diseases. The utilization of food can also be affected by the change in climate. The type of seeds cultivated and varieties which can be grown changes, to be more appropriately suited to the climate. As a result, people change their eating habits and preferences (Schiermeier, 2007). Moreover, climate change affects micronutrient consumptions by changing the yields of important crop sources of micronutrients and altering the nutritional content of a crop. As a result, this can influence decision to grow crops of different nutritional value (FAO, 2009). Climate change further affects the nutritional intake of food by household due to increases in prices and this affects different food items purchased by households.

2.5 FARMER'S AWARENESS, COPING, AND ADAPTATION TO CLIMATE CHANGE

2.5.1 Farmers Awareness of Climate Change

SH farmers play an important role in livelihood creation amongst the rural poor and are important in fostering household food security (Thamaga-Chitja and Morojele, 2014). Their understanding of climate change is essential towards making informed decisions on local adaptation (FAO, 2011). These perceptions usually come from farmers and rural communities' experiences of the impact of climate change on their livelihoods. Based on the IPCC report (2014), adaptive capacity is defined as the

ability of a system to adjust to climate change, with moderate potential damage, take advantage of opportunities, and cope with consequences. Thomas et al., (2007) and Warr (2011) argue that asset set is the key determinant of the adaptive capacity of individuals, households, and community in regarding risk, reduction and coping with risk/adapting to increased risk levels (Gbetibouo et al., 2010). Gbetibouo et al., (2010) argue that capital is close to vulnerability and livelihood, hence, building resilience will require expanding and sustaining the capital of farmers.

Agricultural practices do not only depend on the appropriate biophysical and climatic stimuli for success, but also on other non-climatic variables, such as social networks, particularly in rural communities where social connectivity is a way of life (Neves, 2013; Wood et al., 2014).

2.5.2 Coping and Adaptation Strategies by SH Farmers

Building resilience in rural areas involves considering the possible contribution of capital towards improving resilience in food systems, the stability of food supply, and access of food (Wood et al., 2014). However, Deressa et al., (2011) argue that the main purpose of adaptation is not only to prevent negative impacts from variables (i.e. climate change) but is a long-term resilience measure to create better conditions for societies so that they can absorb the impact of climate change. The emphasis is that adaptation to climate change requires that farmers be aware when climate occurs and identify the appropriate adaptation strategy to employ (Vermeulen et al., 2012). African farmers have employed highly similar adaptation methods in agriculture. They include the use of crops resistant to drought, irrigation, crop diversification, mixed crop farming, changing of planting dates, diversification from farm to non-farm activities and water conservation strategies (Thomas et al., 2007; Copper et al., 2008). However, these adaptation strategies, as well as climate change awareness, are determined by the community and household characteristics which include: educational level, age, farming experience, and gender of household head.

A study was conducted by Obayelu et al. (2014) to observe how farmers perceive long-term changes to local climate. They analyse how farmers adapt their farming in response to such perceived changes in climate. The study discusses perceived constraints for farm level adaptation to climate change. It further shows that historical

adaptation measures at the farm level generally do not include advanced management technologies but are limited to simple measures, particularly changing crops or crop varieties. In the light of the foregoing insights, this research will investigate what farmers know about climate change, what strategies they use to adapt to these changes and whether if the chosen strategies are appropriate to the changes.

The Food and Agriculture Organization of the United Nations (FAO, 2011) explain, climate adaptation is the process of adjustment to expected climate and its effects. The process is both bio-physical and human. Individuals are expected to make complex decisions about adaptation, which determine the consequences of climate change for livelihoods. Phillippo et al. (2015) state that adaptation occurs at the individual, household, community and institutional (government levels). At the household level, adaptation can be through technology adoption, change in livelihoods and migration. Community level adaptation may occur through collective action towards a common goal i.e. cooperatives. The institutional scale can be through intervention.

Furthermore, a study by Gbetibouo *et al.* (2010), has indicated that some farmers have adapted to climate change to reduce the negative impact posed by these changes. However, Bryan *et al.*, (2013) argue that the success of adaptation depends on the availability of necessary resources, such as finances, knowledge, assets and natural resources. The capacity to adapt and build resilience directly depends on the households' ability to access and utilise capital (Cooper *et al.*, 2008; Marshall, 2010).

2.6 FARMERS' SOCIAL CAPITALS IN BUILDING RESILIENCE AGAINST CLIMATE CHANGE

Resilience can be in two dimensions: community and individual resilience. Communities contain many social groups, people of similar interest and sets of relationships, which bring them together (Megyesi et al., 2010). In communities, people come together with an interest in the common activity, culture, norms and beliefs which may arise from a shared environment, interests, and history. This connection among people is also referred to as a sense of community. The sense of community is a feeling of belonging, that members of the community have; a feeling that members matter to one another and to the group, and a shared faith that

members' needs will be met through their commitment to be together. The study by Megyesi et al. (2010) argues that the sense of community can be used by community leaders as a tool for encouraging specific behaviours and actions, among residents within their tribe or society. Thus, it can be harnessed towards coping and adapting to changes and difficulties. Community resilience should be personal and collective capacity of citizens to respond to, and influence change bounces back. Building resilience at the community level can be effective because communities are integrated and changes cannot affect one part of the system without being felt in another part of the system (Megyesi et al., 2010).

Wambugu et al. (2009) and Megyesi et al. (2010) argues that the important contributor to community resilience is a community's capitals i.e. human, cultural and social capitals. Human capital includes people's knowledge, skill, and competencies; cultural capital includes values, history, traditions and behaviours which link specific people together; while social capital involves relationship building to achieve a common goal, and shared objectives and knowledge to contribute to the common goal. The social asset is identified as the most important capital as it provides capacity beyond those that can be easily accessed by most individuals (Abenakyo et al., 2007). Social capital requires collective action, placing a diverse group of people to build, communicate, maintain and collectively using resources to achieve their goals. This social connectivity and co-operation enable solutions to be achieved easily than being an individual (Aldrich et al., 2014).

However, resilience is linked with the two terms: cope and adapt (Deressa et al., 2011). Coping capacity refers to the actions and activities that take place within the existing structure usually, the short-term strategies. On the hand, (Thomas et al., 2007) argued that adapting involves changing the framework within which coping takes place, which usually involves a long-term change in behaviour patterns.

2.7 THEORETICAL FRAMEWORK

The section provides a discussion of a theoretical framework that is relevant to the study. It begins with a historical overview of a social asset in communities. The study approach was chosen based on relation to the study inquiry.

2.7.1 Social Capital

The concept of social capital is based on the idea that relationship matter and social networks have value. The concept has been used in varieties of literature in the 1980s, especially in the works of scholars like Pierre Bourdieu, Robert Putnam, and James Coleman. Bourdieu believes that in social relationships, there is a power struggle between individuals who always seek to maximize their own access to resources, at the expense of others. Coleman defines social capital as a variety of different entities, with two common elements: aspect social structure and they facilitate certain actions of actors. He further points out that individual's behaviours are influenced by characteristics of the social system and further motivated by personal interests and goals. In his theory, social capital is categorised into three forms: obligations and expectations which depend on the trust of social environment; information embedded in social relations which provides the basis for action; and a set of norms. Abenakyo et al (2007) Putnam (1993) defined social capital as the feature of social organization including trust, norms, and networks that improve the effectiveness of community by guiding its actions.

2.7.2 Structural and Cognitive Social Capital

Social capital is categorised into structural social capital which is visible or tangible, and cognitive social capital which is inviable (Abenakyo et al., 2007; Megyesi et al., 2010). Structural capital refers to established formal and informal social networks, which serve as a platform for collective action, decision making, and information sharing. Structural capital can bond individuals into groups, or bring divided groups of different level and power. Structural social capital involves various forms of organization which includes rules, roles, procedures and a variety of networks that contribute to cooperation (Abenakyo et al., 2007). Cognitive social capital consists of values, attitudes, perceptions of trustworthiness and believes. Both categories of social capital depend on respect, trust, trustworthiness and friendship. However, cognitive social capital refers to resources obtained from a common set of goals, shared vision and shared representations. The attributes of cognitive social capital include values and perceptions of people (Abenakyo et al., 2007.)

2.7.3 Forms of Social Capital

In addition to the previously discussed classifications, social capital forms are also commonly grouped based on their strength and diversity, into bonding, linking and bridging. Ties can also be formal and informal. The bonding social capital represents relationships between family members, friends, and neighbours. Bonding social capital is usually used for adaptive strategies by individuals, in response to climate change. However, bridging social capital involves links with others in the village (Aldrich et al. 2014).

Bonding social capital is horizontal and refers to the social interactions within a homogenous group (Halpern et al., 2002). It is characterized by strong social ties and is closely related to thick trust (Aldrich et al., 2014). On the other hand, bridging social capital is vertical between communities and has to do with the relationships interconnecting heterogeneous groups, with different backgrounds (Woodhouse, 2006). Bridging social capital is closely related to thin trust (Abenakyo et al., 2007). Linking social capital refers to relations between individuals and groups in different social strata in a hierarchy where power, social status, and wealth are accessed by different groups (Aldrich et al., 2014). Wambugu et al. (2009) explained that Woolcock (2001) extends this to include the capacity of leveraging resources, ideas, and information from formal institutions, beyond the community.

A great deal of social capital is built during interactions, which occur for social, cultural, or religious reasons. It enables people to build communities, to commit themselves to one another (Aldrich et al., 2014). Agricultural practice not only depends on the appropriate biophysical and climatic stimuli for success but also on other non-climatic variables (social networks). Social networks play distinct roles in the adoption of agricultural technologies: they act as conduits for financial transfers that may ease farmers' credit constraints, provide information about new technologies, and facilitate cooperation among farmers to allow the costs and benefits of adaptation to be shared (Aldrich et al., 2014).

2.7.4 Purpose and Effect of Social Capital in Societies

Coleman theory stated that social capital facilitates certain actions of actors. Further explained that social capital facilitates actions presented to benefit people, such as information sharing, activities conducted and collective decision making (Megyesi et

al., 2010). In summary, social capital facilitates cooperation and further make collection action possible. The absence of social capital is explained as one of the reasons for poor public goods and services. Social capital in societies is expected to bind community members and direct the participation of community members towards common goals (Aldrich et al., 2014). Such capital has been reported to be effective in facilitating co-operation. This, in turn, saves, costs and, help reduce risk through its management and social insurance, through better utilisation and management of resources and lower transactions costs. For instance, through farmers group, the farmers can be connected to agencies which can help sustain their activities beyond farming.

2.8 CONCLUSION

This chapter focuses on the significance of social capital, in building resilience and adaptation to climate change in rural SH farmers. The relevance of social capital in building adaptation and resilience was discussed, considering the works of a variety of scholars. Social capital is particularly relevant in poor and rural communities, where people rely on cooperation for emergency response and shocks. Social capital can be important for communities' adaptation to climate change. SH farmers play an important role in livelihoods creation amongst the rural poor and are their roles are important in achieving household food security. Farmer's understanding of climate change is essential for them to make informed decisions on local adaptation.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter describes the methodology of data collection and analysis used for the study. A description of the background information about Appelsbosch SH farmers, including issues regarding agricultural activities, social structure, livelihoods and climate change is given. The aim of the study was to assess the role of social capital in building climate change resilience and adaptation strategies for the sustenance of the food security and livelihood of SH farmers in Appelsbosch, KwaZulu-Natal province. Appelsbosch was chosen because the community has been engaged in subsistence and SH farming for many years as an essential activity of livelihood.

The study explored three sub-problems as subsets of the overall research question. The sub-problems that were explored are as follows:

- What is the role of social capital in climate change adaptation strategies used by smallholder farmers in Appelsbosch?
- What is the role of social capital in choices of cropping system used by smallholder farmers at Appelsbosch to improve the food security and livelihoods?

3.2 GEOGRAPHICAL LOCATION OF THE STUDY AREA AND DEMOGRAPHIC INFORMATION

Appelsbosch is a community under *uMshwathi* local municipality in KwaZulu-Natal Province. Appelsbosch is made up of 1,356 households with an average of 5-6 people per household (IDP, 2011/12). The land at Appelsbosch is communally owned. Most the houses in Appelsbosch are traditional houses (round mud-based structures with grass roofs), with a few of them made from brick-based materials. The livelihood of the Appelsbosch community is largely derived from subsistence farming, which involves cropping and livestock farming. However, crop farming is dominant, while livestock farming is mainly used for land preparation. Many farmers in the area grow maize, beans, sweet potatoes and taro (*Amadumbe*), while a few grow sugar cane.

3.2.1. Climate Condition of the Region

The crops listed above grow very well under the climate conditions of Appelsbosch. It has a sub-humid climate, with rainfall of 500 to 800 mm/annum. The climate is classified as humid subtropical. February is the warmest month with an average temperature of 25.1 °C at noon, while June is coldest with an average temperature of 6.3 °C at night. Appelsbosch has no distinct temperature seasons, as the temperature is relatively constant during the year. Winter can manifest with frost on some days, with the coldest month most often being June. July is, on average, the month with the most sunshine.

3.2.2. The Location of the Study Site

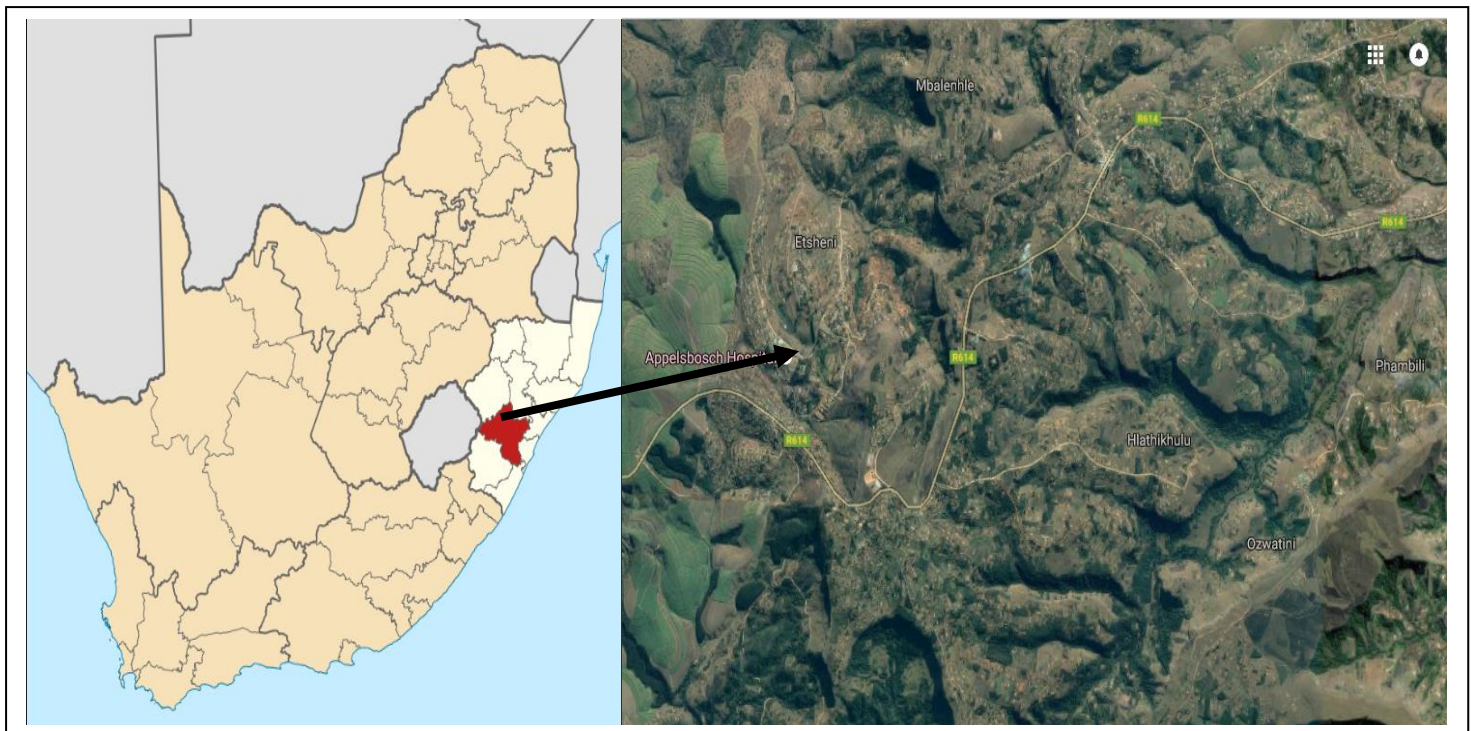


Figure 2: The study site (Appelsbosch location)

3.3 RESEARCH DESIGN

The study used a mixed method for data collection. The mixed method approach combines the collection and analysis of qualitative and quantitative data. The qualitative research approach is an investigation in which data is collected in face-to-face situations by interacting with selected individuals (Creswell, 2003). The qualitative approach assisted in answering questions about the nature of the problem, with the purpose of understanding it from the participants' point of view (Hsieh and Shannon, 2005).

Quantitative data was collected through a structured questionnaire. These include qualitative data which was collected through focus group discussions with SH farmers and key informants' interviews (extension officer). The structured questionnaire was designed to capture data on demographics, crop production, livelihood strategies, farming strategies, food security, social capital and climate change awareness. The structured questionnaire was pre-tested on seven non-sampled farmers in Appelsbosch. After pre-testing, the questionnaire was modified and the finalised structured questionnaire was used for the study.

Focus group discussions were conducted with the purpose of gathering in-depth information on social capital, a structure in the community and their main activities. The focus group discussions were used to establish the active social groups in the community, further, explore how the social capital has been used by farmers to adapt and build resilient strategies for farming. About 3 focus group discussions were conducted, each group with 8 farmers, both women and man, although most groups are made up of women. This caused an unequal number of women and men during focus group discussions. The 8 farmers were randomly selected. The key informant interviews were conducted with 1 extension officer and 4 group members from the seven farmer's groups existing and active in Appelsbosch. The limitation to have more key informant was due to the active planting season when data were collected, less people were available.

3.4 SAMPLING METHOD

Sampling is a very important process in a study as this is when a researcher chooses the participants for their study (Williams, 2007). In this study, random sampling was used for structured questionnaires. The participants chosen for the study had to be subsistence farmers and active in farming activities. However, random sampling was used in the focus group discussions (FGD). In Appelsbosch, 135 farmers were interviewed.

3.5 DATA COLLECTION TOOLS

Primary and secondary data were collected in a bid to achieve the objectives of the study. Primary data was collected directly from the small holder farmers interviewed using structured questionnaire. Secondary data was collected by reviewing literature including studies by various authors on the impact of climate change on SH farmers and the contribution of social capital towards building resilience and adaptation in rural farming.

3.5.1 Structured Questionnaire

A survey questionnaire was employed in the study to gather information about farmers' understanding of climate change, and its impact on their livelihoods and the food security status in their households. The structured questionnaire included both open-ended and closed-ended questions. Open-ended questions gave participants the opportunity to provide in-depth information on their feelings, experiences, and perceptions of the role of social capital in their livelihoods and food security status (Driscoll et al., 2007). The questionnaire was divided into four sections: Biographical information, social capital and social groups, livelihood, and climate change awareness by farmers.

The first section of the questionnaire was structured to explore the biographical information of the participants such as age, gender, educational level, the sources of monthly income and marital status. The second section explored issues related to subsistence and SH farming, including access to production capital such as land,

water, extension services, and farmer groups. The last two sections explored farmers' climate change awareness and the livelihood capital accessible to farmers.

During the structured questionnaires, the farmers were divided into groups at a single venue and face to face interviews were conducted. All 135 farmers were individually interviewed. Six facilitators from the Food Security Programme assisted with the collection of data.

3.5.2 Focus Group Discussion

The study employed focus group discussions (FGD) for generating meaningful discussions to gain an understanding of social capital and structure which exists in the community and the impact it has on their livelihoods and food security in the face of climate change. Focus group discussions (FGDs) encouraged participants to talk and interact with each other, facilitating information retrieval from SH farmers (Creswell, 2003; Creswell, 2013). FGDs were conducted simultaneously with the administration of the questionnaire. Individual farmers were chosen from a sampled number of focus group discussions. Each focus group had a facilitator to assist participants with clarifications relating to questions and ensure that the discussion was on track.

3.5.3 Key Informants

Key informant interviews aimed at obtaining a general idea regarding the extent to which indigenous knowledge practices are applied in each study village and identifying farmers who could be used as case studies were conducted (Creswell, 2003: 2013).

3.6 DATA ANALYSIS

3.6.1 Descriptive Statistics

In the study, the Statistical Package for Social Science (SPSS version 23) was used to analyse the data collected from SH farmers at Appelsbosch. Descriptive statistics and Chi-square tests were used to analyse the data, which is presented in the results section using tables and graphs. The Chi-square test was used to determine the relationship based on social capital and adaptation strategies used by farmers to

sustain their food security and livelihoods, also with a choice of cropping system used by farmers to adapt to climate change.

3.7 SUMMARY

This chapter discusses the methodology used for this study, with regards to the methods used to collect and analyse data. The data was collected from 135 SH farmers using random sampling, and the tools used were structured questionnaire, key informant interviews, and focus group discussions through face to face interviews. The results of the study are presented in the next chapter.

CHAPTER FOUR: DOES SOCIAL CAPITAL PLAY A ROLE IN CLIMATE CHANGE ADAPTATION AMONG SMALLHOLDER FARMERS FOR IMPROVING FOOD SECURITY AND LIVELIHOODS?

ABSTRACT

¹Sub-Saharan Africa is faced with a range of climate risks, which include rapid and uncertain changes in rainfall and temperature patterns that threaten food production and could lead to an increase in food prices and other challenges. South African smallholder farmers are no different, they also face the challenges of adapting to climate change and building resilience. Social capital can be a resource for building adaptation by farmers. The study explores the role of social capital in climate change adaptation for improving food security and livelihoods among smallholder farmers. The study was conducted in Appelsbosch, Kwa-Zulu Natal province. Random sampling was used to obtain a sample of 135 active and long-term smallholder farmers, who were interviewed using questionnaires and focus group discussions. Descriptive statistics were utilised in analysing the demographics of the respondents and the chi-square test was used to test the relationship between social capital dimensions and the adaptation strategies employed by farmers. The results showed a significant relationship between social group and food insecurity coping at a 5% significance level. A significant relationship, at 5% ($p=0.012$), between the social group and the strategies employed by the household to reduce soil erosion and soil quality inputs used was shown. It was found that social capital has a positive impact on the coping strategies used by households on food insecurity and adaptation strategies. Social capital can improve rural livelihoods, although the capital is not fully exploited by farmers. Farmers should be stimulated to expand their social groups to share farmer-to-farmer agricultural knowledge and increase participation and networks with the view of strengthening their adaptive capacity. Extension services and rural leaders can also play a role in strengthening such networks and influence policy on strengthening local and extension systems.

KEYWORDS: Climate change; Livelihoods; Social Capital; Adaptation; Food security

¹ This paper has been submitted to the Journal of Family Ecology and Consumer Sciences

4.1 INTRODUCTION AND BACKGROUND OF THE STUDY

Social capital can contribute to how smallholder farmers respond and adapt to climate change and assist to ensure food security and the resilience of livelihoods. Gbetibouo *et al.* (2010), describes social capital as important for a communities' adaptation to climate change. A high degree of social capital promotes self-organisation and a capacity for learning and adaptation among smallholder farmers (Thomas *et al.*, 2007). Social capital has the potential to enhance people's livelihoods and transfers knowledge and information among people (Tenzin *et al.*, 2015). Social capital is very important in rural communities and where people rely on cooperatives for alternative responses to external shocks (Nieman, 2006).

Sub-Saharan Africa (SSA) is faced with multiple crises, such as ensuring food and nutrition security, alleviating poverty and mitigating climate change (FAO, 2011). SSA has one of the highest rates of poverty, which largely affects the rural populations that rely on farming. Moreover, the negative impact of climate change increases the rate of poverty, especially for rain-fed agriculture. Agriculture in SSA employed 62% of the population and generated 27% of the GDP (FAO, 2009). Poverty among rural farmers in the region can be attributed to small and marginal landholdings, limited use of improved inputs and low levels of irrigation, etc. Thus, the strong dependence on farming, especially in rain-fed agriculture, contributes to the food insecurity and poverty in the face of climate change. (FAO, 2011; IPCC, 2014; OXFAM, 2015). It affects natural assets, on which certain livelihoods depend directly, such as water, land and natural resources (agriculture) (Maponya and Mpandeli, 2012; OXFAM, 2015).

Farmers have developed adaptation strategies. Adaptation is an important way in which farmers respond to climate change (FAO, 2012). However, the way that the affected farmers will adapt, depends on the climate change impacts on their farming production and livelihoods. Previous studies focused on the determinants of households' adaptive behaviour and perceptions of the impacts of climate change (Deressa *et al.*, 2011). However, not much has been done on social capital, which is rooted among smallholder farmers which are highly affected by climate change. The role of social capital in adaptation behaviour has still not been investigated broadly. Researchers have pointed out the need to focus on processes and capacities of

adaptations rather than specific actions and strategies in adaptations (Marshall, 2010). This study focuses on the farmer's capacity, using the social capital, in building adaptation strategies against climate change. The study argues that different dimensions of social capital affect the choice of adaptation measures utilised by smallholder farmers. This is crucial because adaptation to climate change is created by a social component, through interacting with others, networking to gain information, the sharing of resources and creating collective norms to build resilience against climate change. This will be beneficial for agricultural extension officers, government agencies, and policymakers, to achieve effective strategies for smallholder farmers.

Food security is defined as a situation when all people, at all times, have physical and economic access to sufficient, safe and nutritious food, enabling them to meet their dietary needs and food preferences for an active and healthy life (FAO, 2009; IFPRI, 2010). The definition of food security emphasizes the availability of physical supplies of food to the people, the household access to those food supplies, i.e. markets and the utilisation of those food supplies to meet their daily dietary requirements (CFS, 2012). However, Bryan *et al.* (2013) identify socio-economic characteristics and resources of the individual as factors which influence the food security status of their household. The National Income Dynamics Study (2009) showed that the participating rates are highest in the age group of 60-69 years of age, with 10% of this group engaged in agricultural production. The province of Kwa-Zulu Natal accounts for 60% of the total number of subsistence producers (STATS SA, 2012).

Rural people have developed livelihood strategies, which satisfy their need for water, food other goods, and services which benefit them, from their climate (Callaghan and Colton, 2008; FAO, 2012). Rural households are heavily engaged in land-based livelihood strategies, such as livestock husbandry, farming, and trade in natural resources (Naidoo *et al.*, 2013). South African households employ several dynamic livelihood strategies, and these differ monthly and annually, depending on factors such as timing, rainfall, labour availability, input costs, access to public services, credit, remittance income and transport costs (STATS SA, 2012).

Smallholder farmers and subsistence farmers, particularly women, play an important role in the construction of livelihoods and household food security among the rural poor (Ziervogel and Frayne, 2011; STATS SA, 2012). Gbetibouo *et al.* (2010),

highlighted that the climate has changed in the past years and continues to change. Thus, there is a need to adapt and enhance the resilience of farming to secure food security and livelihoods (Deressa *et al.*, 2011). Farmer's understanding of climate change is essential for them to make knowledgeable decisions on local adaptation, support decision-making based on which adaptive strategies can be employed to secure their livelihoods and food security (Deressa *et al.*, 2011; Bryan *et al.*, 2013).

Some adaptive measures which they identified, include switching to drought-tolerant crop varieties, introducing more suitable crops, using manure and fertiliser, the use of contour line and no tillage and shifting from crops to livestock (Connolly-Boutin and Smit, 2016). Some of these strategies were achieved using the social capital i.e. cooperative, self-help and collective action to adapt and build resilience in their livelihoods. Social capital is one of the many resources available to individuals within a community (Aldrich and Meyer, 2014)

Social networks play distinct roles in the adoption of agricultural technologies; they act as a mediator for financial transfers that may ease farmers' credit constraints, they provide information about new technologies, and they facilitate cooperation among farmers to allow the different dimensions of social capital, which include membership density, meeting attendance, and cash contribution. The study was conducted to assess the role of social capital in climate change adaptation by smallholder farmers in Appelsbosch, to improve their food security and livelihoods.

4.2 MATERIAL AND METHODS

4.2.1 Study site and sampling procedures

Appelsbosch is a community under the *uMshwathi* local municipality in the Kwa-Zulu Natal province (-29.398045, 30.863738). The area consists of 1,356 households with an average of 5–6 people per household (IDP, 2015/16). The livelihoods at Appelsbosch are largely derived from subsistence farming. Moreover, the farming system in the community includes crop and livestock farming, however, crop farming is dominant. Farmers in Appelsbosch mostly grow maize, beans, sweet potatoes and *amadumbe*, and a few of the farmers grow sugarcane. These crops grow well in Appelsbosch, which has a humid climate with an average rainfall of 500–800

mm/annum. However, the change in rainfall and high temperatures has had an impact on crop production, threatening the food security, economy, and development of the area (IDP, 2015/16). Farmers in the area used to grow crops all year around, but due to climate change, farmers have diversified their livelihoods into non-farming and farming activities. Moreover, the current short-term drought had a significant impact on the farmers' production, i.e. crop failure. The community-level capacity is low. Farmers have been trained by the Department of Agriculture (Cedara College of Agriculture) and the UKZN SAEES, in climate-smart agricultural techniques, such as integrated crop management, water conservation, storage and irrigation management, and minimum tillage practices (IDP, 2015/2016).

A mixed method approach was used to collect data for the study. The study utilised both qualitative and quantitative methods to outline and clarify characteristics, descriptions, and measurements, to reveal information under the research question. A random sampling was used to select 135 active and long-term smallholder farmers. During the process of the data collection, a survey questionnaire and focus group discussions were conducted to obtain information from the farmers. Focus group discussions were also conducted with 9 farmers in a group, and key informant interviews were held with extension officers and community farmers.

4.2.2 Social capital measures

The social capital dimensions used in this study include membership density, meeting attendance and cash contribution (Gbetibouo *et al.*, 2010). The density of membership, which was measured by the number of existing associations in the community that a household is a member. However, attendance at meetings is an important indicator of participation. Meeting attendance measures the average number of times someone from a household attended group meetings or community meetings. With regards to a cash contribution, the respondents were asked if they were contributing to community-saving clubs.

4.2.3 Data analysis

Quantitative and qualitative data were collected concurrently to allow for triangulation of results. Data was collected over one week in February 2016. The data was analysed

using descriptive statistics as well as content and theme analyses. Descriptive statistics were generated, using the IBM SPSS 24 Statistical Package for Social Scientists (SPSS), to summarise the demographic data of the respondents. The frequency of quantitative data was generated to present the statistics that could be used to complement the qualitative data used in the presentation of the results. The qualitative data was analysed using content and theme analysis. The content and theme analysis involved two processes, coding questions, and group themes. A chi-square test analysis was used to evaluate the significant relationship between social capital and adaptation strategies by smallholder farmers. Given that not much is known about the quality of the intangible assets and effectiveness thereof amongst smallholder farmers in climate change mitigation and adaptation, testing for significant relationships may help guide extension and capacity building of resource-poor farmers. The chi-square test was used to evaluate significant relationships between social capital and adaptation strategies by smallholder farmers.

The formula for chi-square is: $\chi^2 = \sum \frac{(E-O)^2}{E}$

The degrees of freedom are equal to the number of independent observations minus the number of parameters estimated as intermediate steps in the estimation. The degrees of freedom are equal to $(r-1)(c-1)$, where r is the number of rows and c is the number of columns.

4.3 RESULTS AND DISCUSSION

4.3.1 Demographic characteristics

The results (in table 1a appendix) show that many of the farmers were female (83.7%), with the highest number of individuals between the ages of 56–65 years of age (28.1%), followed by an older group over the age of 65 years. The study of Aliber and Hart also showed that women were the main group participating in smallholder farming and further demonstrated that participation in farming was highly rejected by the youth group. Most of the farmers interviewed were married (57.8%), followed by a large group of single individuals (28.1%). The sampled sample had more married participants could have a positive impact on livelihood diversification of the respondents since married couples have more secure access to land, an important

resource for farming and family labour. Several studies have shown that marriage can improve access to land, particularly for female farmers (Thamaga-Chitja *et al.*, 2010). Most of the households interviewed had land sizes between 1 and 2 hectares (51.1%), which Chitja and Morojele (2014), show as being typical among smallholder farmers. About 36.3% of farmer's own land sizes between 3–4 hectares.

The results of the analyses showed that many of the farmers interviewed had completed their primary education (43%), followed by 18.5% who were illiterate. Only 12% of the respondents completed their high school education. In summary, the respondents interviewed showed a high percentage of individuals who had a formal education (69.7%). It was found that many of the respondents in Appelsbosch are literate, and this may increase their livelihood diversification because of human capital arising from high literacy and skills obtained from previous work, which includes farm working and mining. The results analyses showed that, of the farmers interviewed, 61.5% were engaged in crop farming and 34.1% were engaged in both crop and livestock farming. The most common incomes for respondents were government pensions (32.6%), farming harvest (32.1%) and other government grants (22.8%), i.e. social grants. According to the South African Social Security Agency (SASSA) report, a government pension is mainly for people are 60 years of age and above. Government grants in South Africa include foster child care, old age, and disability.

4.3.2 Farmers perception of climate change and its impact on food security

Table 1: Social capital dimensions and climate change awareness by farmers

Social capital dimension	χ^2	P-value
Attendance of community meetings	29.366	0.000*
Number of social groups participation	0.556	0.757

N= 135: * = 5% level of significance

Farmers in Appelsbosch indicated that they are aware of climate change. Moreover, there was a significant relationship at 5 % ($p=0.000$) between the attendance of community meeting by household and climate change awareness. The Chi-square test indicated that household members who attend community meetings were aware of climate change. However, it was not clear if the emphasis appropriate adaptation was flourishing. Hence the insignificant relationship at 5% ($p=0.757$) between the number of social group participation and climate change awareness. Community meetings were important in improving perceptions because information sharing among people at different levels took place (government officials, extension officer, traditional leaders and community).

4.3.3 Food security and coping strategies used by smallholder farmers

4.3.3.1 Participation and coping strategies used by smallholder farmers

Table 2: The participation of household member in a social group and food insecurity coping strategies used by households

Dimension of social capital			strategy	χ^2	P=value
household membership in	social groups		Food insecurity coping strategies	119.72	0.000*
Household attendance of	meetings in a month		Food insecurity coping strategies	114.875	0.000*
Household attendance in	community meetings		Food insecurity coping strategies	95.49	0.000*

N= 135 * = significant at 5% level

The p-value from the chi-square test (Table 2) indicated that the relationship between the participation of farmers in a social group and food insecurity coping strategies employed by the farmer were statistically significant at a 5% significance level. The chi-square test indicated that the participation of farmers in a social group positively influenced their coping strategies with food insecurity. Hence, participating in social groups creates and develops social networks for the members and enhances relationships with other people in the community.

The results showed that 35.6% of farmers are participating in farmers' group purchase of food as their coping strategy. However, 64.4% of 35.6% from 87 farmers still rely on farming for their household food security. Thus, farming is important for their livelihood and food security. Furthermore, in a focus group discussion (FGD), respondents indicated that the coping strategies which they use to survive the effects of climate change and to meet food security include borrowing food, working for food, food exchange, saving clubs, buying food and selling livestock. Based on the significance of the chi-square test, we can say that group participation is beneficial to members as a networking platform to access alternative options to cope with food insecurity for households.

4.3.3.2 Number of meetings attended in a month and food insecurity coping strategies

The results showed that there was a significant relationship, at 5% ($p=0.000$), between the number of meetings attended in a month by a farmer and the food insecurity coping strategies used by the household. In summary, there is a positive influence from multiple meetings attended in a month by a farmer and the coping strategies used by the farmer during household food insecurity. This means that, the more meetings that are attended by farmers, the better the alternative are available to them, i.e. ties, friends, information gained and resources. The attendance of several meetings allows for more interaction between the farmers.

4.3.3.3 Community meeting attendance and food insecurity coping strategies

The results showed that there was a significant relationship, at 5% ($p=0.000$), between community meeting attendance and the coping strategies employed for food insecurity by the household. The results indicated that the perceived coping strategies for food insecurity employed by a farmer had a positive influence through attendance of meetings on the effects of food insecurity.

4.3.4 SOCIAL CAPITAL AND ADAPTATION STRATEGIES ON CLIMATE CHANGE

4.3.4.1 Participation in social groups and adaptation strategies

Table 3: Social participation and climate change adaptation strategies used by SH farmers

Adaptation strategies	df	χ^2	p-value
Soil erosions methods	18	34.119	0.012*
Water harvesting strategies	20	15.505	0.747
Soil input substances	16	32.336	0.009*

N= 135 * = 5% level of significance

The results in Table 3 show that there was a significant relationship, at 5% ($p=0.012$), between the participation of a farmer in a social group and the strategies employed by the household to reduce and prevent soil erosion. The chi-square test results indicated that the participation of a farmer in social groups influenced the strategies used to reduce and prevent soil erosion. A study by Njiki *et al.* (2008), showed that participation in agricultural training and extension programs had a positive and statistically significant impact on the value of adaptation and increased production.

South Africa has recently been experiencing recurrent droughts, low and late rainfall. These experiences, together with other extreme climatic events, are expected to continue. Deressa *et al.* (2009), expresses more of an emphasis on the importance of collective action, and the building of social capital in rural areas, as an adaptation tool. In the focus group discussions (FGDs), farmers at Appelsbosch mentioned water shortages, soil erosion, and poor soil quality, to be the major crises regarding climate change. With these challenges to their farming, they were introduced to coping and adaptation strategies to maintain their livelihoods. Although those coping strategies are labour intensive, costly and time-consuming.

The results in Table 3 show that there was an insignificant relationship, at 5% ($p=0.747$), between the participation of a household member in a social group and the

water harvesting strategies employed by members. This means that the participation of a household member in a social group had no effect on the water harvesting strategies employed by household.

However, the results also showed that there was a significant relationship, at 5% ($p=0.009$), between the participation of a household member in a social group and the soil quality strategies employed by members. This included the use of fertilisers, manure, lime and opening fallows. The chi-square test indicated that the participation of household members in a social group had a positive effect on the strategies employed by the household to improve soil quality. The study by Njuki *et al.* (2008), also showed that social capital influenced the adoption and use of different soil fertility management options. This means that social capital has an influence on the household's adaptation strategy for climate change.

During the FGDs, the farmers mentioned that participating in groups helped in sharing information, knowledge, and methods for farming. However, the challenge in implementing coping strategies against soil erosion was labour, since these strategies were considered labour intensive. The farm sizes differ, some farmers had small areas (less than a hectare), while other farmers had more than 1 hectare, and therefore, labour and input resources would differ if labour was to be shared. This resulted in farmers working individually when implementing actions, although learning and sharing through groups. However, the options for solving the mentioned challenges, such as using the average size (1 hectare) as a guide, seemed to be unconsidered. The researcher observed that the farmers did not seem to have a strategy on how to share labour and labour costs. This implies the absence of a strong leadership among group members, as there seems to be limited farmer-to-farmer innovation, with the farmers being largely dependent on support from extension officers.

4.3.4.2 Community meeting attendance and adaptation strategies

The results (in Table 2a appendix) show that there was a significant relationship, at 5% ($p=0.000$), between the attendance of community meetings and the water harvesting strategies employed by household members. This means that the attendance of community meetings had a positive influence on the water harvesting strategies employed by households. The results show that the information gained from

attending a community meeting by a member had a positive influence on the water harvesting strategies used by the household. The study by Wossen *et al.* (2015), shows that the attendance and interaction of farmers had a significant determinant to the adoption of improved land management practices by farmers.

Then again, the results in (Table 2a appendix) show that there was a significant relationship, at 5% ($p=0.01$), between the attendance of community meetings and the strategies employed by households to prevent and reduce soil erosion. The results indicated a positive effect on the strategies employed by a household member attending community meetings to prevent and reduce soil erosion. The FAO (2012) report showed that, through cooperation and interaction, farmers increase their social capital, access to information and learning about new strategies for increasing productivity under climate change. Moreover, the results show that there was also a significant relationship, at 5% ($p=0.013$), between the attendance of community meetings and the soil quality strategies employed by members, indicating a positive effect on the strategies employed by households to improve soil quality. The results from (Wossen *et al.*, 2015), also showed that social capital played a significant role in enhancing the adoption of improved farmland management practices, such as land degradation and low productivity. Farmers mentioned that, in community meetings, government officials and agencies are often present to discuss challenges faced by the community at large. At this level, the agreement on a solution and actions could be supported at the government level, local authority level (*Nkosi and Nduna*) and community level.

4.3.4.3 Number of meetings per month and adaptation strategies

The results (in table 3a appendix) indicated that there was an insignificant relationship, at 5% ($p=0.781$), between the number of meetings a household member attends a month and water harvesting strategies employed by members. This means that the number of meetings a household attends has no effect on water harvesting strategies employed by the household.

However, there was a significant relationship at 5% ($p=0.013$), between the number of meetings a household member attends a month and the strategies employed by the household to avoid and limit soil erosion. The chi-square test indicated that the number

of meetings a household member attends a month, influences the strategies employed by that household to prevent and limit soil erosion. This may be expected since Table 3 and Table 4 have shown that soil erosion adaptation was one of the key areas where farmers had expressed great challenges. Hence, they were seeking more information by attending more meetings. The FAO (2012) report emphasized that adoption is strongly influenced by members of the same social group. Moreover, new innovations are more easily adopted by members when they come from a familiar member. This may be the result of the different skills of farmers. Some farmers might be opinion leaders and others might have leadership roles that are limited to other issues.

There was also a significant relationship at 5% ($p=0.004$), between the number of meetings a household member attends in a month and the soil quality strategies employed by members. The chi-square test indicated that the number of meetings a household member attends a month, influences the strategies employed by that household to improve soil quality. Farmers mentioned that, by attending a meeting, they gain more information shared in the meetings. A study by Wossena *et al.* (2015), indicated that communities with good social networks and associations are in a better position to tackle poverty and minimise vulnerability.

The section presents results from in-depth focus group discussions (FGDs) on active social groups in Appelsbosch (Table 4). The respondents explained how social groups are formed in their community and how those social capitals differ. Members are engaged in multiple groups to sustain and improve their livelihoods and remain socially connected. These groups consist of community members who have other relationships through church, culture, friendships and being a neighbour. The most dominant social groups in the community were the farmers' groups and savings clubs, which had an impact on how farmers adapted to climate change.

The FGDs included discussions on the role played by these social groups to bring awareness to farmers in adapting and coping with climate change. Farmers expressed that in their farmers' groups, they attend training from department agencies, i.e. extension officers and Potato SA, that operate in the area. The training and workshops taught them about planting strategies to earn high-yield crops and the requirements to sell at markets. Farmers explained that they are encouraged to form groups and engage in cooperative farming, as they would get benefits which include resources,

credit and have a higher collected production, and buying in large quantity as cooperatives, i.e. purchasing seeds.

Table 4: Focus Group Discussion (FGD) on social capital at Appelsbosch

Theme/s	Concept/s	Responses
Level of participation	Norms and society attitudes	“Appelsbosch, there are many social groups formed. This includes burial societies, <i>stokvels</i> (a saving club for distributing money and buying food), church groups and farmers groups”.
Diversity of groups	Norms and society attitudes	“We form groups as friends, neighbours, and wards”.
		“The most driving social groups is the farmers’ group and saving clubs as they improve our livelihoods and generate income”.
Participation	Cultural expectations and society norms	Farmers’ groups were encouraged by extension officers, with the purpose of working together, sharing information, acquiring resources and reducing labour costs”. And also, to discuss farming challenges towards farmers, i.e. drought, high temperature, late rainfall, pesticides and fertilisers to use.
	Society attitudes	In past years, farmers had been struggling with water for irrigation purposes and poor soil quality. Farmers mentioned that it has been difficult to access resources individually and information about improving farming with regards to pesticides to use, climate change and obtaining a high yield.
Participation		Participating in farmers’ groups has introduced them to knowledge (training and workshops) provided by extension officers and the Department of Agriculture”. Farmers mentioned the training which they attended, they were taught the importance of making contour lines in the field and understanding the slope of the land (field) to know which direction the soil would be overturned (tilling) to avoid soil erosion and seed loss.
Collective action		Farmers mentioned that in 2012, the government provided the groups with fertiliser, lime, and a tractor, which led to good harvests. The groups had been following the same strategies (purchasing seeds, fertiliser and pesticides) introduced to them. Although there have been individuals pulling out due to contribution fees required by the groups. <i>Umntu umuntu ngabantu meaning I am because of you.</i>
		Farmers mention that they save money through farmers’ groups and in savings clubs. The saving clubs have a positive impact on their livelihoods as it assists in saving money to buy food products and agricultural input although some months they skip contribution due to monthly cost challenges and other responsibilities.
Networking	Norms and society attitudes	Churches are another social platform which sustains people’s livelihoods through spiritual support and promoting peace, trust, and safety in the community. Respondents also indicated that they

		form (groups) to fight crime in their communities. This community involvement allows people to know each other and build positive relationships.
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Groups seemed linked to finding problems together and receiving group training, with little emphasis on creating capacity for farmers to resolve their own problems. The group power was not being fully exploited to foster capacity and leaders to lead various initiatives. Farmers could initiate methods of sharing labour and create solutions without waiting for government and extension assistance. Non-agricultural groups, such as church groups and burial societies, were important in building trust, safety and a harmonious relation which was positive for group dynamics. Social capital has a positive impact on the coping strategies used by households for food insecurity and their adaptation strategies. Social capital can improve rural livelihoods, although the capital is not fully exploited by farmers.

4.4 CONCLUSIONS AND RECOMMENDATIONS

The relationship between social capital and the adaptation strategies employed by smallholder farmers is presented with supporting evidence from other studies in the literature and results. It is argued that farmers with more social capital are better at adopting adaptation strategies. This is possible because of the created networks and ties during the interaction of people. It emerged that many farmers are using social capital as a platform to acquire agricultural resources, information, knowledge, and credits. Membership in groups increases the likelihood that members will have access to agricultural inputs, technical advice and agricultural practice, and management strategies which help farmers adapt to climate change. The results showed that the participation of household members had a positive impact on the coping and adaptation strategies employed by households. Although, social capital is not fully utilised to benefit all challenges related to farming activities and this may be due to lack of leadership among farmers and training related to social aspects. Based on significant relationships found, this research can assist smallholder farmer support programs in taking advantage of their numbers, organise themselves and harness, strengthen social and human assets amongst themselves to actuate the established strategies to mitigate and adapt to climate change. Based on the findings, it is

emerging that meeting attendance provides a bridge between accessing information on the technical strategies of adapting to climate change and of harnessing social capital to actuate these strategies and thus achieve household food security and cope better with food insecurity.

Thus, this calls for further research to study ways to strengthen the use of social capital among smallholder farmers based on adaptation strategies and to facilitate more farmer participation in meetings. There is a need for igniting capacity among extension services to facilitate the empowerment of community leaders and government agencies, particularly agricultural, environmental and rural development extension services to translate community social platforms into supportive channels to empower farmers and leaders among themselves and translating information across all levels. Information and appropriate platforms for sharing information and capacity to apply information are important. Community meetings have shown to be an important avenue for information, raising awareness and adaptation strategies. However, transforming the information into adaptation, required a greater understanding of farmers' connectivity, showing weakness in the approach of the current top-down extension system that does not seem to be rooted in the process of empowerment. Finally, interventions to improve the capacity of smallholder farmers need to be developed to use social groups and community meetings as a channel and platform to build bottom-up strategies for adaptation to climate change.

CHAPTER FIVE: DOES SOCIAL CAPITAL AFFECT THE CHOICE OF CROPPING SYSTEM TO IMPROVE FOOD SECURITY AND LIVELIHOODS?

ABSTRACT

African people practice mixed farming, which involves farming crops and animals. Farmers make several decisions before placing the seeds into the soil. Furthermore, understanding how farmers make their planting plans can help researchers to plan appropriate crop management strategies to increase the farmers' production. Smallholder farming is characterised by a lower level of education, small land size, poor soil quality, and poor soil inputs. Social capital can address some of the demands in smallholder farming. Further, addressing the lack of social capital and the strengthening or weakening of it could prevent farmers from choosing a profitable and viable cropping system that could improve livelihoods and food security. The concept of social capital is based on the idea that relationship matters and social networks have value. Random sampling was used to select 135 smallholder farmers at Appelsbosch, Kwa-Zulu Natal province. A survey questionnaire and focus group discussion were conducted. Descriptive statistics were utilized in analysing the demographics and the chi-square test was used to test the relationship between social capital dimensions, cropping system and cropping choice used by farmers. There was a significant relationship at 5% ($p=0.021$) between the number of social groups that a farmer participates in and the times of planting in a year by farmers. Results also showed a significant relationship at 5% ($p=0.011$) between the number of meetings attended in a month by households and the numbers of crop planted in a year. Again, the results showed a significant relationship at 5% ($p=0.012$) between the number of social groups and the types of strategies employed by the farmers to reduce soil erosion in their fields. Social capital has a positive impact on farming systems and choices made by farmers to sustain their food security and livelihood. Thus, the capacity of smallholder farmers should be built through social capital so that farmers are aware of cropping system and crop choices that can provide a balanced intake of food with nutrition based on crops grown. The government and NGO's should introduce more programs which will expose farmers in other crops that are drought tolerant and still preferred by farmers.

Keywords: Social capital, Cropping system, food security, and livelihoods.

5.1 BACKGROUND OF THE STUDY

Sub-Saharan Africa is one of the regions in the world currently facing widespread chronic food (in) security (FAO, 2011). South Africa is estimated to have four million people engaged in smallholder agriculture for various reasons which include: agriculture as an extra source of food and generating income (STATS SA, 2012). Farmers make several decisions before placing seeds into the soil. These decisions include the type of seed, seeding rate, and arrangement, date of planting and the cropping intensity, and system (Perret and Stevens, 2006). Different cropping systems are adapted by farmers to fit their socio-economic, household food security and agro-ecological settings (Wambugu et al., 2014). Farmers further decide on what productive method and technology are best suited to their environment and farming systems (Wood et al., 2014). Thus, understanding all the complex interactions between the choices made by farmers would promote understanding the choices made for the types of cropping system employed. Furthermore, understanding how farmers make their planting plans could help researchers to plan appropriate crop management strategies to increase farmers' production. The argument of the study is that social capital can address some of the demand and that the lack of or weakness in the availability of social capital could prevent farmers from choosing profitable and viable cropping systems that could improve livelihoods and food security.

African people practice mixed farming, which involves farming with both crops and animals (FAO, 2011/12). This indication of smallholder farming in South Africa suggests that farming plays an important role in rural livelihoods. The STATS SA (2012) report outlined that less than 2% of households in South Africa practice agriculture as smallholders. Subsistence farming serves multiple household functions including meeting financial, cultural and social objectives. Subsistence farming systems are mostly based on mixed cropping of species to ensure food supplies. The mixed cropping system ensures the resilience of smallholder farmers (FAO, 2012).

In Kwa-Zulu Natal Province, mixed or intercropping is the most common strategy as farmers grow more than one crop simultaneously on the same plot, however, there is competition for resources for all crops to grow (IDP, 2015/16). The intercropping system holds several advantages for farmers. Intercropping is practiced to meet the household demand (balanced diet and nutritional balance), to avoid environmental

risks (diseases, climate conditions) and to provide continuous food for the household. The choice of choosing a crop to grow is determined by several factors, including temperature, soil and the socio-economic conditions of farmers. In summary, climatic conditions, physical relief features, and human preferences determine what crops should be grown in the field. However, the choice of crops to be grown in different seasons is complicated by the increasing impact of climate change.

In KwaZulu-Natal Province, about 83.6% of households are engaged in agriculture to produce an extra source of food, while 7.1% engage in agriculture as an extra source of income (IDP, 2015/16). However, only 1.4% of the households participated in agriculture to produce their main source of food and 2.9% of households used agriculture to obtain their own main source of income (STATS SA 2012). Thus, households are basically engaged in smallholder farming for the household's consumption and needs.

Farmers mostly grow crops such as cabbage, carrots, spinach, tomatoes, maize, taro (*amadumbe*) and sweet potato simultaneously (intercropping) on the same plot. Intercropping is the most common feature of smallholder agriculture (IDP, 2015/16). The system is used mainly on small farms of less than 2 hectares in size. Moreover, the crops grown are selected based on their importance in household consumption and market demand. Intercropping is an essential aspect of livelihood diversification to promote the diversity of a household basket of agriculturally produced crops.

Rural people rely heavily on agriculture. However, the sector still depends on traditional practices of crop cultivation and farm management (FAO, 2011) strategies. Furthermore, farmers still rely on the use of simple tools, i.e. hoes and spades and techniques including manual weeding, hoeing, and harvesting (Wood et al., 2014). This situation forces the poor to rely on social capital, i.e. self-help and community-based creativities, as part of their survival strategy. In most subsistence farming systems, farmers are involved in a social organization that shapes relationships and facilitates exchanges of knowledge and diffusion of practices (STATS SA, 2012). Moreover, the crop diversity and the system are shaped by environmental barriers and social barriers (Wambugu et al., 2010). Social organisations and networks favour the diffusion of planting material, practices, and information between farmers. Community and group clubs (*stokvels*) are amongst the survival strategies that have been

practiced for many years by most black South Africans (STATS SA, 2012). There are different types of social groups (*stokvels*) in South Africa such as savings, burial, investment and high budget *stokvels*. Social groups have both economic and social functions.

A rural background tends to strengthen the need for social capital. Rural communities generally have higher levels of participation in the voluntary activities, thus strengthen social capital in the community (Wossena et al., 2015). Social capital, the focus of this paper, is a concept that suggests that the connections between and among people and the resources with which they interact have economic value. Social capital links people, their communities, and their surroundings. Thus, the accumulation of social capital in communities can help to alleviate rural poverty and help to mitigate threats to livelihoods (Lang and Roessler, 2009). A social capital orientation in rural development values the individual while transforming people into active citizens. The FAO (2010) report and the study of Deressa et al., (2009) state that social capital in agriculture influences the ability of individual smallholders to take advantage of emerging economic opportunities. Thus, individuals and groups can work collectively and create trust-based relationships and networks among members. A farmer in a community observes the farming activities of each of the other farmers, i.e. type of seeds, types of crops and new technology and then updates his own perceptions regarding the technology and seeds and makes decisions regarding cultivation for the next season (Wood et al., 2014).

5.2 MATERIAL AND METHODS

5.2.1 Site selection

The study was conducted at Appelsbosch, in the *uMshwathi* local municipality of Kwa-Zulu Natal Province. The farmers were randomly selected from active crop farmers in the community. The existence, strengths, and weaknesses of social capital and farming systems were investigated. The Integrated Development Plan (2015/16) estimates that the area consists of 1,356 households with an average of 5-6 people per household. Livelihoods at Appelsbosch are largely derived from subsistence farming. Furthermore, the farming system in the community includes cropping and livestock farming (IDP, 2015/16). However, crop farming dominates in this community.

According to the IDP (2015/16), Appelsbosch comprises different types of social groups. These social capital types include farmers' groups, burial societies and grocery/money savings club (*stokvel*). These social groups have both economic and social benefits for households. The economic benefit of the social group includes promotion of income security while the social benefit includes social support. All these social groups contribute to household livelihood.

5.2.2 Sampling Procedure and Method

A mixed-methods research approach and random sampling were used to collect data and to select active crop farmers from the study area. The mixed-methods approach combines the collection and analysis of both quantitative and qualitative data. Random sampling was used to interview active crop farmers from the population. In the study, the selected community had to have active and long-term crop farmer's participation. There were 135 questionnaire respondents from Appelsbosch community. In addition, focus group discussions were conducted with at least 9 members, and key informant interviews were also conducted with an extension officer and farmers' group leaders.

5.2.3 Data collection and Analysis

Quantitative and qualitative data was collected concurrently to compare the findings of the different methods and produce justifiable conclusions (Creswell, 2013). Data was collected using a questionnaire, key informant interviews and focus group discussions over a two-week period. The data was subjected to descriptive statistical analysis using the Statistical Package for Social Scientists (SPSS). The data from the closed questions on the questionnaire was coded and the demographic, types of crops grown by farmers, the methods employed by the farmers, the existing and types of social capital among the farmers and the benefits of being engaged in the social capital for farming sections of the questions were presented through descriptive analysis (SPSS). A chi-square test analysis was used to evaluate the significant relationship between social capital and adaptation strategies by smallholder farmers.

5.3 RESULTS AND DISCUSSION

The study establishes the role of social capital in food security and the livelihood of smallholder farmers from the Appelsbosch community.

5.3.1 A description of the sample

The majority of the farmers interviewed were female (83.7%), with the highest number of individuals aged between 56 and 65 years (28.1%), followed by an older group over the age of 65 years. Most farmers interviewed were married (57.8%) followed by a large group of single individuals (28.1%). Farmers interviewed showed that the majority have completed their primary school education (43%), followed by a group of respondents who are illiterate, cannot read and write (18.5%). About 12% of the respondents had managed to complete their high school education. In summary, the respondent interviewed show a high percentage of individuals who have formal education (74.1%) but who have retired due to age.

Table 5: Rural livelihoods strategies

Sources of Livelihoods by respondents	Frequency	Percentages %
1.Old Age Pension and Farming	67	49.6
2.Old Age Pension and Government Grants	4	3.0
3.Income Wage and Government Grants	9	6.7
4.Farming and Government Grants	37	27.4
5.Old Age Pension and Farming and Government Grants	2	1.5
6.Old Age Pension and Casual Income and Government Grants	1	0.7
7.Remittance and Farming	2	1.5
8.Income Wage and Farming and Government Grants	4	3.0
9.Old Age Pension and Farming and Casual Income	1	0.7
10.Old Age Pension and Remittance and Farming	1	0.7
11.Farming and Casual Income and Government Grants	3	2.2
Total	135	100

The table above (table 5) shows the dominant sources of livelihoods of respondents. About 49.6% respondents showed that their household livelihoods depend on an income from the old age pension and from crop farming. The monthly allowance for old age pensioners through SASSA is R1500 in South Africa while crop farming in the community is practiced throughout the year. This group is followed by 27.4% of respondents who depend on crop farming and government grants (child support grants). The SASSA reports that the monthly allowance for child support is R330. According to a study by Altman et al. (2009), social grants seem to be the most important contributor to reducing poverty and food insecurity in the poorest households.

About 3% of respondents depend on the Old Age Pension and Government Grants together with Income Wage and Farming and Government Grants. Thamaga-Chitja and Morojele (2014) and Statistics South Africa's (2012) studies indicated that South African households, especially those located in rural areas, employ a mixture of livelihood strategies which include: salaries and wages, social grants and income from pensions and remittance to sustain their livelihoods. Regardless of these livelihood

strategies, agricultural activities continue to play an important role in providing much-needed subsistence especially in the form of food (Thamaga-Chitja and Morojele, 2014).

Table 6: The types of active associations (Social capital) at Appelsbosch

Types of Associations and membership	Frequencies	Percentages%
9. farmers group and Burial society	21	15.6
10. farmers group	90	66.7
11. farmers group and grocery stokvel	20	14.8
12. farmers group and burial society and grocery stokvel	4	3.0
Total	135	100

The results in (table 6) show multiple associations in which respondents are participating to support their livelihoods. However, all the associations are money oriented. About 66.7% of respondents were shown to be engaged in crop production to sustain their livelihoods and food security. Respondents indicated that crop farming has a high effect on their livelihoods as they grow crops for both consumption and sale to purchase other food products from markets that cannot be grown. Thulstrup (2015) states that in pursuing different livelihood strategies, people and communities draw their livelihoods from resources available to them, which can be through their associations with other people, clubs, and networks. The farmers explained that the most common benefits from farmers' groups (crop production) were sharing labour, information, and lower purchasing costs. The farmers interviewed represented eight farmers' group associations that are active in the community. The groups vary in numbers and some were formed 4-5 years ago, while others were formed more recently.

The farmers also indicated that being engaged in other social community groups such as burial societies and savings clubs (*stokvel*) also improves their livelihoods. About 15.6% of respondents indicated that being engaged in crop production and burial societies to help with funds and buying food while about 14.8% of respondents showed that being engaged in crop production and grocery *stokvel* also helped them. These

organizations provide opportunities for interaction and support from other people. They also impose a sense of shared values and norms among participants and bring individuals together in a cooperative community. Lastly, 3% of respondents were shown to be active in crop production, a burial society, and a grocery *stokvel*. This form of social capital may potentially enhance adoption by farmers by improving their knowledge and information. Grocery societies (*stokvel*) help to save money for members then be rotated as loans among members and to buy food at the end of the year for members. The results show that crop farming is very active and dominant in activities to diversify their livelihoods.

5.3.2 GROUP DISCUSSION ON SOCIAL GROUPS AND MEMBERSHIP AND ITS BENEFITS



Figure 3: The map of Group farmers at Appelsbosch

Based on discussions conducted with participants, the most dominant association is the farmers' group. Most participants are only involved in farmers' groups while others engage in farmers' groups and burial society or a grocery *stokvel*. Other participants stated that they cannot afford to participate in other societies due to the monthly

contributions to be part of the association. Most the interviewed participants are old and dependent on old age pensions and crop farming for their livelihoods. The monthly allowance by the government, which is R1500, cannot support their household needs as well as societies. The main reasons given for the high participation in farmers' groups is because of agricultural inputs such as chemicals, fertilizer, seeds, equipment and the workshops conducted by the extension officer (Department of Agriculture). It is normal for the government agencies to relate to farmers on a group basis rather than on an individual basis. Aldrich and Meyer's (2014) study emphasizes that many of the poor are rural dwellers who lack agricultural inputs and equipment, thus subjecting them to low productivity. Therefore, to adjust to their poor conditions, the rural dwellers join social groups that would supply the necessary farm support services they need (Connolly-Boutin and Smit, 2016).

However, the distance between the existing farmers' groups is a challenge. Members of these groups are unable to meet and interact with external group's members for knowledge transfer. The distance has a negative impact on the networking of farmers and limits the number of meetings to one per month.

5.3.3 The farming system by farmers at Appelsbosch

<i>Table 7: The farming systems used at Appelsbosch</i>		
<i>Farming system employed by farmers</i>	<i>Frequency</i>	<i>Percentages %</i>
<i>Crop farming</i>	83	61.5
<i>Livestock farming</i>	6	4.4
<i>Crop and livestock farming</i>	46	34.1
Total	135	100

The farmers interviewed, showed that most respondents are engaged in crop farming (61.5%) and 34.1% who are engaged in both crop and livestock farming (6). Only 4.4% of respondents are engaged in livestock farming. Livestock production is closely interrelated with crop production. The use of livestock and their products such as manure are important in crop production. The livestock social functions correspond to

the symbolic values associated with each species and the use of animals for the implementation of rituals and social obligations of families (FAO, 2009). Livestock gives social status to their owners and is also considered as a mean of demonstrating wealth to the households (Wood et al., 2014). Livestock capitals are also a source of cash for investment in other forms of capital. Traditionally, African people practice mixed farming, namely the production of both crops and animals (FAO, 2011). The size of the settlements area is usually about 0.1 ha in size. However, the field at Appelsbosch area is not fenced which constrains animal keepers.

5.3.4 FARMING SYSTEM AND SOCIAL CAPITALS BY RESPONDENTS

5.3.4.1 Composition of cropping systems for crop species

<i>Table 8: The types of crops grown by SH farmers at Appelsbosch</i>		
Crop items	Frequency	Percentage %
Green mealies, potatoes, dry beans and leaf vegetables	113	97
Leaf vegetables	2	1.5
Green mealies, potatoes and dry beans	2	1.5
Sugarcane	0	0
Total	135	100%

The crop species mentioned in (table 8) are cultivated by the 135 smallholder farmers sampled. The farmers stated that their gardens were associated with the production of staple food crops, mainly maize (green mealies), dry beans and vegetables with tuber crops such as potatoes and sweet potatoes. The farmers' production at Appelsbosch is mainly aimed at producing crops for home consumption then, when there is sufficient production, for sale. Thus, human nutrition is considered regarding the crops grown. Wood et al., (2014) explain that farmers practice intercropping (mixed farming) to produce enough to meet the consumption required by households. Moreover, increasing the variety of food in the diet within the food groups is highly recommended in South African food-based dietary guidelines. The availability of a

greater variety of nutritious food at the household level is achieved through intercropping farming.

The smallholder farmer produces a variety of crop species based on the staple for household consumption and market demand. However, a crop species that is a household staple food is the most important consideration to the crop choice made by a farmer. Intercropping is a common farming system employed by smallholder farmers at Appelsbosch. In smallholdings, intercropping offers a diversity of organic sources of manure which may be added to the soil directly as crop residues. Moreover, crop diversity ensures the resilience of smallholder farming systems in changing environments. The crops mentioned in (table7) are also outlined on DAEA and UKZN SAEES reports on crops produced by smallholder farmers in Kwa-Zulu Natal Province to increase the use of climate resilient crops and agricultural practices.

5.3.4.2 Crop planting schedule and social capital

Due to the availability of drought tolerant and early maturing varieties, most of the farmers delayed the time of planting until there was continuous rainfall while the other farmers have changed to ploughing once or twice a year rather than throughout the year.

Table 9: The agricultural adjustment calendar by SH farmers

	January	February	March	April	May	June	July	August	September	October	November	December
Weather	High rain falls and sunlight	High rain falls and sunlight	Low rain falls, cold winds	Very low rain falls, more cold winds	Cold wind, frost	Dry & cold winds	Dry & cold winds, frost	Strong & cold winds	Rain-falls	More rain-falls	More rain-falls	More rain falls
Green mealies	Sowing mealies	Weeding period	Weeding again	Early harvesting	harvesting	Soil preparation	Soil preparation	Maize planting preparation	Sowing	weeding	harvesting	Maturing harvesting
Potatoes	Sowing	Early maturing	weeding	Weeding & soil	Soil covering	harvesting	Soil preparation	Sowing	Early maturing	Weeding	Soil covering	harvesting
Green leafy vegetables	Soil preparation and seeds	Sowing	Early maturing	Fully matured, harvesting	harvesting	Soil preparation	Mature added	Sowing	Early maturing	Adding insecticides	Fully maturing	harvesting
Dry beans	Soil preparation	Sowing	Sowing	Early maturing	Full maturing	harvesting	Soil preparation	Sowing season again	Early maturing	Growing process	Fully maturing	harvesting

The decisions made by the farmers based on cropping system are influenced by many factors which include climate change, the farming demands, i.e. seeds, labour required, fertilizer, machinery, and production. Due to these challenges, farmers have adopted many methods: crop diversification, adoption of mixed crops and livestock farming system, and changes in agricultural activity dates. Farmers have changed and adjust their agricultural activities to sustain and improve their household food security throughout the year. The most crucial stages are soil preparation, sowing, weeding, and harvesting. The soil preparation takes place at the beginning of the rainy season, which makes it easy to prepare ridges and furrows. Farmers explain that once there are delays in rainfall (drought) that affect the sowing dates or may result in double sowing and intercrop. However, the adjustment to the agricultural calendar is not consistent because of the amount of rainfall received each year. Farmers explained that the help they receive from extension services and social groups is essential and assist their decisions with agricultural activities and adjustment. In social groups, farmers share their personal experiences to help other farmers adjust in their agricultural calendar. Farmers showed that generally most SH farmer plant more than once a year, while the other farmers plant once a year. The limitation to planting (sowing) times a year also include factors such as access to credit, availability of machinery and labour, land size, fertiliser, and seeds.

5.3.4.3 Crop planting schedule by respondents

<i>Table 10: The number of social groups and crop planting schedule by farmers</i>						
Planting times a year and number of social group	1	2	3	df	X²	P-Value
Once a year	22	19	2	4	11.539	0.021
Twice a year	49	13	9			
Whole year	16	4	1			
Total	87	36	12			
1= farmers group 2= burial society 3= grocery stokvel						

The table above (table 10) shows the number of social groups active at Appelsbosch community and the planting schedules (times) in a year by smallholder farmers. There was a significant relationship at 5% ($p=0.021$) between the number of social groups that a farmer participates in and the times of planting in a year by that farmer. The chi-square tests indicated that the number of social groups that a farmer participates in has a positive influence on the number of times a household plough its fields in a year. The benefit of being active in a social group or even more than one social group exposes farmers to more information across the different groups of people. Farmers explain that the social groups help them to buy agricultural inputs in large quantities which are a challenge as an individual farmer, thus allowing the farmers to cultivate more than once because of the availability of resources.

During the focus group discussions, farmers outlined that participating in these social groups allowed them to share knowledge and ideas across all levels i.e. extension officer, farmers and neighbours and sharing information on planting strategies, such as using the intercropping system to achieve better harvesting. Furthermore, through farmer's groups, members mentioned that they also attended training and workshops that were organised by extension officer on methods of planting, inputs to use during the planting stage and methods to maintain the fields. The farmers mentioned that all these social groups are money oriented and rotate to allow members to benefit.

Table 11: The number of meetings attendant and crop planting schedule by farmers

Planting times a year and number of meeting attended by respondents in a month	1	2	3	df	X ²	P-Value
Once a year	22	19	2	4	13.087	0.011
Twice a year	49	12	10			
Whole year	16	4	1			
Total	87	35	13			

1= one meeting 2= two meetings 3= three meetings

The table above (table 11) shows the number of meetings attended by households in a month and the numbers of crop planting by the households. There was a significant relationship at 5% ($p=0.011$) between the number of meetings attended in a month by households and the numbers of crop planting in a year by the households. The chi-square tests showed that the number of meetings attended monthly by households has an influence on the number of times of planting in a year. During the focus group discussions, participants mentioned that in the past years they use to plant the whole year but due to climate change they shifted to planting twice or once a year and shifted the planting times, season and type of crops planted. However, households participating in social groups and attending meetings stated that they were trained and taught methods to cope and adapt to climate change by building resilience. During meetings, the government official also conducts training and demonstrations on planting methods to survive with a change in environment.

5.3.5 THE TYPES OF AGRICULTURAL INPUT AND MANAGEMENT STRATEGIES TO SUSTAIN FARMING SYSTEM BY SMALLHOLDER FARMERS AND SOCIAL CAPITAL

Table 12: Social participation and agricultural inputs and soil management strategies used by farmers

Categories	df	χ^2	Sig (P-value)
Soil erosion strategies	18	34.119	0.012
Soil quality inputs	16	32.336	0.009

N= 135 5%

The results (in table 12) show that there was a significant relationship at 5% ($p=0.012$) between the number of social groups a farmer engaged in and the types of strategies employed by the farmers to reduce soil erosion in their planting fields. The chi-square test results indicate that participation of a farmer in multiple social groups has a positive influence on the strategies used by farmers in preventing soil erosion. The farmers stated that these strategies are labour intensive, with high transaction cost and are time-consuming when employed as an individual, but that being engaged in the social groups reduced the costs. The study by Njuki et al. (2008) also showed that

the type of social capital influences the adoption of soil management by farmers. Associational involvement may also contribute to learning and training in sustainable agriculture practices.

The results further showed that there was a significant relationship at 5% ($p=0.009$) between a number of social groups a farmer engaged in and the types of soil input management employed by the farmers to sustain soil quality. The chi-square test indicated that the participation of farmers in multiple social groups has a positive influence on the types of soil inputs to sustain the soils in their fields and promote high productivity. A study by Njuki et al., (2008) showed that social capital influences the adoption and use of different soil fertility management options used by smallholder farmers. Fertilizer is expensive in price and inadequate in supply but less demanding of labour in its application. The manure is freely available but it is labour intensive in transportation and spreading on the field.

5.3.5.1 Number of meetings attended within a month and crop farming strategies

There was a significant relationship at 5% ($p=0.013$) between the number of meetings a household member attends a month and the strategies employed by the household to reduce soil erosion. The chi-square test indicated that the number of meetings a farmer attends in a month influences the types of strategies employed by the household to prevent soil erosion. The study by Deresse et al., (2009) showed that the use of several soil management technologies depends on socioeconomic variables and the existence of different dimensions of social capital.

The results also showed a significant relationship at 5% ($p=0.004$) between the number of meetings a farmer attends in a month and soil quality inputs employed by the farmer. The chi-square test indicated that the number of meetings a farmer attends in a month influences the types of inputs used farmer to improve soil quality. The study finds that bonding, bridging and linking social capital all influence the adoption and use of different soil fertility management.

5.3.5.2 Attendance of community meetings by farmers and crop farming strategies

There was a significant relationship at 5% ($p=0.010$) between the number of meetings a household member attends in a month and the strategies employed by the household to reduce soil erosion. The chi-square test indicated that the number of meetings a farmer attends in a month influences the types of strategies employed by the farmer to prevent soil erosion. In any society, there are strong pressures on its members to behave in certain ways. The results also showed a significant relationship at 5% ($p=0.013$) between the number of meetings a farmer attends in a month and soil quality inputs employed by the farmer. The chi-square test indicated that the number of meetings a farmer attends in a month influences the types of inputs the farmer uses to improve soil quality. The attitudes and desires of farmers are influenced by their norms and culture. In all communities, there are accepted ways of doing things and these ways are directly related to the culture of the community.

5.4 CONCLUSION

Farmers diversify their cropping practices using a mix of crop species both in space and time, growing different crops at different sowing dates and on different farm plots; combining less productive drought-resistant crops with high-yielding but water-sensitive crops. In South Africa, African people predominantly practice smallholder agriculture. Smallholder farmers comprise small land and the cultivation of a diverse mix of crops. However, there are several factors affecting farmers' choices and decisions on which crop varieties to cultivate. The purpose of this study was to explore the effect of social capital, in the form of associational memberships and attendance of monthly meetings on decisions made by farmers on the choice of cropping system to improve food security and livelihoods.

The findings showed that associational memberships have a positive effect on the planting times by farmers. The farmers stated that being an active member in associations reduces the costs of purchasing agricultural inputs i.e. fertiliser, seeds, and pesticides that are highly expensive when purchased by individuals. Moreover, members in associations assist each other during planting seasons to reduce the time spent and the labour. Most of these smallholder farmers are females and over 50 years

of age, thus heavy digging work requires a massive effort. Moreover, most farmers had only completed lower grades of education hence being active in associations and attending meetings introduces farmers to greater information and skill.

Social capital is important in adopting decisions and technologies. Moreover, strengthening social capital can enhance the selection of cropping systems and crops which are drought tolerant and nutritious to sustain food and nutrition security. Thus, more support to farmers through appropriate and effective social capital enhancing programs among smallholder farmers can increase more knowledge on crop growing conditions in the region. Moreover, policy interventions should focus on strengthening knowledge transfer channels and social networks among farmers.

The understanding of social capital among smallholder farmers is crucial and is important for rural leaders, extension officers, and agricultural agencies for planning strategies that assist farmers to produce more regardless of financial and resource constraints. However, studies that have examined the effect of social capital on technology adoption rarely go beyond its impact to analyse its determinants of social capital in rural areas. Yet, information on what influences social interaction in rural areas is important. Thus, there should be further research to assist policy makers on factors that influence the formation of social capital, the factors that cause weakening and strengthening of the farmer's social capital.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

Most South African households, especially those located in rural areas employ a mix of livelihood strategies such as: salaries and wages, social grants, income from pensions and remittance to sustain their livelihoods. Regardless of these livelihood strategies, agricultural activities continue to play an important role in providing much-needed subsistence, especially in the form of food (Thamaga-Chitja and Morojele, 2014). The work was constructed to assess the impact of climate change on smallholder farming and how social capitals can be used by smallholder farmers to mitigate the impact to build resilience for sustained livelihoods and food security. The objective was broken down into two sub-problems namely:

- What is the role of social capital in climate change adaptation strategies used by smallholder farmers in Appelsbosch?
- What is the role of social capital in choices of cropping system used by smallholder farmers at Appelsbosch to improve their food security and livelihoods?

The study was guided by the sustainable livelihood framework (SLF) and the theory of social capital. The SLF outlines the necessary capitals which are acquired by household wellbeing to survive. These livelihood capitals include natural, financial, physical, human and social capitals. The SLF helps to understand how livelihood functions and people react with shock and stress to survive. Nevertheless, social capital is mostly identified as the facilitator for other capitals. The social capital theories outline the social structure, ties, and the relationship between individual and households. This helps to understand the farmer's livelihood and social capital, which exist within the studied area and the way in which the social capital has been used to adapt to climate change and build resilience for sustainable livelihood and food security.

A mixed method was used to resolve the above mentioned sub-objectives. Data were collected using questionnaires, through holding focus group discussions and liaising with key informants. The questionnaire was translated into the local language (*isiZulu*) to gather more information from randomly selected respondents at Appelsbosch. The resulting data were analysed using descriptive statistics from Statistical Package for the Social Sciences (SPSS, version 24). The data were further analysed by running Chi-square tests to analyse the relationship between variables.

6.2 CONCLUSIONS

The objective of the sub-problem 1: What is the role of social capital in climate change adaptation strategies employed by Appelsbosch smallholder farmers?

The objective under investigation in sub-problem 1 were to explore on the farmers' capacity, using social capital, in building adaptation strategies against climate change. Secondly, the study sought to understand the different dimensions of social capital and how they affect the choices of adaptation measures utilised by smallholder farmers. The results of the study indicated that social groups, i.e. saving clubs (*stokvel*), have a positive contribution towards food crop production as it enhances the farmers' ability to purchase farm inputs and acquire other farming demands i.e. credit, information. Farming households derive benefits of credit access through social capital. The farmers explained that to access credits and other agricultural inputs they must be participating and active in local groups or cooperatives.

The results continuously showed that farmers in Appelsbosch are aware of climate change and its impact on their farming production. Impacts of climate change have resulted in farmers diversifying their livelihood strategies into farming and non-farming activities. However, climate change is still a challenge. Most farmers are engaged in saving clubs and social groups which serve multiple purposes in their households. Social capital has shown a positive impact on coping strategies used by the households to reduce food insecurity and improve adaptation strategies. Social capital shows the ability to improve rural livelihoods, but in the case of Appelsbosch farmers, the existing social capital is not being fully exploited by the farmers.

The results also showed that farmers are continuously trying to cope and adapt to climate change. The social groups, including farmer groups and social clubs have been used as coping strategy by the farmers. Farmers used social groups as an asset to seek information and gain resources at the community level and among other farmers. Support to farmers through social capital can promote appropriate and effective strategies to adjust to a changing environment. Thus, increase their production and improve their food security. Government and NGO's should support and build farmers social capital to enhance coping strategies at the farmer's level. This can be achieved through supporting social networks, existing self-help groups (SHG's) and co-operatives. An audit of social asset levels and nature would be crucial to design an effective social asset building.

The objectives of the sub-problem 2: What is the role of social capital in cropping system used by smallholder farmers at Appelsbosch to improve the food security and livelihoods?

The objective under investigation in sub-problem 2 were to determine the types of crops grown and the cropping system employed by smallholder farmers and as well as to investigate the planting processes employed by the farmers throughout the year in order to meet their demands. The argument was that social capital can address some of their demands and that the lack of it or weakness of it could stop farmers from choosing profitable and viable cropping systems that could improve their livelihoods and food security. The results showed that the farming system in Appelsbosch is maize-based, which is combined with groundnuts and sweet potatoes, with other green leafy vegetables being grown primarily for home consumption and selling.

The results showed that social capital can address some of the demand in smallholder farming systems, i.e. agricultural inputs such as seeds, fertiliser, and labour. The farmers mentioned that the participating in social groups has reduced the cost of expenditure, labour and time require. The social capital index such as attendance of monthly meetings and the number of social groups that a household participates in, were used to measure the social capital of the household. These are the social capitals used to build resilient farming systems and supports to maintain their household food security in the face of climate change. Nevertheless, participation in these social

groups is challenged by factors such as finances, lack of trust and leadership among the farmers.

The results showed that most of the farmers of the studied area are highly dependent on old age pensions and farming, whereas others used social grants and farming as their sources of income. Therefore, it can be said that the farmers in the study poll are mostly retired and using farming to nurture their grandchildren. Most of their time is spent in their home garden. The findings also showed that associational memberships help to educate these farmers regarding the best times of planting their crops throughout the year.

The farmers stated that being an active member of associations helps to reduce the costs of purchasing agricultural inputs, i.e. fertiliser, seeds, and pesticides, which are usually expensive when purchased individually. However, several studies have examined the effect of social capital on technology adoption, but not much has been studied on the factors affecting the participation of farmers in social capital. Thus, there's a need for further studies to address such factors and determinants.

The community has multiple active social groups/societies ranging from farmers' groups to burial, food, and money saving societies. However, all these social groups are money-oriented, although the monthly contribution differs based on the structure and constitution of the association. However, the low and various types of income, i.e. old age pensions, households restricted as to how many groups they can attend. A big portion of their income goes towards sustaining their household needs and responsibilities. Thus, households must choose which social groups to attend based on the benefits associated with that group. Government and NGO's should initiate effective strategies to strengthen social capital and networks among farmers to promote various social channels and new partnership that improve farmers' choice of crops and cropping system. This study provided information on the role of social capital in climate change and food security and how it can be effectively used by farmers. This is crucial for policy makers, government and non-governmental for translating climate change technologies and strategies into effective solutions.

6.3 POLICY RECOMMENDATIONS

This study thus leads us to conclude that the social capital gained through well-organised associations and groups help to boost the adaptation strategies and choices made regarding which cropping systems should be employed by smallholder farmers. In Appelsbosch, the study showed that there are multiple causes of the breakdown in social capitals. This is associated with lack of leadership (traditional and elected leaders), disagreements between members and a lack of support from community leaders. This breakdown hinders the ability of the farmers to work collectively when attempting to improve food security and better their livelihoods in the face of climate change. While recognising the advantages of social capital among farmers, there is still a need to investigate social resources, i.e. *stokvel*, saving clubs, leadership groups as well as the role of traditional leaders when building and strengthening social capital. These social resources (groups) can give a better understanding of how the community uses social capital resources and parts where there might be a gap, leading to the ineffective social capital. Climate change mitigation policies should consider building the capacity of farmers to effectively adapt to a changing climate through building the social capacity of farmers, however a well-informed strategy informed by a social asset audit is important.

The Department of Agriculture (DoA) and Non-Governmental Organisations (NGO's) should sustain and support the development of well organised social capital. The Department of Co-operative Governance and Traditional Affairs along with the Department of Agriculture, Forestry and Fisheries together with the participation of people/communities, need to strengthen the community's social capital resources to enhance food security.

Farmers should be encouraged to establish communication routes to share information and knowledge regarding successful local climate adaptation strategies. This could be achieved through the formation of community-based associations and farm-based groups. Forming these associations will give farmers access to social capital as well as offer farmers the opportunity to access credit, agricultural inputs, and other financial institutions.

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Appendix

Tables

Table 1a: The demographics characteristics of smallholder farmers

Demographic	frequency	Percentages %
Gender		
Female	113	83.7
Male	22	16.3
Age		
<25 years	5	3.7
26-35	9	6.7
36-45	16	11.9
46-55	31	23
56-65	38	28.1
>65	36	26.7
Marital Status		
Single	38	28.1
Married	78	57.8
Divorced	3	2.2
Widow	16	11.9
Land size		
Less than 1 ha	69	51.1
2-3 ha	49	36.3
4-5 ha	13	9.6
6 and more	4	3
Educational level		
None, can't read and write	25	18.5
None, But can read and write	10	7.4
Finished primary education	58	43
Finished secondary education	19	14.1
Finished high school	17	12.6
Vocational trainings	6	4.4
Farming Strategies employed by farmers		
Crop farming	83	61.5
Livestock farming	6	4.4
Crop and livestock	46	34.1
Total (n)= 135		100%

Table 2a: The relationship between the household member's attendance of community meetings and adaptation strategies employed

Table 2a: The relationship between the household member's attendance of community Meetings and adaptation strategies employed

	Number Of Meetings			df	X ²	P-value	N of valid cases
	1	2	3				
Soil erosion							
contours	35	21	7				
no tilling	2	0	0				
cover crops	17	2	4				
swales	10	0	2				
cover crops&swales	6	0	0				
contour&cover crops& swales	3	0	0				
contours&swales	4	2	0				
contours&no tilling	1	5	0				
contours&cover crops	5	5	0				
none	4	0	0				
Total	87	35	13	18	33.87	0.0	135
Water harvesting							
river	8	5	1				
roof water	22	9	4				
municipal water	19	7	4				
used water	1	3	2				
river& roof water	3	0	0				
roof water& municipal water	18	7	1				
river& municipal water	5	2	0				
river& roof water& municipal water	4	1	1				
river& roof water& municipal water& used water	3	1	0				
river&roof water& used water	2	0	0				
river& used water	2	0	0				
Total	87	35	13	20	14.91	0.00	135
Soil Quality							
fertiliser	3	7	0				
manure	8	6	0				
Lime	10	5	5				
Fertiliser &Lime	8	7	2				
Manure &Lime	11	3	2				
Fertiliser &Manure&Lime	34	3	4				
Fertiliser &Manure	10	1	0				
fertiliser&manure&fallow	1	1	0				
feritliser&manure&Lime&fallow	2	2	0				
Total	87	35	13	16	34.99	0.013	135

1= yes 2=no 3= sometimes

Table 3a: The relationship between the number of meetings a farmer participating on and coping strategies employed

Table 5: The relationship between the numbers of Meetings a household member participating on and coping strategies employed based on the issues mentioned. (Level of participating in social groups vs coping strategies)							
	Number of Meetings			df	X ²	P-value	N of valid cases
	1	2	3				
Soil erosion							
contours	35	21	7				
no tilling	2	0	0				
cover crops	17	2	4				
swales	10	0	2				
cover crops&swales	6	0	0				
contour&cover crops& swales	3	0	0				
contours&swales	4	2	0				
contours&no tilling	1	5	0				
contours&cover crops	5	5	0				
none	4	0	0				
Total	87	35	13	18	33.87	0.013	135
Water harvesting							
river	8	5	1				
roof water	22	9	4				
municipal water	19	7	4				
used water	1	3	2				
river& roof water	3	0	0				
roof water& municipal water	18	7	1				
river& municipal water	5	2	0				
river& roof water& municipal water	4	1	1				
river& roof water& municipal water& used water	3	1	0				
river&roof water& used water	2	0	0				
river& used water	2	0	0				
Total	87	35	13	20	14.91	0.781	135
Soil Quality							
fertiliser	3	7	0				
manure	8	6	0				
Lime	10	5	5				
Fertiliser &Lime	8	7	2				
Manure &Lime	11	3	2				
Fertiliser &Manure&Lime	34	3	4				
Fertiliser &Manure	10	1	0				
fertiliser&manure&fallow	1	1	0				
fertiliser&manure&Lime&fallow	2	2	0				
Total	87	35	13	16	34.99	0.004	135

1= yes 2=no 3= sometimes

Questionnaire



SCHOOL OF AGRICULTURE, EARTH AND ENVIRONMENTAL SCIENCES UNIVERSITY OF KWAZULU NATAL

A. RESPONDENT'S PERSONAL DETAILS

1. Name _____ Farmers

Group _____

2. Sex of Respondent

1. Male	2. Female
---------	-----------

3. Age of Respondent

1.<25 yrs.	2. 26-35 yrs.	3.36-45 yrs.	4. 46-55 yrs.	5.56- 65 yrs.	6.> 65 yrs.
------------	---------------	--------------	---------------	---------------	-------------

4. Marital Status of Respondent

1. Never Married	2. Married	3.Divorced	4.Widowed
------------------	------------	------------	-----------

5. If Married, Please Provide Type of Marriage

1. Full Traditional	2. Part Traditional	3. Court/Church	4. Other, Specify
---------------------	---------------------	-----------------	-------------------

6. Respondent's Educational Level

1. None, can't read and write	2. None, but can read and write	3. Finished primary school	4. Finished Sec school	5. Finished high school	6. Vocational training	5. Other (Specify)
-------------------------------	---------------------------------	----------------------------	------------------------	-------------------------	------------------------	--------------------

7. Sources of Monthly Income

1.Pensions	2.Remittances	3.Wages	4.Farm Harvest	5.Casual Income	6.Government Grants	7.Others (Specify)
------------	---------------	---------	----------------	-----------------	---------------------	--------------------

8. What is the main livelihood strategy for the household bread winner?

1. Farming	2. Self Employed	3. Casual Labour	4. Others
------------	------------------	------------------	-----------

9. How many times in a month does the household experience hunger?

1. None	2. Few	3. Several	4. Most times
---------	--------	------------	---------------

10. How many times do you run out of money to buy food in one month?

1. None	2. Few	3. Several	4. Most times
---------	--------	------------	---------------

11. What Livestock do you have in your Household?

1. Cattle	2. Goats	3. Chicken	4. Other (Specify)
-----------	----------	------------	--------------------

12. What are the farming systems employed by farmers and community?

1.Crop farming	2.Livestock keeper	3.Crop and Livestock	4.others
----------------	--------------------	----------------------	----------

13. Farming techniques employed

1.Hand planting	2.Machinery methods	3.livestock methods	4.Mixed methods
-----------------	---------------------	---------------------	-----------------

SECTION C: INFORMATION OF FARMERS ASSOCIATION AND SOCIAL CAPITAL

C1. How many farmers' association are active in a your community

1.1-2	2. 3-4	3.5-6	4.7 and more
-------	--------	-------	--------------

C2. Thinking about the members of your group, would you say that most are from the same?

1.Neighborhood/Village/ community
2.Family or kin group
3.Religious group
4.Ethnic/tribe
5.Educational background and income level
6.Gender

C3. How many association (s) are you involved in?

Name Co-operative	Main activities	Is any of your family a member of the organisation?		When do you or any other member of the household attend its meetings?
	1 Crops/ veg production 2 Livestock 3 Baking 4 Poultry farming 5 Funeral cover 6 others, specify	1. Yes	2. No	0. Never 1. Once a week 2. Twice a week 3. Once a month 4. Less than a month
	1 Crops/ veg production 2 Livestock 3 Baking 4 Poultry farming 5 Funeral cover 6 others, specify	1. Yes	2. No	0. Never 1. Once a week 2. Twice a week 3. Once a month 4. Less than a month
	1 Crops/ veg production 2 Livestock 3 Baking 4 Poultry farming 5 Funeral cover 6 others, specify	1. Yes	2. No	0. Never 1. Once a week 2. Twice a week 3. Once a month 4. Less than a month

C4. What kind of training has your cooperative received?

Training	Trainer (Institution)
.....
.....
.....

C5. With whom do you share farming information with?

People	1.Group Members	2.Members of Other groups	3.Non-Group Members	4.Others
How Information is shared				

C6. Do you contribute to any community savings funds?

1. Yes	2. No
--------	-------

C7. What is the main reason of this community savings fund?

1.Social community activities	2.Provision of loan for other members	3.Other reason
-------------------------------	---------------------------------------	----------------

C8. How often has your household experienced theft of tools or equipment?

1.never	2.Very often	3.Sometimes
---------	--------------	-------------

C9. Do you have a good relationship with the chief?

1.Yes	2.No	3.Not sure
-------	------	------------

C10. Do you or any other member of your family attend community meetings?

1.Yes	2.No	3.Sometimes
-------	------	-------------

C11.Do you have good relationship with your neighbours?

1.Yes	2.No	3.Not sure
-------	------	------------

C12. What activities have you done collectively in the community in the past years?

If yes, what is encouraging the collective work?

If no, what are the reasons for stopping the collective work?

SECTION D: CLIMATE CHANGE INFORMATION

D1. Are you aware of climate change?

1.Yes	2. No	3. Not sure
-------	-------	-------------

D2. With your own understanding and knowledge, what do you think are the causes of climate change?

1. Human activities	2. Nature causes	3. Gas produced	4. Industrial Chemicals	5. Do not know	6. Others
---------------------	------------------	-----------------	-------------------------	----------------	-----------

D3. Which sources of technology do you own to receive information about climate change?

1.Tv	2.Cellphone	3.Computer	4.News paper	5.Radio	6. Other
------	-------------	------------	--------------	---------	----------

D4. How else do you get information about climate change?

1. Extension Officer	2. Neighbours	3. Other Farmers	4. School Children	5. Others
----------------------	---------------	------------------	--------------------	-----------

D5. Do you think the change in climate has affected your agricultural activities?

1. Yes	2. No	3. Not sure
--------	-------	-------------

D6. How are the following farming decisions affected by climate change?

Decisions	severe	moderate	low
-----------	--------	----------	-----

1. Planting time/season			
2. Planting kind (short or long maturity)			
3. Planting input (seeds, fertilizer, water availability)			
4. Planting Area (hectares)			
5. Planting purpose			
6. others			

D7. Which method or technique do you use to overcome the following?

Activity	Strategy/technique				
1. Water shortage (crops irrigation)	1. Tank	2. Roof water	3. Drums	4. Dam	5. Other
2. Soil protection	1. Contours	2. No till Farming	3. Cover Crops	4. Swale	5. Other
3. Soil quality/ quantity	1. Fertilizer	2. Manure	3. LAN(Lime)	4. Fallow	5. Other

D8. Which factor(s) influence the farmers' adaptation to climate change?

Factors	tick
1. Gender	
2. Farmer	
3. Experience in farming activities	
4. Household size	
5. Finance	
6. Failure to understand rainfall forecasts	
7. Others, specify	

SECTION E: LIVELIHOODS ASSETS

E1. Which one of the following assets does your household have?

Type of asset	Number of assets	Livelihood activities contribution
A) Household assets		
Mud house		
Brick house		
Furniture		
Car		
B) Farm implement		
Plough		
Tractor		
Planting machine		
Irrigation pipes		
wheelbarrow		
Spade/hoes		
Others		

E2. What coping strategies have you adopted to meet family food requirements in case of farming/crop failure?

1.Buying	2.Borrow	3.Food for work	4.Hand out/parcel	5. Stokvel	6.Exchange food	7. Farming
----------	----------	-----------------	-------------------	------------	-----------------	------------

E3. What coping strategies have you adopted to sustain your family income in case of poor harvests/harsh season?

1.Sale livestock	2.paid labour	3.Borrow	4.Selling vegetables	5.Craft work	6.farming	7. grants
------------------	---------------	----------	----------------------	--------------	-----------	-----------

E4. Which crops do you grow and why?

Crop	For Sale	Consumption	Both
Maize (Green Mealies)			
Potatoes			
Beans			
Vegetables (<i>Imifino, spinach, Cabbage, Sweet potato, amadumbe</i>)			
Sugarcane			
Others _____			

Thank you/Siyabonga

Ethical clearance



10 November 2015

Ms Mthabaling Tamako (210526551)
School of Agricultural, Earth & Environmental Sciences
Pietermaritzburg Campus

Dear Ms Tamako,

Protocol reference number: HSS/1478/015M

Project title: The assessment of climate change impact on food security and livelihoods of small holder farmers: The role of social assets in adaptation and resilience

Full Approval – Expedited Application

In response to your application received on 14 October 2015, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

Dr Shenuka Singh (Chair)

/ms

Supervisor: Dr J Othja
Academic Leader Research: Professor O Mtshana
School Administrator: Ms Marsha Marjoo

Humanities & Social Sciences Research Ethics Committee

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