

INCLUSIVENESS AND RESILIENCE COMPETENCES FOR SCALING UP CLIMATE SMART DAIRY FARMING: CASE STUDY OF GITHUNGURI AND OLENGURUONE DAIRY FARMERS, KENYA



A research project submitted to the Van Hall Larenstein University of Applied Sciences in partial fulfilment of requirements for the degree of Master in Management of Development, Specialisation: Rural Development and Food Security.

This Research is carried out on behalf of VHL in collaboration with NWO_GCP-CCAFS 'Climate Smart Dairy in Ethiopia and Kenya'

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Dedication

This is to my Late Father "sir' 'John thank you for the solid foundation you gave me.

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List of abbreviations

MOAL	Ministry of Agriculture Livestock and Fisheries
CSA	Climate Smart Agriculture
CSD	Climate Smart Dairy
FAO	Food and Agriculture Organisation
UNDP	United Nations Development Program
GDP	Gross Domestic Product
ASDP	Agricultural
SDF	Smart Dairy Farming
NAMA	Nationally Accepted Mitigation Strategy
VHL	Van Hall Larenstein
IFAD	International Fund for Agricultural Development
NG0	Non-Governmental Organisations
FGD	Focus Group Discussion
KALRO	Kenya Agriculture And Livestock Research
кі	Key Informant
SLF	Sustainable Livelihood Framework
WBG	World Bank Group
UNDP	United Nations Development Program

Definition of terms

Resilience:

This study defines resilience as the ability of a household to manage change by maintaining or transforming in the face of shocks and stresses (DFID, 2011).

Inclusion: Inclusion in this study refers to people who are disadvantaged and left out. Inclusion involves improving 'participation in society for people who are disadvantaged based on age, gender, disability, race, or economic status, through improved opportunities to access to resources, voice and respect for rights' (UN, 2016)

Youth: Article 260 of Kenya's Constitution defines a Youth as a" person aged between eighteen (18) years and thirty-five (35) years". The United Nations defines youth as persons between the ages of 15 and 24 years. Under the African Youth Charter, a Youth is a person between 15 and 35 years. This study will adopt the definition of Youth in the Constitution of Kenya

Competence: This refers to knowledge and skills for the adoption of climate-smart dairy. (Agricultural knowledge and information system AKIS) as described by Röling (2004:21)

ABSTRACT

A case study on inclusiveness and resilience competencies for scaling up climate-smart of small-scale dairy farmers was done in Olengurone (Nakuru County) and Githunguri (Kiambu County) Kenya. The objective of the study to assess was knowledge and skills on Climate-Smart Agriculture to identify appropriate options to scale up Climate-Smart Dairy practices in Githunguri and Olenguruone. Qualitative data were collected using semi-structured questionnaires, key informant interviews, focus group discussions and observations. This study found that female and male dairy farmers experience the effects of climate change like drought, pest and diseases, feed unavailability, high costs of feeds, death of animals and fluctuating milk prices due to seasonality. Both male and female farmers cope these vulnerability through different strategies and activities such use of hire land for pasture, water harvesting, diversification of production and engaging in off-farm activities like trade and employment The access and control of livelihood assets(social capital, financial capital, physical capital, and natural capital) influence the ability to adapt and build resilience. This study found out that although women play a big role in dairy production they do not have access and control of assets in dairy production. Farmer's source knowledge from both formal and informal sources. There exist sources of formal information but there is no clear linkage and connectedness for information flow.

CHAPTER 1: INTRODUCTION

1.1 Background information

Agriculture production is the mainstay of Kenya's economy and the main source of livelihood for rural farmers (MOALF, 2015). The livestock sub-sector in Kenya continues to be a fundamental pillar for sustainable development and poverty reduction. MOALF, (2015) states the sector makes a significant contribution to the country's economy and household income. With a livestock population estimated at 60 million animals comprising of indigenous, exotic and crossbreeds. Kenya's dairy industry boasts of a well-developed production and processing capacity that is playing a key role in ensuring food security, (MOALF, 2015). The dairy sub-sector contributes about 8% of Gross Domestic Product (GDP) with annual milk production of 3.43 billion litres (Kenya VISION, 2030). Kenya's, dairy farming is dominated by smallholder farmers constituting 80% of total dairy producers who contribute 56% of milk production (NAFIS, 2019).

However, this sub-sector is most vulnerable due to the impacts of climate change affecting it directly and indirectly. These changes result in increased temperatures, erratic rainfall, and drought pest and disease. This sector is also one of the greatest contributors to Green House Gas emissions. (MOALF, 2016; FAO, 2010). Lobell et al, (2011) state that climate change significantly affects agricultural production and is a global threat to achieving food security. In the livestock sub-sector, droughts and floods reduce grazing land and forage, depreciating the environment and increase poverty and food insecurity. (FAO, 2009; Thornton, 2010; Thornton and Gerber, 2010).

Climate-smart agriculture (CSA), a strategy to mitigate climate change is "agricultural practices that sustainably increase productivity and system resilience while reducing greenhouse gas emissions" (FAO, 2009). Moreover, CSA contributes to climate change adaptation and mitigations supportive of agricultural development strategies that ensure food security (FAO, 2010). Smart dairy farming (SDF) concept is an important aspect contributing to the development of dairy farming systems. SDF is achievable through the adoption and utilization of efficient production resources with a low impact on the environment, climate, and health. Contributing to good farming practices and social and economic entrepreneurship.

Kiambu County is one of the 47 counties located in central Kenya (Figure 3). Agriculture is the predominant fiscal activity in this county contributing 17.4 percent of the county's population income (ASDP, 2011). This sector also provides employment, food security and income earnings contributing to the people's socio-economic wellbeing (ASDP, 2011). Wambugu et al, (2011), estimated 85 percent of the farmers own livestock as a source of livelihood.

Githunguri a sub-county in Kiambu is home to Fresha Dairy one of the largest dairy processing plants in Kenya and is owned by a farmers' co-operative, namely Githunguri Dairy Cooperative (GDC) Sacco. Dairy Farmers in Githunguri are predominantly male and female small-scale farmers who depend on rain-fed agriculture for production. Githunguri Dairy Community's' proximity to the Nairobi city center and the rapidly increasing population has increased the demand for dairy products (Njarui et al, 2011). This has resulted in intensified dairy production with limited land for forages making the farmers more vulnerable to climate change. Olenguruone a sub-county of Nakuru is a sub-county in Nakuru County. Dairy farmers are predominantly small scale practicing who belong to Olenguruone dairy Cooperative and practice semi

and intensive dairy farming for sustainable dairy farming in Githunguri and Olenguruone there is a need to scale up climate-smart dairy. FAO, (2010), states that CSA can sustainably increase agricultural production and income, adapt and build resilience to climate variability and reduce greenhouse gas emissions from farming practices.

1.2 Project description

Climate-Smart Dairy project in Kenya and Ethiopia (NOW/GCP/CCAFS)

The research project is on inclusive and climate-smart business models in Ethiopia and Kenya Dairy value chains. The project is connected to the CCAFS project titled Nationally Appropriate Mitigation Actions (NAMA) for Dairy development in Kenya. NAMA supports stakeholders in Kenya to design/pilot activities to reduce greenhouse gas emissions from dairy production. Scaling up of good practices is still lagging despite the many initiatives in the dairy sector. This research aims to describe business models of chain actors and supporters to identify opportunities for scaling up good climate-smart practices. Six dairy value chain case studies were in Kenya and Ethiopia with varying degrees of Market Orientation (Baars,2018) Van Hall Larenstein University of Applied Sciences consortium has commissioned this research in Kenya and Ethiopia for an in-depth analysis into the inclusiveness, resiliency and competencies of the Dairy farmers in Kenya and Ethiopia with an aim of for scaling up climate smart of scaling up climate smart dairy.

1.3 Problem overview

Climate-smart agriculture is key to addressing the multiple challenges of climate change and food security by sustainably increasing productivity and enhancing resilience (FAO 2010). However, despite many development initiatives in the dairy sector, adoption, profitability and implementation of smart dairy actions for small-scale farmers remains low. Bernier et al, (2015) indicates that climate smart agriculture strategies may not be effective or transformative without the inclusion of women and youth. Notably, FAO (2014) indicates there is an increase in adoption of climate smart practices when women's knowledge, awareness and access to agricultural information to the practices increases, (FAO 2014). Further (WBG, FAO and IFAD, 2015) argue that the strength and resilience capacity of households, food systems and communities facing climate shock depends on the involvement of men, women and stakeholders like information and extension service providers. Male and female livestock farmers in Githunguri are key in the implementation of smart dairy actions (Wambugu et al, 2011) for sustainable dairy production; there is need for availability of information to enhance the skills and practices of Githunguri dairy farmers. Therefore, VHL University of applied sciences in collaboration with Climate Change, Agriculture and Food Security (CCAFS) has taken the initiative for this study linking with Githunguri and Olenguruone Dairy farmers in Kenya.

1.4 Problem statement

Van Hall Larenstein (VHL) University of applied sciences in collaboration with Climate Change, Agriculture and Food Security (CCAFS) lacks knowledge on the triggers influencing scaling up of good dairy practices, inclusiveness and competencies of dairy farmers that improve their resilience to scale up good climate smart dairy.

1.5 Research objective

The main purpose of this research is to:

- a. Analyse the Githunguri and Olenguruone dairy farmers' awareness, knowledge and skills on Climate Smart Agriculture as regards inclusiveness and resilience.
- b. Identify appropriate options to scale up Climate Smart Dairy practices in Githunguri and Olenguruone.

1.6 Research questions

- **1.** What are the factors that affect resilience and inclusiveness among smallholder dairy farmer in Githunguri?
 - a. What is the vulnerability context of men, women and youth dairy farmers in relation to CSD?
 - b. What are adaptive capacities of dairy farmers (men, women) that support resilience?
 - c. What are the livelihood assets of dairy farmers that improve their adaptive capacities?
 - d. How do stakeholders (Dairy farmers, research institutes, extension officers) perceive the concept of inclusiveness and resiliency

2. What are the factors that determine the level of information accessible to farmers about Climate Smart Dairy farming in Githunguri and Olenguruone ?

- a) What is the role of formal and informal knowledge, information and, training networks in which men, women and youth are involved?
- b) What are the strategies used by knowledge and training networks in order to scale up climate smart dairy?
- c) How are women and youth included in the existing dairy knowledge training networks?
- d) What is the role of men, women and youth in scaling up CSD?

CHAPTER 2: LITERATURE REVIEW

2 Introduction

Literature review provides a theoretical background for this study and has a key role in shaping the research problems as a means to help in understanding the subject area better (Kumar, 2011). Based on the objectives of the study, this section will focus on the review of existing literature regarding resilience, inclusivity, and the agricultural information system in relation to dairy farming.

2.1 Sustainable livelihood framework

Figure 1 Sustainable Livelihood Framework

The Sustainable Livelihood Framework is an analytical tool used to understand the set of interconnected factors that connect people to assets. It is basis for analysis on how people draw on different types of livelihood assets or capitals in different combinations. The human capital is closely linked to empowerment and includes skills, knowledge, good health and ability to work. Social capital concerns social resources that include markets, neighbours, institutions and community groups. Whereas natural resources, water, rivers and other ecosystem services in which people depend for wellbeing are part of natural capital. Physical assets are the shelter and buildings. How people access these livelihoods assets to achieve desired outcomes is influenced by the existing structures and processes (DFID 1999).



Source: (DFID.2000)

2.2 Vulnerability of dairy farmers

The vulnerability context structures the external environment of the dairy farmers. The farmers' livelihoods and availability of assets depends on how they operate within a vulnerability context that is shaped by different factors like seasonality, constraints economic shocks and longer-term trends. Vulnerability context affects the resilience and adaptive capacity of farmers. (Ellis, 2000).

2.3 Resilience in dairy farmers

The unpredictable nature of dairy farming along with commonly occurring shocks affect farming households and food security. To cope with this shocks building resilience in important. Resilience is the

ability of a system to endure hazardous events in a timely and efficient way (IPCC,2012,p.563). Resilience is best understood through the 3D resilience Framework, (Bene et al, 2012) who classifies the resilience concept into three distinct capabilities: Absorptive or buffer capacity, the capacity to take intentional protective action to cope with known shocks and stresses. Adaptive capacity, the capacity to make intentional incremental adjustments in anticipation of or in response to change, in ways that create more flexibility in the future. Transformative capacity ,the capacity to make intentional change to stop or reduce the drivers of risk, vulnerability and inequality, and ensure the more equitable sharing of risk so it is not unfairly borne by poor and vulnerable people. All three capacities are critical and they feed into and reinforce each other to be able to achieve resilience. However, this study will focus on the adaptive capacity aspect of resilience as it is appropriate in climate change activities where incremental adjustment is done to reduce and address vulnerability (Bene et.al, 2016).

Figure 2 3D resilience Framework

Inten	sity of change / transaction	costs	
stability	flexibility	change	
Absorptive <mark>coping</mark> capacity	Adaptive Capacity	Transformative Capacity	
(persistence)	(incremental adjustment)	(transformational responses)	
•	Resilience		

Source: (Bene et al, 2012)

2.4 Adaptive capacity of dairy farmers

Adaptive capacity is defined as the adjustments in humans and natural systems in response to actual and unexpected climate change stimuli or their effects that moderate harm or exploit beneficial opportunities (IPCC,2001). Adaptive capacity is the modifications people make to continue functioning without change during a vulnerability. These modifications and changes are varied. They include adopting new farming techniques, change in farming practices, diversification of livelihood asset bases, engaging in new social networks and access to information. The adaptations are dependent on the people's access of and use of the livelihood assets (Levine, Ludi and Jones 2011)

In dairy farming, resilience has gained popularity and importance due to the effects of climate change, economic crisis, floods, drought and other shocks. Dairy farmers' major challenges are inadequate fodder, erratic rainfall, pests and diseases, high cost of inputs, decreasing land sizes, access to information and poor markets all which increase their vulnerability. In a study in Ethiopia, it was observed that resilience in the advent of climate change concerns with how farmers function within a farming system. The resilience of dairy farmers depended on their livelihood assets within their control and how they utilized them to adapt to the changes. A study by Bram (2018) on the resilience of farmers in Tanzania developed resilience indicators as found in the SLF: human capital, social capital, natural capital, financial capital diversity and innovation to identify two categories of farmers as regards resilience. High resilient and low resilient farmers based on their adaptability strategy to spread risk, skills and information level, technological innovativeness and ability maximise opportunities during shocks.

2.5 Resilience Indicators

Human Resource: This relates to the level of knowledge, education health, labour and skills that are important for farmers' resilience.

Social Resource: is the most widely accepted measure to cope with risk. These represents the formal and informal relations between families, social networks, and community organizations acting as sources of knowledge and resource support during shocks (Martin-Breen & Anderies, 2011).

Natural Resource: provided by natural resource stock is important in adapting to shocks, as it is inherent to a farm and is an asset used to produce goods. Including rivers and water

Physical Resource: Are the tools, equipment and infrastructure (roads, markets, structures, transport and energy) that support productivity of farmers.

Economic/Financial Resource: acts as buffer to shocks and a means to changing the farm. Of these are major means to buffer shocks. It includes availability and access to financial services, credit and savings

Diversity: This is one of the main strategies to building resilience which if maintained at a certain level offers more choices for transformation in the farm. Diversity includes the different portfolio activities both on farm and off farm, which act as a buffer. Activities include trading, crop production, keeping of other livestock among others.

Innovation: A key characteristic of adaptive capacity relates to the system's ability to support innovation and risk taking. A key characteristic of adaptive capacity relates to the system's ability to support innovation and risk taking. Innovation can be described as the improvement of the outcomes of farms, with technical, managerial and social means (Woodward et al., 2008).

2.6 Inclusiveness in dairy farming

Inclusion is defined as improving participation of people disadvantaged based on age, gender, disability, race, ethnicity, origin, religion, or economic status, through improved opportunities, access to resources, voice and respect for rights' (UN, 2016). Inclusion has recently emerged as a key concept in development (Khan, 2012; World Bank, 2013).and endeared in the United Nations sustainable development goals (SDG) as "leaving no one behind". In a lot of literature, the concept of inclusion is discussed interchangeably with exclusion and will apply in this study. Inclusion has many dimensions like political inclusion, social inclusion, market, financial inclusion among others. This study will focus on social inclusion.

2.7 Social inclusion in dairy farming

From literature reviewed, it is evident that dairy farmers are not a homogenous group. Culture and Social norms create differences that results to reduced inclusion of women and youth inhibiting the ability of women and youth to gainful participate in dairy farming. According to FAO (2012), there is less inclusion of women due to their productive roles. This study stated that 80 percent of men and 20 percent of women provide labour in the agriculture sector with the women providing unskilled labour like cleaning. A study by Oxfam, (2017) in Kenya states that participation can be inhibited by social norms and micro politics that affect the choice of livelihood activities and access to other requisite resources such as land and finance. Which is corresponds with the Ethiopian government agricultural program, which allocated a 30percent financial target for women's involvement in agricultural projects (Oxfam, 2017). As The dairy labour force continues to age in most developing countries. The older farmers are less likely to adopt the new technologies needed to sustainably increase agricultural productivity, and ultimately increase food production while protecting the environment. Hence, there is need for the youth to participate in agriculture (FAO, 2016). Low participation of youth is attributed to the challenges of limited productive

resources, extension services and lack of voice. A study by SNV KIT recognises the importance of inclusion of youth as the drivers of agricultural development in their study of youth in Kenya and Ethiopia. (SNV, 2016).

Figure 3 Social Inclusion Framework



Source: (DFID, 2003)

2.8 Competence in dairy farming

The adoption of climate-smart practices is dependent on the dissemination of information to farmers to equip them with adequate knowledge and skills. The agricultural information systems encompass the generation, transfer, consolidation, reception, and feedback of agricultural information leading to its subsequent utilization (Kizilaslan 2006). A study in Kenya by Wangila (2018) stated that agricultural information is mainly obtained from research and targets agricultural practices. The effectiveness of any information system is defined by the interactions between the different actors to ensure information pathways are systemic for optimal information transfer and utilization of information. Aside from the farmers, other primary actors in the sector include Government, Non-Governmental Organizations, aid organizations, and education institutions. In an assessment of Nigeria's agricultural information and knowledge system, Abudu (2005) explores the idea of "linkages" in referencing effective communication and working relationships between different actors in the agricultural sector such that barriers to communication flow are permeable enough to allow information flow and feedback. In the case of Nigeria, Abudu proposed the establishment of a linkage system that brings together all actors in the sector to facilitate smooth operations. Although there are common interactions between institutions and farmers, a notable problem is the lack of inter-institutional interaction to come up with better strategies for boosting sustainable agriculture. Karanja and Ouma (N.d.) also support this proposal in their assessment of the agricultural knowledge and information system of Meru, Kenya. Based on the research findings, the existing linkages were largely informal and relied on personal contacts, which the researchers pointed as inadequate to ensure strong linkages over long periods.

Climate smart Dairy practices

In developing world, the effects of climate change continue being a risk factor for dairy farmers as it affects rainfall patterns and feed availability. Further, it results to increase of pests and diseases, drought and

poor yields. Adoption of climate smart technologies and practices has been identified as a potential to reduce adverse production impacts, increase food security and reduce carbon emission from agriculture. Moreover climate smart dairy practices have increase resilience, reduces greenhouse emission and increase productivity while achieving food security (Rosegrant et al. 2014).Dairy smart practices that are efficient in production and reduction of emissions as include : Breed improvement, herd reduction, improved forage production, improved feeding management, proper manure management and ,Record keeping (CIGAR ,2015)

2.9 Scaling up Smart Dairy Framing

This refers to the benefits of brought through any intervention in terms of numbers and coverage, time and equity scales (Pachico, 2004). With the dynamic effects of climate change on dairy farming, there is need to scale CSD for sustainable livelihoods, mitigation of Climate change and food security CSD scaling up is requires a multi-dimensional approach with collaboration of all stakeholder. Key in scaling up are the sources of the CSD information and the extension service, providers, policy makers and their linkages to the farmers.

2.10 Conceptual design and operationalization.

Three analytical frameworks will be adapted to reviewing the farmers' awareness, knowledge and skills existing in Climate Smart Agriculture as regards to inclusiveness and resilience in order to identify appropriate options to scale up Climate Smart dairy practices in Kenya. The Sustainable Livelihood Framework (DFID, 2000) (figure 1) and the Resilience Framework Béné et al. (2012). (Figure 2) In addition, the DFID social inclusion framework (DFID, 2003). (Figure 3) The Sustainable Livelihood Framework draws on different perspectives and cuts across sectorial boundaries contributing to means of analysis. Resilience Framework is to understand the vulnerability context and adaptation strategies. The Social Inclusion Framework will focus on women, men and youth regarding the effect of the social norms on participation in scaling up of dairy smart practices.



Figure 4 Conceptual Framework Adapted From SLF, Resilience Framework and Social Inclusion Framework

Source: (Author 2019)

In this study, the analysis of the inclusiveness and resilience of dairy farmers in Githunguri is operationalised to give the dimensions, aspects as indicators to guide the study in answering the research questions

Figure 5 Operationalization of concepts



Source: (Author)

CHAPTER 3: METHODOLOGY

3.1 Description of the study area

This research was conducted in Kiambu and olenguruone sub counties of Kenya. Olenguruone was included as a study area during the data collection stage

Description of the Study areas.

The research was conducted in two sub-counties, Githunguri, (Kiambu county) and Kuresoi south (Nakuru county)

3.1.1 Geographical location.

Githunguri is a sub county in Kiambu located in central Kenya and occupies a total area of 1448km2. Kiambu lies between latitudes 00 25'and 10 20'South of the Equator and Longitude 360 31'and 370 15'East. The county has a total population of 1.6million according to the 2009 Kenya Population and Housing Census. According to Wambugu et al, (2011), the county has a long history of dairy farming with 85% of households estimated to own dairy cattle. Kiambu county experiences two rainy seasons with long rains between Mid-march to May followed short rains between October and November, which contribute to the thriving livestock production. (Kiambu, 2018).

Nakuru County lies within the Great Rift Valley covering an area of 7,495.1 km². The average land size is 2-3 acres on small scale, mainly found in high potential areas and 0.1 acres for urban landowners. According to 2009 Kenya population and housing census, the county population stood at 1,756,950 persons in 2012 and projected to be 2 million in 2017. It is located between longitude 15^o 28',35^o 36 East and Latitude 0^o 13 and 1^o 10' south. To the west it borders Kericho and Bomet, North, Baringo and Laikipia, East Nyandarua, South West, Narok and to the South Kajiado and Kiambu (County Government of Nakuru, 2013).

3.1.2 Topography and Physical Features

Kiambu County has four distinct topographical zones. Upper Highland Lower Highland, Upper Midland, and Lower Midland Zone. Githunguri is in the lower highland zone between 1,500-1,800 metres above sea level. The area is a tea and dairy zone characterized by hills, plateaus and high elevations plains. The sub-county has high-level uplands soils from volcanic rocks which are fertile making the area.

Nakuru County has 11 sub counties, Kuresoi South being one of the sub counties. There are several AEZ covering different regions of the county, with altitudes between 2980- 3050 meters above sea level with an average annual rainfall of 1200- 1900mm and UH1 100- 1200. (County Government of Nakuru, 2013) (MOALF, 2016).. Sheep rearing, dairy farming, Potato and vegetable farming are the main agricultural activities in the area (County Government of Nakuru, 2013).

3.1.3 Climatic conditions

Kiambu County experiences bi-modal kind of rainfall with long rains falling between mid – March to May followed by a cold season with drizzles and frost from June to August. The mean annual temperature in the county is 26°c with the upper highland having 7°c and the lower areas 34°c. The lowest temperatures are in July and August while January to March are the hottest months (County Government of Kiambu, 2018).

Nakuru County has a bimodal rainfall pattern with the short rains falling in October and December while the long rains fall between March and May. In the months of December, January, February and the early part of March, the temperatures are 29.3 ^oc while in June and July they are 12^oc. (County Government of Nakuru, 2013).



Figure 6 Map of Kenya showing the location of Kiambu and Nakuru County.

Source: Google Map (2019)

3.2 Research Design

The strategy for the research is a descriptive research design where a case study was employed with focusing an in-depth analysis of factors that affect inclusiveness and resilience and among small-scale dairy farmers in Githunguri and Olenguruone sub counties. The study examined the knowledge and information sources, linkages and the factors that determine the farmers competencies on climate smart practices that can be scaled up for sustainable smart dairy production.

3.3 Research methods

This study uses a qualitative approach to collect primary data through semi structured farmer interviews, key informant interviews, focus group discussions and observations to understand their vulnerability context, their adaptive capacities how they perceive regarding inclusiveness and their vulnerability context and adaptive capabilities. Quantitative data on demographic characteristics for households, composition by sex, age, farm size and education level to understand how their access to livelihood assets influences the vulnerability and resilience of men, women dairy farmers.

3.4 Sampling procedures

Githunguri and olenguruone are p purposively selected as the sampling frame because of the dairy farming activities and the interest of VHL/CCAF. Dairy farmers in both Githunguri and Olenguruone were purposively selected for the study. The farmers are stratified based on sex. Through Simple random sampling dairy farmers were selected come up with a sample size n=24 for semi structured interviews. (**Table 3:1**). In this research, the study population units for analysis are female and male small-scale dairy farmers.

	Males	Females
Below <35	6	6
Above >35	6	6
Sub Total	12	12
Total	24	I

Table 1Sample size characteristics of semi structured interviews

3.5 Data collection methods

Research tools

Both primary and secondary data was used in carrying out this research. Secondary data sources through literature review of published books, articles, reports, journals and internet sources to understand the concept of study was used. Primary data on the inclusiveness and resilience competencies of the dairy farmers including their perceptions, vulnerabilities, linkages to agricultural information was collected during the fieldwork. Data collection tools used include semi-structured interviews, focus group discussions, key informant interviews ad observations. See (Appendix 1, 2, 3, 4)

The study commenced by holding (1) one key informant interview with the Dairy extension manager at Githunguri dairy cooperative to highlight the objectives of the study. The manager a set up an introductory meeting between the researcher and the extension officer who was the link to the sample frame. The interview provided information on the dairy's' operational activities, role and positioning as an information source, stakeholders they collaborate with, the perception of inclusiveness and the strategies for sharing information. The meeting with the extension officer to develop a working plan of selecting the sample and general view of area was scheduled and followed by a 2-day tour of the study area. Based on the set sampling criteria 18 farmers were randomly selected. After 2 weeks of farmers' interview, the research reached was not collecting any new data reaching saturation point. After consultation with the supervisors, Olenguruone based on its similarity to Githunguri was selected as an additional study area based on its climatic conditions and dairy activitie. The study sample increased from 18 respondents (both men and women) to 24.

3.5.1 Focus group discussion.

After incorporation of the new study area, six focus group discussions were conducted three rounds in each study area. The first two rounds comprised of farmers who were not participating in the individual farmer interviews in order to collect additional information and validate data collected data. The first round of FGDs participants were male dairy farmers that consisted of men whereas the second FGD participants were women dairy farmers. The two rounds of FGDs were carried out through a topic guide, (Annex 3) to gain understanding of the dairy farmers the adaptive capacity, livelihood assets, training linkages, services and information platforms that they are participating in and the access and control of resources between men and women. The discussions additionally used the Sustainable Livelihoods Framework to collect in-depth data on vulnerabilities and capacities of dairy farmers by identifying the climate related shocks, stress and trends that affect the dairy farmers. The Asset pentagon was used to rank livelihood assets that build their resilience and how they cope with such situations. Venn diagram tool was used to identify, analyse and rank the key actors, institutions and groups that provide specific services, knowledge and information on dairy and the linkages with dairy farmers. The Harvard analytical tool was used to identify the activity profile, access and control profile, and influencing factors of women men and how it relates to their resilience, competencies for scaling up of climate smart dairy farming. At the final round of FGDs, the preliminary findings of the study were presented to the key informants and interview respondents for validity of the research findings.

.Picture 1Focus group discussion with men in olenguruone.



Source: Author (2019).

Picture 2 Focus group discussion with women in Githunguri



Source: (Author)

Picture 3 Farmer interview using semi structured questionnaire



Source: (Author)

3.5.2 Key Informant Interviews

Guided interviews using a checklist (annexe4) was conducted with seven different key informant (KII) individually in their offices after setting out appointments. Data collected was on how they view different dimensions and perceptions of inclusiveness and resilience the and competencies of the dairy farmers. and to give understanding of the institutional activities and knowledge sharing strategies to the farmers. The KII Data collected was for triangulation and validity of data collected from the farmer interviews.

Key Informant	No	Information
Dairy extension manager	2	Information linkages adaptive capacity inclusiveness
Dairy field extension workers	2	Extension service, inclusiveness
Ministry of agriculture Officer	1	Extension , resilience , policies, policies
Livestock production officer	1	Information linkages and strategy, vulnerabilities
SNV extension officer	1	Linkages, strategies scalable CSD
Lead farmer	1	Information linkages,

Table 2 List of KII interviewed

Source: (Author)

3.5.3 Observations

Participatory observations were done in the farmers' homesteads during the interviews guided by a checklist (annex 3) to observe and probe on how and why they engage in various dairy farming activities, climate smart technology, the different roles of men and women, competencies, livelihood assets and inclusiveness and adaptive practices. The information was recorded in a log book/dairy and visual documentation. Observations was for triangulation and validity of interview data.

3.6 Data Analysis

Qualitative data was analysed using Grounded theory. Data content analysis is a systematic approach to qualitative data analysis that identified and summarises message content. Textual analysis of words (spoken or written) including questionnaire responses, interviews, and documents were done using content analysis based on to reduce the large amounts of unstructured textual content into manageable data relevant to the evaluation of the research questions. Collected data will be analysed based on the strata of women and men dairy farmers. The transcribed text was be broken down into manageable categories on a variety of levels using key words, word sense, phrase, sentence, and themes and later coded. The coded content was quantitatively analysed for trends, patterns, relationships, similarities, differences, from which conclusions were drawn. The Harvard analytical tool was used for activity profile of women and men, their access and control of the livelihood assets and the influencing factors. A Venn diagram was used to identify the key institutions and organisations providing information and knowledge

key in Dairy farming and linkages with the farmers. The Sustainable Livelihood Framework was used, the Asset Pentagon and Harvard analytical tool was used for comparison of the livelihood assets and adaptive capacity and vulnerability and inclusiveness between men and women small-scale dairy farmers. The analysed data was discussed with reference available secondary data and presented as a narrative conclusion.

3.7 Operationalization of methodology

Sub Question	Source of Information	Data Collection Methods	Data Analysis	Expected outcome
What are the livelihood assets of dairy farmers that improve their adaptive capacities	Key informants Dairy Farmers	-Semi- Structured Interview guide -Focus Group Discussion Vulnerability and capabilities matrix	Asset pentagon to see the combination of assets are the women and men use to be resilient	Levels of livelihood assets
		-Semi-structured Interviews		
What is the vulnerability context of men, women and youth dairy farmers In relation to CSD	Key Informants Subject specialists Dairy Farmers	-Focus Group Discussion Vulnerability and capabilities matrix	SLF vulnerability context analytical tool the for the differences in the vulnerability of the women and men	Resilience and inclusion of women and youth
What are adaptive capacities of dairy farmers (men, women) that support resilience?	Dairy farmers	Sustainable livelihood framework	Based on the resilience indicators	Levels of livelihood assets of Men and Women dairy farmers
How do stakeholders (Dairy farmers, research institutes, extension officers) perceive the concept of inclusiveness and resiliency	KII Dairy farmers	Interviews Focus group discussions	Venn diagram for stakeholder Mapping	Perceptions on resilience institutions and processes

Table 3 Operationalization of methodology

What is the role of formal and informal knowledge, information and, training networks in which men, women and youth are involved	key informants Dairy farmers	Focus group discussion Semi- structured Interview	Stakeholder analysis Venn Diagram Thematic Content Analysis	AKIS linkages and systems between farmers and providers
What are the strategies used by knowledge and training networks in order to scale up climate smart dairy?	Key Informants Farmers	-Semi- structured Interviews Observations	Thematic Content Analysis	Knowledge .skill and practices Scalable competencies
How women and youth are included in the existed dairy knowledge training networks?	Dairy farmers Female and Youth	Focus group discussion Semi- structured Interview	Thematic Content Analysis	Drivers of scaling up
What is the perspective of men, women and youth in scaling up CSD?	Dairy Farmers	Semi structured interviews	Thematic content analysis	Role of women, youth and men in CSD

Source: Author 2019

3.8 Validity and reliability

This research used different methods for triangulation to enhance the reliability and validity of both the data and findings. Multiple methods and sources of data collection were used in order to ensure consistent and verifiable results are obtained. Further, sample size and, validity and reliability of the research was directly proportional. In the study the number of dairy farmers interviewed was small (no=24) even if high number of farmers was sampled, results would be similar size and validity and reliability of the research is directly proportional. Moreover, the study used FGDs and key informant interviews to validate the information and results.

The researcher is an employee with the ministry of agriculture involved in provision of information services. This might have created some bias as the researcher already had prior knowledge about the information systems. As a result, the researcher practiced objectivity and reflexivity during the research by explaining the purpose of the research and objectives to reduce researcher bias. To further reduce bias and increase validity of data collected the researcher explained to the farm guide the purpose and objectives of the researcher presented preliminary findings of the farmers for verification and validation by the respondents who had participated in interviews, further the researcher held separate FGDS for male and female farmers reducing respondent bias.

3.9 Ethical considerations

In this study ethical considerations were done during the research design and planning, data collection process and after data collection. During the research, the researcher sought informed consent from the

dairy farmers for their participation in the research before embarking on the interview While explaining the purpose of study. At the data collection phase, the study-sought consent from the individual farmers to hold interviews with them and to take pictures within the respondents' farm. Farmers interviews were carried out in open spaces or around the farm for privacy. Confidentiality of data collected was paramount, the researcher ensured this by coding of respondents' response and analysed data using numbers although the names were known. The researcher also sought respondents consent to share out the study findings during the presentation of preliminary finding.

CHAPTER 4 FINDINGS AND ANALYSIS

4.0 Introduction

This chapter presents the analysis and findings of the study. The primary data was collected using semi structured interviews, focus group discussions, key informant interviews and observations. Data Analysis was by going through the content to determine inclusiveness and resilience competence for scaling up climate smart dairy farming in a case study of women and men small-scale dairy farmers in Githunguri and Olenguruone of Kiambu and Nakuru sub counties respectively. Qualitative data was analysed using content analysis and findings presented in descriptively, frequencies and graphs. Data on the background of respondents was analysed quantitatively and results presented in frequencies.

4.1. Social Economic Characteristics of respondents

4.1.1. Age distribution of interview respondents

The respondent's age ranged between 18 years to over 66 years. The number of both male and female respondents generally increased with increase in age bracket implying age is positively correlated to farming engagement. Only (n=7) of the respondents were between the age of 18-35 years. This finding highlights low participation of youth in dairy farming.

Age	Sex		Total frequency
	Male	Female	
18-35	3	1	3
36-45	2	3	5
46-55	2	4	6
Over 55	5	3	8
Total	12	12	24

Table 4 Age distribution of respondents

4.1.2. Sex Distribution of Respondents

Out of the 24 study participants, 12 were males (50 %), while 12 were females (50%) both males and females involved in dairy farming activities. This shows equal participation of both women and men in farming activities. The involvement of both sexes shows that farming remains the main source of livelihood among 80% of the rural dwellers in the study area (GOk, 2009).

4.1.2. Education Level of Respondents

Most (n=21) respondents had attained both primary and secondary level of education. Very few (n=2) had attained middle level college and university education. Only (n=1) lacked formal education (Table 4.2). This showed that most of the farmers in the study area had sufficient capacity to understand and apply farming principles, and therefore capable of adopting Climate Smart Dairy Practices. More women (n=6) had primary level of education as compared to men (n=5). Conversely, more men had attained secondary education and above compared to women. This was probably due to higher dropout rate among girls and women at primary level due to social cultural challenges. These results were consistent with government statistics, which exhibited high literacy rate (86.5%) in the study area. (GOK 2009)

Level of education	Sex		Total frequency
	Male	Female	
Primary	4	6	10
Secondary	5	2	7
Tertiary	2	2	4
University	1	2	3
Total	12	12	24

Table 5 Education Level of Respondents

4.1.3. Farm Sizes of the Respondents

From the semi-structured interviews, 76.4 %(n=18) of respondents owned 2 acres and less of land, with only 23.6 %(n=6) owning beyond 2 acres. Of this majority (n=3) are women. The average mean land holding size in the study area was 2 acres. These results show that men own land.

4.1.4 Farming Activities of Respondents

Respondent interviews showed that most of the farmers (83%) in both Olenguruone and Githunguri are involved in both crop and dairy farming (Figure 2 below). 17% of the respondent, are engaged entirely in livestock rearing in spite of the conducive climatic conditions. This results show farming is the main source of livelihood for the farmers.

Figure 7 Farming Activities



Source: Author (2019)





Figure 4 above gives a summary of the research components

4.2 The vulnerability context of men, women dairy farmers in relation to CSD

4.2.1: Shocks

Farmers experience many sudden changes that affects their production. Farmers are experiencing long periods of drought that results to scarcity of animal feeds and they are frequently having the cows treated for diseases like ECF and foot and mouth. During periods of excessive rain and cold their milk production goes down and the cows suffer from mastitis. From the interviews both women and men (n=24) experienced the effect of excessive rains. While (n=12) women respondents, 10 indicated that they have been affected by drought compared with (n=8) men. A difference was also noted in disease outbreak with (n=10) women affected and (n= 8) men affected.



Figure 9 Shocks to dairy farming

Source: Author 2019

Focus group discussions established that there has been an increase in the temperatures compared to the previous years. Prolonged periods of draught and erratic rainfall has affected their pastures resulting to unavailability and high cost of feeds and even loss of livestock. Observed Changes in temperature has resulted to increase of diseases and pest thereby increasing the dairy expenditure in veterinary medicine.

"...you see these ticks have become very many and I have to keep the medicine in my store because I spray every time I see them..." Respondent 24 "... Usually the lean period is only three months. But this time it extended for six months and the river down my farm dried and I was forced to travel far to buy water..".

Respondent 18

4:2:2. Trends

Farmers are witnessing rapidly changing technology like use of machine milking in farming that concerns them. Youth who are the main source of labour are migrating to the urban centers resulting to high labor cost. Increasing population is putting pressure on the land resulting to subdivision of land to very small parcels. Credit sources for the farmers charge very high interest rates making it not accessible to many farmers. In the focus discussions and interviews, it emerged those trends in dairy affect women and men differently (figure 4:3) below. Men are mostly affected by the milk imports (n=11) out (n=24) of the total respondents. Milk imports from neighboring counties was retailing at Kenya shillings 38/= compared to the local brand which was retailing at Ksh 50/=. The decreasing land sizes was attributed to the increasing population, which affected men more than women (10 men compared to 5 women). Men attributed this to the land ownership. Whereas women are, affected more by the changing dairy technology (n=8) women against (n=4) men. Focus discussions highlighted that some of the technology required a lot of money which women which women found unaffordable since they do not access finance easily.



Figure 10 Trends affecting dairy farming

Source: Author, 2019

'..... If you to the shops at the local town you will find them, selling imported brands that are cheaper than our own..." respondent 7

4.2.3. Seasonality

The buying price of milk and inputs is constantly changing without any prior notice, affecting productivity of the farmers. The increase of inputs discourages affects their production. change in the weather pattern affects the availability of forage as they are unable to plan their planting of fodder for the animals. All the (n=24) respondents indicated that their main milk market is the dairy cooperative. Majority of the Female farmers (n=11) are affected by the high costs of A.I (between KSH 1000-2500), increased A.I failure rates and repeated serving resulted in reduced milk production and lactation cycles. Focus group discussions pointed that Milk prices offered to the farmers keeps on changing and is decided on by the dairy cooperatives board. An interview with the key informants from Olenguruone dairy confirmed that farmers cost of production is not considered when setting the buying price. Rather, it is based on the price offered by the market and the dairy operating costs.





Source: Author, 2019

... the milk prices are dictated by the large milk processors whom

we have no control over....'KII2

4.3 Adaptive capacities of dairy farmers that support resilience

To cope with the effects of the effects of climate change like drought, pests and diseases, floods and lack of feeds the farmers are involving themselves in several activities to maintain dairy farming. During the focus group discussions, the farmers mentioned activities like use of alternative feed sources, fodder conservation, use of improved breeds, animal health and water conservation and diversification of activities. Some of these activities was observed during interviews.

Focus group discussions with the men and women farmers showed that the dairy farmers are engaged in different activities that enable them to continue with dairy production and sustain their livelihoods. They hire farms in different areas where they plant fodder to ensure the cows have feeds during lean times. The farmer take loans from the cooperative society and social groups, which they use to purchase feeds and water tanks for water harvesting. Some dairy farmers especially the women are using the entire farm for fodder to ensure they have enough forage then collect food commodities from the Cooperative stores at a subsidized cost. Men are seeking alternative sources of income to subsidize low milk production by engaging in business, seeking employment in the city. While the women are keeping poultry and goats. The women have diversified into goat rearing, poultry keeping and vegetable production for sale. Farmers feed their cattle on pineapple waste and brewer's yeast as alternative to the commercial feed.

	women	Men
Adaptive strategy	frequency	Frequency
Loans from Sacco	4	9
Leasing of farms	9	6
Diversification	3	6
Check off food commodities	6	0
Water harvesting	3	6
Innovativeness	3	4
Fodder preservation	3	6
Employment	0	6
Improved breeds / animal health	3	6
Livestock insurance	0	3
Safety nets	1	3
Selling cows	0	4

Table 6 Adaptive capacity strategy of women and men farmers

Results from the Interviews with farmers gave as shown that more women (n=9) are hiring of farms for fodder production as compared to (n=6) for men. Which the farmers attributed to small land parcels and women not owning land because of the and the cultural laws on land ownership. When a female respondent was asked during the interview if she owns the land she is raising cows on she said:

"... My brothers have only allowed me. They have not yet allocated me any portion as I am not married"

More men have water tanks and wells for water harvesting (n=6) with only (n=3) women owning to which the farmers said men can afford it because they have money which they get from the milk sales and they also get loans from the Cooperative. There are more men engaging in more off farm activities like business and employment (n=6). Compared to (n=2) women. This shows that there is a significant difference the adoption options practiced by women and men to build resilience.

I do not get worried that my family will go hungry I usually collect cooking oil, maize meal and washing soap from the dairy store. Which is reduced from my monthly pay,,," Female respondent 14



Picture 4Githunguri dairy store at Ikinu Milk collecting center.

Source: Field study (2019)

...like now when there is plenty of Napier I am preparing silage. I had feed for my cows all through the time when we had drought..." Male respondent 4
Picture 5 Pineapple waste for feeding cattle (alternative feeds)



Source Field study (2019)

Picture 6 Adaptive option of silage making and water Harvesting



Source: Fieldwork (2019)

4.4 Livelihood assets of dairy farmers that improve their adaptive capacities

Livelihood assets owned by farmers show their base upon which they rely on for dairy farming. They include the skills experiences of family members and the relations other farmers: incomes and credit source, land and dairy equipment. These assets are referred to as social capital, human capital, physical capital, natural and financial capital. This section presents results on the livelihood assets that increase the adaptive capacity of the dairy farmers. During the focus group discussions, a simple proxy asset of

indicators was developed and used during the interviews for ranking the livelihood asset between the men women. Results were presented in the preliminary findings meting for validation.

Financial capital	-Loan products from SACCO's savings
	-Loan products nom SACCO's, savings
	-Proceeds from produce like Milk
	-Employment, pension, cash transfers for the elderly
	-table banking Loans
Physical capital	-Cattle, goats, vehicle, Motorbike , chaff cutters, wheelbarrows,
	trolleys
	-Biogas plants, Farm houses ,Zero Grazing units
	-Well, boreholes, water tanks, Electricity,
Social Assets	-Women groups, table banking groups, self help groups
	-SACCOS, Families
	-Churches
Natural Assets	Land , rivers soils rain weather
Human Assets	-Education,Farmer training programs,Livestock management skills
	-First Aid skills

Table 7 Inventory of Assets of the Dairy Farmers

Source: Author, 2019

4.4.1. Natural capital

The natural stocks upon which dairy farmers find the valuable resources for profitable dairy production include water, soil and land. Farmers use the available land to grow grass and Napier for the cows and

crop farming for food for the families. In the interviews, all the respondents considered farmland as the most important natural capital in dairy. Water availability and fertile soils were also mentioned as beneficial in dairy farming. During the interviews, it emerged that out of n=24 respondents owning land only (n=3) are women. Focus group discussions indicated that it was because land ownership is largely governed by customary laws that limits women' land ownership. Most women access land only through their husbands or sons. The women who own land either are widowed, single parents or had purchased.

"...this piece of land was given to me after 5 years after my father died and it is mostly because I have 2 sons. I am not sure if they would have considered me if did not have sons..." female respondent 07 (54years)

This results showed that land ownership was mostly with the men.

Picture 7 Hand drawn water well



Source: Fieldwork 2019

4.4.2. Physical capital

Physical assets comprise the infrastructure that supports the farmers to be more productive. The farmers own like cows, zero grazing units, chaff cutters, milking machines, motorbikes, milk trolleys and hoes which they use in production Farmers have access to the dairy, electricity and good roads. Observations during interviews realised other assets like radios, mobile phones, motorbikes were important for to them for transportation and communication. Access to the dairy milk market through the dairy cooperatives was mentioned to beneficial to in providing a dependable market for the milk.

.... Since joining the dairy, I no longer worry where I will sell my milk or there is surplus. I just take to

the dairy milk buying centre and wait to be paid at the end of the month... Respondent 11

Interviews indicated that it is men owning the cows, dairy units, and dairy equipment. Men decide are the ones who decide when to buy or sell the cows. Focus discussions with men mentioned that cows are culturally cows are a as a status symbol for men which women should not own. Further it is used to pay

for their dowry. From the interviews Cattle is mostly owned by men (n=16) and women (n=6). These findings were also observed during interview.

.... What is a man without dairy? My wife cannot decide to add to the herd even if she may have the money. From the days of our ancestors issues about cows is for us... Respondent 15(66 years)



Picture 8 Dairy equipment owned by farmers: chaff cutter and milking machine

4.4.3. Social capital

Social capital of the dairy farmers consisted of the connections they have with their fellow farmers, family members, churches and other social groups. Focus group discussion with men indicated that the strongest social capital was membership in dairy cooperative where there is a high enrolment of men (12 men). Men are also involved in investment groups where they meet on regular basis contribute money which they invest in land buying. The men have also formed farmers groups, from which they gain information.

Women on the other hand are involved in other social networks known as "*Chama*" where out of n=12, women interviewed, n=8 of them are members. The women meet together on regular basis and engage in table banking. They give loans to members and provide support a member has difficulties. These findings indicate that both men and women have social capital.

(''.....) During my admission in hospital for 6 day, my farm was watered and children was taken care of....'' Respondent 11.

('...). We have formed a farmer's breeders group and we hope to breed for pedigree animals and join the Kenya stud book...." Focus group discussion

Picture 9 Olenguruone dairy cooperative society



Source: Fieldwork (2019)

Picture 10 Githunguri dairy Cooperative society



Source: Author fieldwork 2019

4.4.4. Financial capital

The main sources of financial capital for the dairy farmers was is the income from milk sales, savings in the sacco, loans, salaries and social security payments. From the interviews it was evident that women have limited access to financial sources. Cooperative loans are offered only to registered members who are mostly men. Other credit facilities also require collateral, which the women often do not have.

However they women respondents indicated that they access finance from informal institutions known as" Chama". Where they get loans at a very low interest rate. Men on the other hand have access finances from milk sales, cooperative, businesses and social security. Findings indicate women are low on financial capital.

".... My wife takes care of the farm while I run a grocery shop at the town centre....

.... I also collect milk from my neighbours and deliver to the dairy using my motorbike at the cost of 2shillings per litre...'' Male respondent 18(43 years)

...the "chamas "are very helpful to us as women ... I took a loan at a very ow interest and bought myself the cow that I am now milking. Female respondent 05



Picture 11 Olenguruone farmers Savings and credit Cooperative

Source: Fieldwork 2019

4.4.5. Human capital

Human capital are the skills, knowledge, ability to work and good health that together enables the farmers to pursue different farming activities to increase production. Education is one of the proxy used for human capital showed both women and men dairy farmers 21 out of 24 had attained formal education. Notably fewer women attained secondary education (2) compared with five in men indicating differences in levels of education between the men and women.

".....I only reached class 7. I took all my children to school to make up for what I missed...

However, all my children are educated up to secondary school level and are employed. One sons is practising dairy and provides labour. I receives training from Githunguri Dairy cooperative and my farm is a demo point for maize suitable for silage..."

Interview respondent

When asked how they access labour, all the 24 respondent indicated that whenever they hire labour it is not based on skills but rather on the tasks to be done. Focus group discussions indicated that most of the labour source were school dropouts without formal skills on dairy. Interviews also confirmed that they hired farm hands and most of the women do not attend dairy trainings. Discussions further highlighted, most of the farmers were raised in dairy farm families and learnt dairy skills from their parents. Interview results showed a significant difference on dairy information sources. With 16 men attending dairy trainings in comparison to only six women. This results shows that women are low on human capital

Asset ranking

Using the proxy indicators as a guide asset ranking was done during the focus group meetings scoring of asset between women and men was done and is presented in the asset pentagon in figure 4:2 below.



Figure 12 Asset pentagon

Legend: 0-3 very low;4-6: low;7-8; above 8: very high

Results show that both men and women are strong in the social capital this is attributable to the strong social networks the farmers are involved in. Women scored low on physical and financial capital. This according to the focus group discussion with the women was because they cannot access loans from the dairy cooperative as it is for registered members and again they do not have collateral for loans from banks. The asset pentagon shows a declining access to physical and limited access to natural and physical capital but with a strong social capital with a strong.

4.5 Stakeholder perceive the concept of inclusiveness and resiliency

Resilience: Interviews with all the key informants showed awareness of the concept of resilience, which they described as ability to continue milk production despite all through the seasons. KI with the dairy cooperative extension manage Githunguri indicated that the dairy has set up feed and food stores in all the milk-buying centers of their 14 routes. The dairy Cooperative has a scheme allowing registered members to collect are animal feeds, minerals human food commodities on credit. The dairy is also providing loans against milk sales through their saving schemes. To cushion the farmers against the shocks the dairy has entered into a partnership with an insurance company to provide insurance for their cows. The dairy has enrolled in a medical scheme (National Hospital Insurance Scheme) which is deducted from their monthly sale.

Interviews with all the 24 respondents indicated awareness of the concept of resilience, which they explained by describing the different dairy activities like use of AI for breeding to improve their breed. They are also using other forms of feeds to ensure the cows have food. Some have diversified into growing of vegetables, poultry and goat keeping were observed during interviews.

Inclusiveness: Interviews with Key informants showed awareness of inclusiveness. The dairy cooperative is operating on the principle that everyone deserves a chance. Out of the 14 extension workers, seven are women giving a good representation. The dairy has employed several women to work at the structure but there is no female representation in the board of directors nor in the 9 route representatives.

The Harvard analytical tool in table 4.3 below looked at the access and control of resources and activity profile between men and women during interviews and focus group discussions with men and women respectively.

Table 8 Harvard Analytical Framework

ASSET/RESOURCE	WOMEN	MEN	REMARK
Land	Α	A/C	Men and women both have access to land but it is the men having control.
			women with control have either purchased or inherited through
			widowhood
Dairy animals	Α	A/C	Source of prestige for men so women have no control over purchase or even
			Disposal
Sales	Α	A/C	Women deliver the milk to the dairy but have no control over the sales. It is
			the prerogative of men
Labor	A	A/C	Men mostly decide the level of labor to be used
Extension	A	A/C	Men mostly attend trainings although it is open to registered members who
/trainings			are mostly men.
Coop Loans	A/C	A/C	Men control, as mostly they are the registered Coop members and have
			collateral. The dairy Coop gives equal opportunities to all.
Dairy Equipment	A	A/C	Men control what is to be used in diary
Water	A/C	A/C	Both men and women have access to water both for dairy and home
			consumption
Zero grazing	A	A/C	Men Control the type and size of structure to build
Income	А	A/C	Cultural Norms gives men power to make decisions
			over allocation and use finances for and enterprise.

Source: Author, 2019

Results show women have access over most of the dairy assets like land, cattle and even the dairy equipment but they are evidently excluded in the assert control, ownership and decision making. During the focus discussions, this was attributed to the cultural and traditional customs that foster unequal treatment of men and women. For example, a focus group discussion in Olenguruone indicated that cattle ownership is considered a status symbol for the men. Similarly it is used for payment of dowry therefore cannot owned by women. The cooperative extension officer, who indicated that during

advisory visits to the farmers, they find women in the farm although they do not make any decisions on the advice they give, further confirmed this. Women have access to resources that do not have financial decisions attached to them.

Table 9) Dairy	farmer's	activity	Profile
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ΑCTIVITY	MALE	FEMALE
Feeding		Х
Milking		х
Cleaning		х
Harvesting Fodder	x	х
Weeding		х
Manure collection		х
Selling Milk		х
Watering animals		х
Animal Health		х
Collecting Payments	x	
Supervising	x	х
Dairy Management		х
Culling	x	
Purchase	x	
Dairy Feeds	x	
Spraying	x	
Deworming	x	
AI	x	х
Cooking		x
		I

Household chores	Х

Source: Author, 2019

During farm visits, the researcher observed that it is women who are milking and feeding of the cows. During a focus group, discussion with the men it was clear that culture has a role in what activities women do and what men do. The men considered women from their reproductive activities and felt that due to their reproductive roles, the women do not make good dairy employees.

"...... My wife is not at home. She has gone to visit a sick relative so I cannot offer you some tea...

...hiring a women worker is not easy as she will keep absenting to attend to family needs" respondent

In the focus group discussion with the women dairy farmers, they all felt that the extension staff do not pay attention to them farmers during advisory services because they do not make decisions on the advice offered to them. This results show there is exclusion of women among dairy farmers.

Picture 12woman working manure in a bio digester



Source: fieldwork (2019)

Picture 13 women with animal feeds for animal feeds



Source: Fieldwork (2019)

4.6 Information and knowledge networks

Interviews with farmers showed that there sources of information was both formal and informal

Informal sources: This was as identified neighbours, family members and other farmers especially who were perceived to be progressive in dairy activities. Farmer interviews identified informal sources of information and knowledge as neighbours, family, and other farmers especially lead farmers whom they perceive as Progressive. Informal sources appeared favorable especially to the women. When asked why it was so, a female respondent during the FGD with women indicated that they preferred it, as the results were practical and you visit the farmer at your convenience and time. Information given by these sources were practical skills believed to beneficial in dairy in comparison to the formal sources that provided. Feed preparations and planting of fodder was mentioned as the commonly sourced information. Focus group discussions indicated that the formal institutions were not practical to the local context

"Whenever I want to learn about dairy I go to Mr Rotichs farm. I have seen the difference in his dairy.

What I learn can be done because he is doing it.." female respondent

Formal sources: Key informant interviews mentioned the Department of Agriculture, livestock, veterinary services, Kenya dairy board, the dairy cooperatives, dairy inputs stockists, Traders, Feed manufacturing companies, NGOs, research and agricultural institutions as the main source of information. This however differed with the farmers view during the focus group where they perceived that the government institutions were not a source of information. Interviews showed that key formal source of dairy information and as the dairy.

During focus group discussions, for the men and for the women, a Venn diagram was drawn showing information sources and their linkage. A list of stakeholders relevant to the farmers was done. Farmers then ranked them using stones to show the relevance.

Picture 14 Farmers ranking stakeholders



Source: Fieldwork, 2019

Figure 13 Venn diagram presenting male farmers perception of information sources.



Focus group discussions with men showed that men get information mostly from the cooperative and other farmers. The dairy linking them to the manufactures and private veterinary services where they

learn about feeds and animal health. local stockist dairy inputs also provide information. The bigger the circle the closer the linkages. the overlapping circles show the linkages between two information sources to the farmers.



Figure 14 Venn diagram showing females perception of information sources

In focus group discussions with the women other farmers and NGOs were the main sources of information, when probed further to explain how one respondent indicated that they prefer the NGOs because they are empowered. for example in olenguruone Groots was said to be helping women own dairy through a heifer buying scheme, further she said the you do need membership to be trained

Githunguri dairy and olenguruone provide a milk market for the farmers. Membership to the cooperatives is based on the farmers' ability to deliver milk to the factory. Trainings are for their registered members only. They have employed their own extension workers who provide information on dairy production

SNVIs an international not-for-profit development organization that provides capacity development to farmers in both olenguruone and Githunguri. Are providing the organisation is using the lead farmer approach to share information and has established a practical farmers training centre in the area. Farmers are selected based on their willingness to learn and dairy farming.it offers practical skills. The organisation gained entry to farmers through the dairy cooperative. Their strategy is formation of lead farmer groups in all locations in their area of operation; they provide extension services through farm visits trainings and exchange programs. The practical school in olenguruone

Department of livestock is a government organisation whose main task is facilitate trade and livestock production by providing information breeding, feed production and livestock management to the dairy farmers. The department uses demonstrations, seminars, workshops, filed days, collaborations with

other stakeholders to share information. recruitment of farmers is based on farmers' interest with women and vulnerable given opportunities in line with government policies.

4.7: Stakeholder strategies for scaling up climate smart dairy

During the informant interviews and focus group discussions, it was mentioned that there are different methods that were in use to share information. Identified strategies are listed below table.

Discussions further revealed that the most preferred method of sharing information was demonstrations and farmer schools. It also became clear through informant interviews that dairy cooperatives rely on other stakeholder for their trainings. Information source connect to the farmers based on the service they provide. Linkages between the information sources are based on extension service, marketing and service provision.

Focus group discussions results showed that the strongest market and extension linkage was the dairy cooperative where all the respondents are members and sole traders during interviews all 24 respondents indicated the extension and training linkages with the dairy cooperatives was through its extension workers providing them with information and buying their milk.

"When my cow has a problem I call the dairy extension officer for advice on what to do. And she does

not delay in visiting "respondent 01

To identify the strategies used by the agricultural knowledge and training networks to scale up climate smart dairy, KII were interviewed and the results presented in Table **4:7** below

STRATEGY	DAIRY COOP	MIN OF AGRIC	NGOs	FARMER	FREQUENCY
Farmer Groups	V	V	V	٧	4
Lead Farmers	x	V	V	V	3
Stakeholder Forums	v	V	v	х	2
Collaborations	x	V	v	x	2
Farmers schools	х	V	V	v	3
Common Interest Groups	х	V	V	v	3
Demonstrations	V	V	V	v	4

Table 10 Stakeholder strategies for information Networks

Refresher courses	x	V	х	х	2

Source: Author 2019

The results in table 4:7 above show the commonly used information strategy was farmer groups and demonstrations when further probed on how they source for information, which they give to farmers from the research to the dairy farmers, 6 out of 7 stakeholders had no flow. This showed that there is here is no clear link between research, agricultural training institutions and the stakeholders

Picture 15 Farmer's practical training center farmer school in Olenguruone



Source: Fieldwork, 2019

4:8:1 Climate smart practises

From observations and farmers' interviews, it was evident that the farmers are practising several climate smart practices in their farms despite the fact that they did not know that they were climate smart. Out of the 24 respondents, only 10 were aware about climate smart dairy.

Table 11 Existing dairy smart technologies

Smart Technology	Frequency
Biogas	6
Silage	4
Agroforestry	8
Machine milking	1
Manure	24
Water tanks	9
ΑΙ	16
Exotic breeds	14
Vaccinations	24
Zero Grazing	17

Source: Author, 2019

4.8:2 Biogas production/ bio digesters.

Six out 24 respondents have bio digesters purposely for cooking and confirmed that they have not only saved money but also time, as it is efficient.

Picture 16 bio digester in Githunguri



Source: Fieldwork 2019

4.8.3 Water harvesting technology

Clean water is essential not only for human consumption but also for the dairy animals but for maintain clean milk production. Farmers had water tanks for storing water that they pumped from the wells for harvesting rainwater, which they used for home consumption and for livestock purposes. The harvested water used during the dry months but not during the rainy season as they used the rainwater.

4.8.4 Fodder production and conservation

Interviews showed that only 4 farmers are engaging in fodder preservation although they all are growing Napier and other types of grass.

4.8.4 Manure management

16 out of 24 respondents are using manure for planting their fodder and other food crops reducing fertilizer application and saving and was observed in the field and confirmed by the presence of Manure reduced the cost of production as they did not purchase fertilizers, improved their soils and increased fodder production.

When asked to rank climate smart technology, which they considered scalable fodder conservation, all the women and male respondents (24) indicated; feed conservation technology as the most important scalable climate smart technology. Results further show that women preferred biogas and mechanization technologies to men

Table 12 Scalable Dairy smart technologies

Technology	Ranking	Women	Men
Fodder conservation technology	1	12	12
Upgrading breeds	2	9	8
Biogas/Bio digester	3	12	4
Water harvesting technology	4	8	7
Mechanization: milking machines,	5	8	6
Intensive dairy farming (Zero Grazing)	6	7	5
Solar Panels	7	4	4
Agroforestry	8	4	3
Others : Water Bath,	9	2	4

Source: Author, 2019

4.7 women and youth inclusion in existing dairy knowledge training networks

Results from key informants from Githunguri and olenguruone dairy cooperative dairies stated their dairy had no deliberate action to ensure that women and youth are included in the training schedules. The existing training networks are only for their members.

"... our monthly trainings are open to our entire member as long as you are in our milk delivery register " KII (1)"

Cooperatives hold monthly trainings, which are open to all the members, whether male or female as long as they have a membership to the cooperative. As an incentive to motivate the men and women farmers, they provide transport allowance and lunch to the members. To encourage women members to attend trainings the cooperative looks at timings appropriate to women farmers. Respondents mentioned that NGOs gave priory to women. Groots was using women groups as contact points for providing trainings on dairy. However, during the female Focus group discussions, a female farmer lamented that the younger women were often left out.

"... To ensure our women members attend we schedule our trainings for only 3 hours" This is to allow the

females to attend to other reproductive chores

The dairy extension officer indicated that they incorporate human health talks and financial institutions during trainings to attract women and youth.

The government of Kenya through the ministry of agriculture has a youth in agribusiness strategy that seeks to empower youth along the various agricultural activities livestock included. The ministry through it agricultural sector development policy (ASDP2017) which says that women and youth must incorporated in all its projects

"...." in the KCSAP project women and youth are identified as vulnerable groups and are receiving trainings and service support through the formation of common as contact points" KII

This project is capacity building women and youth on aspects of dairy processing and fodder preservation.." key Informant

4: 8 Role of men, women and youth in scaling up CSD

Key informants interviewed acknowledged women and youth as key asset for the sustainability of the dairy industry. Discussions and interviews identified dairy as a very labour intensive activity that requires energy and strength that the youth have. The women have a lot of contact time with the dairy farm and can be key drivers for upscaling of climate smart dairy technology. Further, the unemployed youth can be incorporated as crucial actors in various nodes of the dairy value chain. The women and youth are actively supporters but can be encouraged to move up the value chain to from producer to processor. From the interviews held with key informants from the livestock department, showed the importance of the youth for the sustainability of the dairy industry. Youth are innovative in nature and was confirmed as the most innovative farmers,

' he has developed his own salt which he is not only using but also selling to other farmers respondent

Key informant interview, (SNV) mentioned that the Innovative farmers are youthful as seen by the youth who have been trained in silage making and are doing it on commercial basis by their adoption of dairy smart technology, they are also technology smart and looking out for new knowledge even over the internet indicative of a willingness to learn new technology.

Chapter 5: Discussions

5.0 This chapter discusses the findings from the research based on existing literature and findings from similar studies

5.1 Vulnerability context

The study found that climate change is affecting small-scale dairy farmers in Olenguruone and Githunguri in both direct and indirect ways. Direct changes experienced shocks in the form of drought, floods, pest flooding, feed unavailability and diseases. Whereas indirect changes trends and seasonality's like shortage of labour, increased population growth and increase in input prices and changes in milk price. These changes increased vulnerability of men and women farmers, thereby reducing their milk production. These challenges exposed them to poverty and food insecurity. This concurs with (Lobell et al, 2011) who states that climate variability and change affects dairy farming through decreased forage availability , reduced milk production thereby increasing poverty and food insecurity.

Findings as supported by Njarui et al, (2012) noted that the cultural norms, practices and responsibilities of women and men influence how they experience the effects of climate change differently. Women are more vulnerable to the effects of drought, disease outbreaks as compared to men. There are cultural norms and values which influence women's access and control of resources for example traditionally it is the women's duty to feed ,water and milk the animals.

This study noted that whereas the cooperative it plays a key role in dairy farming by providing a ready market to farmers' as it is also a source of vulnerability as it contributes to the fluctuating milk prices. The dairy does not offer competitive prices to cover the farmer's production costs. Further, this study found out that the dairy has the monopoly of the market and which can possibly cause lack of growth in the farmers. (Bebe et al 2012) However, this study saw this as an opportunity for the farmers to move from producers to processor.

5.2 Adaptive capacity and Resilience

Levine et al, (2011) states that adaptive capacity of farmers is the ability to make modifications to continue functioning without change during a vulnerability building resilience. They include adopting new farming techniques, change in farming practices, diversification of livelihood asset bases, engaging in new social networks and access to information.

This study found out that the dairy farmers respond to the effects of climate change in different ways, which include leasing of land, alternative feeding options, feed conservation water harvesting, take food commodities and feed on loan, diversification, seeking employment as other adaptive strategies. Farmers engage in silage making especially during after the rainy season when there is a lot of grass and forage as an adaptive strategy is also an opportunity for scaling up climate smart and engaging from the study findings most farmers especially the women considered it to be hard work. During the presentation of preliminary findings capacity building the youth on how to make silage is opportunity to engage the youth.

Farmers are engaging in farming activities to increase their resilience. It this study whereas the women were diversifying to dairy goats and vegetable farming, the men were engaging in small business and seeking employment elsewhere. Rearing of the small animals require less food and the women are allowed to own them thereby increasing their asset base.

This study noted the dairy cooperatives had both a feed and food loan scheme, which this study found this as an important strategy, which was also ensuring food security for the farmers. Farmers get feeds from the dairy factory on credit. This study however noted that this facility was mostly available for men who are members of the cooperative

5.3 Livelihood assets

Livelihoods comprise of the capabilities, assets and activities that enables recovery from shocks and stress (Chambers and Conway, 1992). In this study farmers' livelihood were human capital (education, skills, knowledge, information sources), social capital (social groups, cooperative membership, links to information), financial capital (loans, milk sales, savings, salary) natural capital (land, water, crops) and physical (dairy equipment, house, market)

Social capital of the dairy farmers consists of their fellow farmers, family members, churches and other social groups. The dairy cooperative where farmers sell their milk is a strong social capital especially for men owing are the ones who register in the dairy cooperatives owing to their ownership of the cattle. This contradicts results from a study by Katothya, 2011) which indicated there was a higher enrolment of women in the cooperative. Women equally scored high on the social capital, which concurs with results from a similar study in Ethiopia Mehdi (2019). Social capital is seen as an opportunity for scaling up climate smart dairy especially for women owing to their small-organised groups, which make them more accessible. Women farmers easily form relationships with other farmers as they spend more time in the farms.

Financial capital plays a crucial role in increasing milk production. The farmer's main source of financial capital is milk sales employment and other income generating activities. This study woman scored low on financial capital, a finding that is in agreement with Hassn (2019) who in a study small in Ethiopia found similar results. Women have limited access to credit services whereas in men it was found to be high. Financial capital is important for dairy farmers because it enables them to buy, feeds and to access other dairy related services.

Education is a key indicator to human capital. Access to dairy farming information is important for farmers for improving their production. Formal education is important for farmers to interpret the dairy information and implement easyly. In this study, both men and women have formal education although a small number of women attained secondary education and above. This study established that women have limited access to dairy information scoring very low limiting them from having innovative adaptive capacities.

The accessibility of key dairy production resources such as land, water and livestock determines to what extent farmers can participate in dairy production (Njarui,2014)The analytical framework was used in this study highlighted the access and control of assets by women and men. Men have control of all the important assets that are necessary for dairy production. This includes cows and the dairy equipment .this contributed to the low score of women on physical resources. However, the study established that women have access to the physical assets but cannot make any decision concerning the purchase and disposal. Women's ownership of assets, like land are inhibited by Cultural and customary land laws. This study finds that women have a low physical capital base which can be linked to them having a low financial base. This limits their choice of adaptive strategies a study by Bee (2013), which found that women have less adaptive strategy options as they encounter resource constrains, have limited access to information and

services The men on the other hand had diverse options mainly because of access to land, finance and access to information services.

5.4 Inclusiveness.

This study further found out that though women farmers were engaged in a milking, feeding, watering among other activities in dairy production. Existing customs and Cultural and practices on land and cow ownership inhibit them from making decisions on related to dairy production. A similar study by Oxfam in Kenya stated that participation can inhibited by social norms and micro politics that affect the choice of livelihood activities and access to other requisite resources such as land and finance.

Further, it was established that the dairy cooperative is in support on inclusiveness through their staff establishments where more than half of the employees are women. Supporting the Government of Kenya's policy on gender advocating that at least there is a 30 per cent representation of women in all establishments. (Kenya VISION, 2030) promoting inclusions.

However, it is noted that the implementation of government strategies continues to be slow due to the influence of culture, which continues to widen the gender gap. There is influence of the patriarchal society, which gives power to the men to make decisions. However, the study observed differences in levels of education between women and men, supported by finding by (KDHS 2014), stating there are inequalities between male and female in education and the Labor market.

The representation of women in the cooperative is very low with women engaged to work in the supportive staff. This concurred with findings by Bebe et al (2016) stating that participation of females in leadership positions is low in dairy cooperatives, unions and associations.

5.5 Agricultural knowledge and information systems

Access to training and extension is important for the increased dairy production and upscaling of climate smart dairy. The information sources and contact with farmers influence the choice of information source. This study found that farmer's information sources was either formal or informal concurring with results from a similar study in Ethiopia where government and non-governmental institutions were identified as information sources, Hassn (2019).

Practical farmers' schools and Other farmers can be an opportunity in upscaling climate smart dairy especially among women as shown in study .in this study women main source of production information is farmers, relatives, NGOs (SNV and Groots) veterinary doctors and the local radio stations. This the cooperatives restrict information services to their registered member's whereas most women are not member's of the cooperative. women tend to perform more duties more and have less time to participate in the scheduled trainings. On the other men were receiving the information from the trainings organised by the dairy, dairy extension workers and farmer groups.

The information sharing strategies like field days, farmer field schools, farm visits, lead farmer approach and exchange visit to share information on dairy farming. Both men and women farmers preferred demonstrations and farmers training. These results are similar with (Elifadhili 2013) who stated that agricultural information can be delivered to farmers in different strategies.

Further, this studied noted that there was no clear linkage between the different information sources that for upscaling climate smart information. The study identified extension linkages, market linkages and service linkages for information source. This concurs with a study in Nigeria by Abudu 2005 proposed the establishment of a linkage system that brings together all actors in the sector to facilitate smooth operations.

5.6 Inclusion of women in knowledge networks

The role of women is increasingly appreciated across different quarters, and significant amounts of literature exist supporting that inclusion of women in different economic sectors a report by IFAD (2015) recognised women as key drivers in the green economy.

The dairy, which is the main source of information limits women from their trainings by virtue of them not being members of the cooperative, on the other hand during home visits the extension officers find the women at home, as they are the ones caring for the cattle. Non-governmental organisations like SNV include women in their policy. Their extension services are open to all as long as you are a dairy farmer.

This has increased the access of info formation by women. The livestock department works on the government policy that states that in every implementable project there has to be a component of for women and other vulnerable groups

The dairy cooperative in as and institution has no gender policy in place. They however have employed more women in in service related jobs in the dairy. Githunguri dairy for example has female extension worker out of 14. is perceived to have influence women's participation and access to information. This supports by findings Rabindra n. (2008) that observed that women extension workers increased participation of women. Further, the study established that time and location for trainings affected women's participation. Women dairy farmers have other household responsibilities like childcare and food preparation. Further, the study noted the provision of lunch and travel allowance as incentive to the dairy farmers influenced more women to attend the trainings.

5.7 Role of youth in scaling up CSD

This study observed that youth participation is low to which was attributed the perceived low and slow returns and high labour requirement of dairy production. This was contrary to a study by Sulo et Al, (2012) that identified lack of livelihood assets like land, finance and lack of skills as constraints hindering youth participation in dairy.

5.8 Role as researcher

The genesis of my research began with understanding my research topic "Inclusiveness and resilience competence for upscaling climate-smart dairy. Which I achieved through several meetings with my supervisor for guidance, for feedback on my research questions methodology and design

Having no prior knowledge about the research topic and research area was a challenge that prompted me to read widely and consult with the other students who were to research the same study area. This helped me in enabling me to come up with the concepts that guided me in developing a conceptual framework and operationalizing it especially with indicators that helped in my data collection and organizing data and compiling the report.

The researcher encountered quite a several challenges related to the research and most particularly during the process of data collection. The research question on inclusiveness caused some respondents especially male to be suspicious and the researcher felt that Some respondents were biased while giving information due to fear of the consequences of their response. This called for constant reassurance of the farmers of their confidentiality.

Planning and holding of 6 focus group discussions was a challenge as it had financial implications of booking of the venue, providing lunches and transport allowance for the respondents. Conducting the FGDS called for the researcher to be objective especially to ensure that it was participatory considering

the sensitivity of sections of the study. For example, during one FGD session with the women one respondent was dominating the sessions, the researcher gave her the responsibility of writing down the answers and give a summary at the end of the session. During the final FGD for giving preliminary findings was done jointly with both men and women. To reduce biases when asked to vote for a certain issue the power of the pen was a crucial instrument that ensured the confidentiality of members' responses. Carrying out interviews with farmers required objectively as it is easy to drift away to other issues. Writing down the responses was a challenge especially when I had to write down the response in English getting the exact meaning was sometimes difficult.

The research process is iterative and I was in constant communication with my supervisor on whatsup. In consultation with the supervisor, I extended my research to a different area and increasing my sample size after interviewing 13 farmers the researcher realized that there was no variation in the responses.

Transportation was a challenge. Riding a motorbike across terrain was a frightening experience for the researcher especially as the riders were males unknown to them. My participation in the refresher course by VHL and attending conference made me understand dairy as an enterprise it was also an opportunity for interacting networking with stakeholders like SNV, Wageningen and 3R project and Agripofocus and their impact on the dairy industry.

The element of self-awareness of me as a female researcher researching inclusiveness helped me to be objective. My upbringing from a patriarchal society allowed me to go into the field with open-mindedness and objectivity to reduce biases of believing in the ownership of resources within the household.

Although Data collection tools were carefully selected, should there be another round of the research the results may not be 100 percent the same. Triangulation in this research was by using Focus group discussions and key informants.. To increase the reliability of my study I chose not to disclose to my respondents that I am a civil servant but rather student. Conferences and workshops attended proved useful in for triangulation.

Although I had prepared adequately for the research, I still encountered some challenged. the research reached saturation and within a short time. Consultation with my supervisor I was able to move to a new area. This was a challenge as the ice area was almost 300 km away from the initial study area. though I was well prepared for the field study on several times, I had to find innovative ways to deal with some challenges as I couldn't readily reach out to my supervisor due to the challenge of internet connectivity. I have learned that understanding key information provided before the research is key as it allows proper planning. In future research activities, I hope to understand instructions and make appropriate strategies that suit the field. Having a flexible mindset to suit situations in the field and finding ways to improvise solutions to likely challenges is something I have learned from this experience too.

Organizing the data to form a report was a challenge. I had collected so much data that seemed relevant but turned out not to be important. Developing themes that would effectively answer my research question was a big task as there was a lot of interrelation between several answers. Finally compiling the report has been challenging, nonetheless, the useful feedback and constructive criticism of my supervisor which I have always incorporated most of the time have been of enormous the process.

CHAPTER 6 CONCLUSION AND RECOMMENDATION

This chapter presents study conclusions based on the main findings and discussions of the

6:0. Conclusion

Small-scale dairy farmers of Olenguruone and Githunguri experience the effect of climate change, which affects their productivity and increases their vulnerability. These include feed unavailability, pests and diseases, increased feed prices and seasonality like fluctuating milk prices. This study concludes therefore that men and women experience have different vulnerably based on the activities of production they undertake.

Adaptive strategies that increase resilience are the different Livelihood assets farmers have access to and control over. Women and men, dairy farmers have different access and control over the livelihood assets. Land as a physical asset is important for dairy farming, owned by men. Women have limited financial capital with limited access to credit services. Both men and women are involved in social networks in the form of family and friends and enrolment in the dairy for men.

The main information sources of information for the farmer are both formal and informal. Dairy cooperatives with its extension workers are the main source of information for the farmers especially men. Other formal sources include SNV and GROOTS. Informal sources include farmer's friends and relatives, which is preferred by women. There are however are no linkages that support the flow of information between the different sources and the farmers. Lead farmer approach and farmer schools the most popular strategies of information sharing.

6: 2 Recommendations

Based on the findings of this study the following recommendations are made

The dairy cooperative:

The study found that dairy is the main source of information for the farmers. This study, therefore, proposes that to scale up climate-smart dairy to improve production the dairy Cooperative should link up with knowledge institutions like the research and Department of livestock to capacity build their extension workers through who were found to have limited capacity for scaling up dairy smart innovations through regular training

Farmer training by the cooperative targets registered members who are mostly men. To enable women to access dairy information the study recommends the dairy consider registration of registering two people per household, to increase the human capital of women, the dairy should include them in their training by allowing registration of two household members.

Access to credit from the cooperative is restricted to members only. To increase unregistered women dairy farmers access to credit this study recommends that Cooperative should create linkages with other financial and credit institutions to provide.

The Ministry of agriculture

- the study found that due to low staffing department is not able to reach many farmers this study, therefore, recommends that the department Strengthens the information linkages between

the dairy cooperatives and the sources of knowledge (research, agricultural institutions, and government departments) to increase the competencies of both farmers and dairy extension workers through regular training

- to encourage the youth to participate in dairy the ministry through its policy on youth and agribusiness should hold training for youth to equip them with skills that enables them to Capacity building of the youth to provide skilled services (feed manufacturing, silage making and animal health) in dairy Youth to be included in dairy by participating in other nodes of the value chain

- To address the fluctuating milk and increase competition for milk. department of livestock together should train the farmers especially women on milk processing

- to address lack of information linkages, the government through the ministry of agriculture should take the initiative to develop and reinforce a working information system linking up all stakeholder

To the commissioner

- this study was carried out among dairy farmers who are cooperative members This study recommends further research to be carried among dairy farmers who are not members of a dairy cooperative.

- - the study found out that informal sources are sources of information for dairy farmers, Further research should be carried out to find out the role of the informal sources in scaling up climate-smart dairy.

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ANNEXES

1: Work plan

	Ap	or-1	.9		Μ	ay-	19		Ju	n-1	9		Ju	1-19)		Αι	ug-1	19		Se	p-1	.9	
Week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Desk study																								
Problem statement																								
Research objective																								
Research questions																								
Topic pitch																								
Proposal writing																								
1 st & 2 nd supervisor																								
3 rd meeting with supervisor																								
Itinerary plan for Githunguri																								
4 th meeting with supervisor																								
Submission of proposal																								
Identification of case study farms																								
Proposal defence																								
First meeting																								
Data collection																								
Data analysis																								
Return trip																								
5 [™] meeting with supervisor																								
Report writing																								
meeting with supervisor																								
Thesis submission																								
Thesis defence																								

Annex 2 questionnaire

Semi structured Interviews

(All answers are anonymous and treated with confidentiality)

Good Morning/Afternoon. Madam/Sir.

My name is Florence Aguda, I am a student at Van Hall Larenstein University and I have come to carry out a research on behalf of my institution. I would like to gather information from you on inclusiveness, resilience competences for scaling up climate smart dairy of small-scale dairy farmers. You are free to decline or withdraw your willingness to participate in the research. Anonymity and confidentiality is guaranteed for information provided and this research does not have benefits from participation.

Respondent Name:	Name of Interviewer:
Date :	

General background

- 1. Sex of respondent
- 2. Occupation of respondent
- 3. Respondents position in the household
- 4. Highest level of education attained

Household socio-economic background

- 5. No. of people in the household
- 6. Age and current education level of people in household
- 7. Size of land occupied
- 8. Type of land ownership
- 9. Sources of income

<u>Motivational</u>

- 10. When did you start dairy farming
- 11. Type of ownership of the dairy farm
- 12. Who manages the farm
- 13. Prior knowledge of dairy farming
- 14. How did you start dairy farming
- 15. What was the motive behind setting up the dairy farm
- 16. Do any of your family members practice dairy farming

What are the livelihood assets of dairy farmers that improve their adaptive capacities?

Social Assets

17. What is your role in dairy farming?

- 18. Do you belong to a cooperative or any farmers group?
- 19. How many workers do you have on the farm?
- 20. Are a member of any social group?
- 21. How many employees do you have and how do you engage workers(gender, age)

Financial Asset

- 22. Do you have access to credit facilities?
- 23. What are you mainly using you income for?
- 24. Where do you sell your milk?
- 25. Who decides what feeds to purchase?
- 26. Is your business profitable throughout the year (if no, how many months do you receive positive cash flow)?
- 27. How do you share or spend income from dairy farming?
- 28. Who determines the milk prices and why?

Human

- 29. Have you heard about Climate change or climate smart dairy?
- 30. Did you receive any kind of training on Climate Smart Dairy?
- 31. What kind of training did you get?
- Milking
- Marketing
- Processing
- Use of manure
- Breeding
- Feeding
- Artificial Inseminations
- Disease diagnosis
- 32. Who provided this training?
- 33. Do you need further training on Climate Smart Dairy?

Natural

- 34. How big is your farm?
- 35. Who owns the farm?
- 36. Do you have access to clean water sources?
- 37. Do you have adequate grazing land for your dairy cattle?
- 38. If grazing land available: have you undertaken any land improvement and conservation measures during the last two years; type of grass grown?

Physical

- 39. How many dairy cattle do you have?
- 40. How many cowsheds do you have?
- 41. What type of farm equipment do you have?
- 42. Are roads accessible all year round?
- 43. How do you transport your milk to the nearest market?

- 44. Do you have a physical market?
- 45. What other livestock do you have on your farm?
- 46. How did you get the dairy animals?

How do the livelihood asset improve adaptive capacities of dairy farmers?

What is the vulnerability context of men, women and youth dairy farmers In relation to CSD?

- 47. Have you experienced any climate challenges in the past 3 years?
- 48. What are the challenges and how do they affect dairy farming and production.
 - Probe: Do you experience any shortages (If yes, during which months/ season)?
 Do you have enough water for your animals across the year?
 Do you experience high and low seasons in milk production across the Year and what are the contributing factors
 Which are the common occurring diseases in the area

What are adaptive capacities of dairy farmers (men, women and youth) that support resilience?

- 49. How do manage and overcome these challenges?
- 50. Have you adopted any of the following smart dairy farming practices?(if no, why) (if yes, what are the benefits you have noted)

	Dairy smart Practice	Adopted	benefits
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Feed conservation

Bio gas

Use of manure

Agroforestry

Animal breeding

vaccines

- 51. Are there technologies that you have adopted in your dairy farm?
- 52. In what aspects of your dairy farming have you adopted the use of technology (transportation, storage, milking, breeding, others) and to what extent?
- 53. How frequent do you conduct healthcare checks on the animals?
- 54. Who carries out artificial insemination and at what cost?
- 55. How frequent do you conduct cleaning and maintenance of your farm?
- 56. How do you utilize the manure collected from the farm?
- 57. What safety measures do you implement regarding the animals?

What is the role of formal and informal knowledge, information and, training networks in which men, women and youth are involved?

- 58. What informal networks are you involved in and how do they benefit your dairy
- 59. Do you get any government information support for your dairy farming (if yes, what kind)?
- 60. Do you get any other kind of support for your dairy farming (if yes, what kind, how)?
- 61. How frequent are these support initiatives?
- 62. How important is this support for your dairy farm?

What are the strategies used by knowledge and training networks in order to scale up climate smart dairy?

- 63. How did you get information about dairy farms?
- 64. Is it consistent? If so how consistent

How women and youth are included in the existing dairy knowledge training networks

- 65. What are the factors that could affect access to support program me?
- 66. Do you have access to dairy information?
- 67. What community activities are you involved in and you role?
- 68. Do you attend farmer's trainings?
- 69. What kind of knowledge information or skill did you get? From where? How relevant it is
- 70. What incentives are there for women and youth to join dairy farming?

Thank You For Your Time!
Observation Check list

ActivityRemarkProductive role in dairy like, Who is milking, processing, selling, feeding cattleWhat equipmentAnimals (indigenous or exotic)Number of Animals (herd)Feeds (fodder, grazing)Selling of milkManure useAvailability of water in nearby area, water sourceImproved infrastructure (nearby market, road)Record keeping (financial and cows insemination day)

Focus Group Discussion Topic Guide

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Activity	Remark
Asset ranking	
Harvard Framework (access/control of assets	
Vulnerability and capability matrix	
Who supports the dairy farm (list governmental and non- governmental)Venn Diagram	
What are their roles	
How important is the support and provision of this institutions	
How do you access information and knowledge	
How effective it is the way institution give their service and why do you think	

What are the constraints and opportunities to adopt and not to adopt technologies and information?

Key informants interview checklist

Good Morning/Afternoon. Madam/Sir.

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Activity	Remark
Name of Interview and sex	
Name of institution	
Position of interviewee	
Main task of the institution	
Type of service provided	
Types of training, technologies provided (in which area and for whom)	
How is information and knowledge is transferred	
Who are the partners	
How do you define inclusiveness and resiliency	
How important it is for your institution and farmers	
How technology reaches the farmers	
What type of climate smart dairy information have you provided before	
Service they provide	
How long are the services	
How they select farmers for service provision or information	
Consideration of youth and women in trainings and information development	
Role of women and youth in dairy	
How responsibilities are established and enforced? Are they reflected in policy/legislation?	

How do you measure your performance in proving your service and how effective do you think your performance is

Existing gaps and opportunities in transferring technologies and information

How do stakeholders perceive the concept of inclusiveness and resiliency?

Have you ever heard about inclusiveness and resilience?

How would you characterize resilient dairy farm?