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ADOPTION OF CLIMATE SMART AGRICULTURE (CSA) TECHNOLOGIES AMONG FEMALE SMALLHOLDERS FARMERS IN MALAWI

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Msc. International Relations

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Declaration

I, Kitsao Edith Zighe, declare that this thesis is a result of my research and findings. Sources of information other than my own have been acknowledged and a reference list has been attached. This thesis has not been previously submitted for award of any type of academic degree.

Signature……

Date……

Dedication

This research is dedicated to all the smallholders farmers in Malawi who live a selfless life in order to ensure their households have become food secure. Have it not been their desire to participate in this research, I would not been able to complete my work. They have inspire me with their hard work and dedication and I will forever remember them.

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Lastly I would also like to thank the University and Noragric department staffs for supporting me during my research. Though it may seems to be "normal thing" for me I can't take it for granted. To my family members you have been my pillar, to my friend's thank you for encouraging me.

Oslo, 10th December 2016

Kitsao, Edith Zighe

Abstract

Climate change has affected and affected many countries leading to food insecurity. As results, a number of coping and mitigation strategies have been advocated developed. The purpose of this study was to find out the adoption of CSA technologies among smallholders farmers in Malawi.

The objective of the study was to explore how gender is affecting the uptake of CSA technologies and find out the gender related barriers to the diffusion and uptake of CSA technologies among female smallholder's farmers in Malawi.

In this research, I used the mixed methods of research which include both qualitative and quantitative data collection methods. The sample size was entirely selected from the target population. The sample size was selected based on the ration of 60% women and 40% men. From the 60% of women, the sample was divided further into 60% women who are adopters while 40% who are non-adopters

In sampling method, I chose to use purposive sampling because it helps the me to select a sample that had knowledge on the researched area and this reduced the chances of biasness. I had issued 250 questionnaires and I got a response of 91% from the farmers, which is a good response for research.

Finally, research I used self-administered questionnaires with both open-ended and closed-ended questions for collection of data and data was analyzed using descriptive statistics. I edited and coded before the questionnaire before analyzing. Analysis was done using SPSS software and Microsoft excels

List of Abbreviation

CSA-Climate Smart Agriculture

TLC-Total Land Care

UN-United Nations

FGD-Focus Group Discussion

GHG-Green House Gases

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Chapter One

1.0 Introduction and Back ground to the Study

African is considered one of the most vulnerable continents when it comes to food security due to its dependent and reliance on natural resources and agricultural products for survival. As a results the concept of adaptation to climate change has become an important aspects of discussion to many governments (Denton et al. 2008). A lot of attention has been shifted towards the development of means and methods of sustaining agricultural activities in sub-Sahara African by promoting the use of climate smart agriculture among the small holders farmers through empowerment and capacity building (Branca et al. 2011).

The emerging of CSA can be note to have started in 2010 after the Hague conference where countries met to discuss the adverse effect of climate change and how to mitigate the effects. This conference led to a number of actions and policies to be implemented in order to achieve its objectives (FAO, 2015). As a result, the use of CSA technology has been widely campaigned for because it is considered to be an efficient way of high productivity in agriculture. This is due to its ability in offering farmers with a "triple win effect" through reduced greenhouse gas emissions, increased production and increased adaptation to climate change especially in countries which highly dependent on agricultural products. CSA is define as an approach that aims at addressing the challenges of food security and climate change by ensuring there is resilience sustainable systems to increase food productions that may lead to increase of farm income from smallholders farmers (CCAF & UNFAO, 2014). In another research Lipper et al (2014, p. 1) defines CSA to be "an approach for transforming and reorienting agricultural systems to support food security under the new realities of climate change". Lipper further stated that CSA technology helps in increasing adaptive capacity through efficiency use of resources and creating an agriculture system that can stand the threats of climate change. The focal point in CSA is proper use of land, soil and water conservation and residual management since these are the factors that determines the productivity as well as they are affected by the climate change (Branca et al. 2011).

Women and smallholders farmers have for a long time be known to be the backbone of many families in developing countries and the main source of income from this groups being agricultural products. As a results the effects of climate change on agriculture has affected negatively on food

security especially on the rural people because they highly dependent on agriculture as a source of income. Hence this makes it important to look at the CSA concept since it seems to provide solutions in many of the developing countries on how to overcome the effects the climate change (Beddington et al. 2012).

1.1 Statement of the problem

Agriculture is one of the pillars in economic development especially in developing countries. This is because in these countries, the weather is conducive throughout the year and most families rely on agriculture for their daily survival. However due to the current unstable weather conditions, many smallholders farmers have suffered due to drought or too much rain which leads to floods that damage the crops (Kaczan et al. 2013). Furthermore, research shows that most smallholder farmers owns land that is less than 2 hectares. In Malawi majority of smallholders own a piece of land on average about 1.2 hectares per household, making most farmers to be small-scale farmers who produces mainly for the purpose of consumption (ibid).

Malawi was one of the twelves countries to have experience adverse effects of climate change which includes floods and drought. As a result, smallholder's farmers have been badly affected considering the fact that a larger population in Malawi are smallholder's farmers. In addition, most of the Malawian smallholders farmers are women who contribute to about 70% of the household food which its produces mainly for the purpose of consumption (Asfaw et al. 2014).

It is argued that one of the contentious issues around the world is how to mitigate the impact of climate change. However, the question is how developing countries can practice agriculture in order to, increase productivity especially in the era where the world is affected by global warming due to change in weather patterns (Branca et al. 2011). Even though there are many agricultural practices that teaches farmers on how to practice smart agriculture, research shows that many smallholders farmers are yet to implement this practices in their farming due to lack of resources and information (Lipper et al. 2014). Hence, this study seeks to address three keys objectives that are highlighted in the next section.

1.2 Research Objectives

The objective of the study is to explore how gender is affecting the uptake of CSA technologies and find out the gender related barriers to the diffusion and uptake of CSA technologies among female smallholder's farmers in Malawi.

1.3 Sub – research objective

1. To analyze how gender is affecting the uptake of CSA technologies among female small holders farmers in Malawi.
2. To identify the gender related barriers to the uptake and diffusion of CSA technologies among female smallholder's farmers in Malawi.

1.4 Research questions

The main research question is does gender affects the uptake of CSA technologies and what are the gender related barriers affecting the diffusion and uptake of CSA technologies among female smallholder's farmers in Malawi?

1.5 Sub-research questions

1. How does gender is affecting the uptake of CSA technologies among female smallholder's farmers in Malawi?
2. What are the gender related barriers affecting to the uptake and diffusion of CSA technologies among female smallholder's farmers in Malawi?

1.6 Limitation of the study

It is important to note that as a researcher I had some limitations because Malawi is a foreign country with different cultural practice and languages. However to counter the limitations, I used research assistance who are familiar with CSA technology and they could speak the local languages. This helped me to save time and to ensure the right information is given to the responded.

Chapter Two

2.0 Literature Review and Theoretical Frame Work

The general review of this chapter is to give a deeper discussion of CSA technology evolution, adoption and implementations of these technologies by different countries, but my focus will be on countries Rwanda and Kenya. The reason for choosing these countries is the fact that the two are part of East Africa community while Malawi is in the South of Africa. This will help me compare the CSA technologies in these countries with Malawi by getting a global picture of CSA technologies. This chapter will also act as a basis of theoretical foundation of the study that will help the researcher to understand and investigate the research problem.

"Agriculture is more vulnerable to the increasing effects of climate change than any other economic sector, and it uses almost 80 percent of the world's freshwater—a vanishing resource in some parts of the world"(Mundial 2012, p. 11). According to UN (2014) the world population is expected to reach 9 billion people by 2050 hence there is a need of coming up with sustainable agricultural practices in order to meet these demand. As a result enhancing smallholder farmers' capacity to adapt to climate change is very essential for both local production as well as the international food demand.

Due to unstable rain patterns, flooding and drought many of the families have become vulnerable to food insecurities. In many of the countries around the world, weather patterns have turn out to be irregular, which has led to low food production. As a results CSA technology has been consider to be a friendly approach that cut across both political and financial aspects for the achievement of sustainable development goals which is in line with the UN vision 2030 (Bank 2015)

2.1 Other Countries Background on CSA

2.1.1 Rwanda

A larger population of households around the word are affected with poverty and most of them depend on small-scale farming for their daily living. Small-scale framing is known for its ability to sustain families through food production as well as source of income through manual labor in the farms. However, the major challenges that faces the developed world is lack of land or inability

to access land due to poverty or cultural barriers. In Rwanda due to over populations in one place, there has been scarce land for agriculture (Branca et al. 2012). According to World Bank (2015), Rwanda has experienced climate change like any other countries around the world. These changes has led to scarcity of resources like water and food shortages until late 1990s. As results the country has tried to implement, some CSA technologies as way of mitigating and adapting to climate change.

Due to increase of greenhouse gases, the climate has become unstable and there is no longer consistence when it comes to climate weather patterns. However according to the research by Yu et al (2011), indicated that in Rwanda greenhouse gas emission is low as compare to other countries. They further indicated that these gases were from livestock manures, usage of land and forestry activities. Rwanda being a country that relies on rains for agriculture, the impact of climate change has caused many of the smallholder farmers to be affected on food provisions to their families. Prolong drought has affected both the arid and semi-arid areas with the country leading to food shortages (Tostensen et al. 2016). The country has experience floods, mud slides and erractic rains that have cause so many destruction in the agriculture sectors leading to losses of crops (Nduwayezu et al. 2015) .

The government is implementing polices in order to help farmers to have accessibility to land for farming. Furthermore, farmers have been organized in community-based cooperatives so as they can have accessibility to information such as weekly forecast on weather while at the same time being able to help each other in adoptions of CSA technologies. One of the actions that is required to ensure CSA is implemented is the formulation of policies and frameworks to ensure there is gender equality in land ownerships and that there is a clear guidance on agricultural practices that are favorable to the ecosystem. This strategy has shown a dramatic change in the rates at which CSA technologies are adopted by the farmers in general (Thornton & Herrero 2014). Furthermore, the Government is implementing CSA technologies to help the farmers to produce food in a commercial system. The technologies are planting hybrid that provide farmers with seeds that can with stand the climate, soil conservation to address the infertility problem that is caused by soil erosion. In addition, there is also implementation of crop rotation and intercropping to boost the food production at the same time improve soil fertility (Isaacs et al. 2016; Nahayo et al. 2016).

Research has shown that the smallholder's farmers in Rwanda have been able to implement the CSA technologies due to accessibility of infrastructures, credit facilities and input services. As a

results there has been a lot of empowerment to the farmers on these new technologies (Ya-Bititi et al. 2015).

2.1.2 Kenya

The major staple food in Kenya is Maize and wheat, however for a number of years the country has experience food shortages leading to hunger, starvation and death in some parts of the country. In Kenya the agriculture sectors has experience food shortages due to the unfriendly weather patterns as well as lack of resources (Fleming et al. 2016). Research shows that in Kenya, the agriculture systems relies heavily on rain fed system hence any changes in the weather conditions means the productivity is also affected. Currently climate change, there has been a decrease in productivity among smallholder's farmers who entirely depend on agricultural products hence understanding of why there is low rate of adoption among smallholders farmers become a key concern (Mati 2006). It is also well know that agriculture is a source of employment in many of the country and as result the effect of climate change does not only affect productivity but also income in many of the families. This income limitation from agriculture sectors and hamper other developments among the farmer and poor families (Korir et al. 2015).

Conservation agriculture is the major climate smart technology that is being used in Kenya. It involves the use of minimal soil disturbance to prevent soil erosion. In Kenya, soil erosion has been caused by deforestation and improper cultivation along the sloppy areas. Due to frequent floods in different parts of the county, farmers have been force to use minimum tillage of the land. In addition agroforestry is another technology being advocated by the government in order to prevent deforestation which causes soil erosion (Onduru et al. 2016). Other than the above stated form of CSA technologies some farmers have implement crop rotation and mulching in the farming system (Rockström et al. 2009). However research as equally shown than in some parts of the countries, the use of mulch is going down because farmers are using it as livestock feeds (Giller et al. 2009).

The farmers in Kenya equally have challenges when it comes to adoption of CSA technologies just like other developing countries. Poor infrastructure has made most of the farmers not to access markets for sale of their produce as well as the purchase of farm inputs. This has led to some smallholder farmers using traditional method of seeds preservation. There is also limited markets to sell the products leading to losses. This contribute to demotivation and disadoption by some

farmers. Some farmers do not have access to information and training of the CSA technologies and hence they cannot adopt or use it.

2.1.3 Malawi

Malawi is one of the least developed countries in Africa which been experiencing harsh climatic weather. As a country in sub-Africa, Malawi is a landlocked country that is located in the Southeast of Africa; it is bordered with Zambia on the northwest, Mozambique on the east, south and west and Tanzania on the northeast. In 2014, the country is estimated to have a population of 16.83 million and about 50.7% of the population lived below the poverty line (World Bank, 2014). Malawi economy is highly dependence on agricultural activities hence this make farming to be the back bone of the countries' economies. According to FAO report (2014), Malawi had a GDP of 5.7%, which was largely contributed by agriculture while other sectors had a small percentage of influence. The report further state that agricultural activities accounts for 30% of the GDP and in 2014 there was a growth of 6.1% in agriculture sector due to good weather conditions and supports programs offered to small holders farmers.

It can be noted that for the last 10 years, the level of poverty has not changed for the better but rather continues to deteriorate due to factors such as drought, floods, HIV/ AIDS, poor infrastructures and many other factors. As a result the country has experience a sluggish economic growth and development making (Bank 2014).

In another research, it is noted that women in Malawi are mostly affected by climate change due to their roles within the households that comes as a results of cultural responsibilities. Men and women have different gender roles within the society and that a woman faces more challenges and barriers when it comes to accessibility and control of resources such as natural resources, financial and social resources (Kakota et al. 2010). Kakota further stated that the concept of land ownership in African soil is mostly set for just a few people, mostly men and yet the women are the core producers of agricultural products for family use. Because of this cultural practice and norms, many households have been living in poverty. The research further stated, "Women and men need different capabilities to be able to implement adaptation strategies that ensure sustainable household food security".

Research shows that CSA technology is mostly used by policy makers to make policies in orders to mitigate the effect of climate change and shortage of food security. Women and children are

considered to be vulnerable and are exposed to the risks of climatic change hence it is important for many government agencies to address the impacts of climate change (Lipper et al. 2014). Climate smart agriculture technologies can be used in combination with other CSA or can be used individually.

2.2 Theoretical Framework

Women are key contributors in the agricultural sectors at least in three third of the countries around the world due to their gender roles with the society. However, it is important to note that most of the women especially from developing countries have no accessibility to land ownership due to the cultures that allows men to dominate (FAO, 2011). Cultural norm and value has been a key contributor of gender in equalities leading to an equal distribution of roles with the society. As a result, for a number of years, many women in sub-Sahara Africa have experience development challenges due to lack of accessibility to resources and information. In this theoretical framework, I looked into Gender and social inclusion of female smallholder's farmers in terms of accessibility to resources and their involvement in decision-making process. I further looked at what other variables affects women when it comes to accessing resources and how they affect the adoption of CSA technology.

2.3 Conceptual Framework

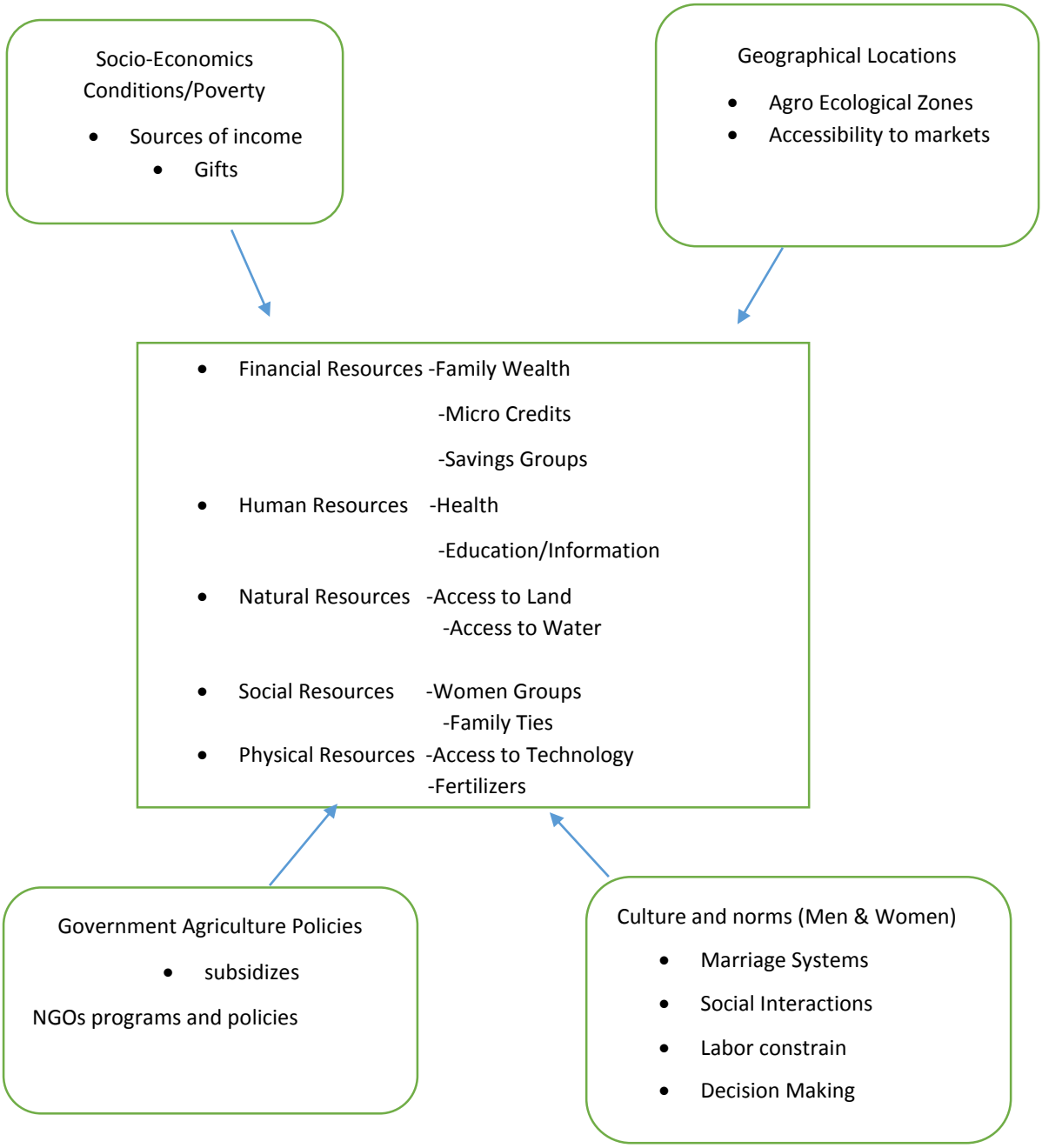


Figure 1.0: Conceptual Framework

Source: Researcher (2015).

Chapter Three

3.0 Research Methodology

A research methodology is always necessary in every research since it states on the different methods that the researcher used in collecting and analyzing the data. In this chapter I elaborated on the different research methods available and the reasons for choosing the method I used in my research.

3.1 Research Methods

A research design is a mode in which it helps the researcher to achieve the research objectives. It can be defined as a means for a study and the plan by which the research is to be executed. Research design specifies the procedures for data collection, measurement, and analysis (Berge, 2001). In this research, I used the mixed methods of research which include both qualitative and quantitative data collection methods. Under the mixed method approach, both the inductive and deductive perspectives was assessed since the mixed method approach involves back and forth movement in order to combine the knowledge from both methods(Newman & Benz 1998). Bryman (2012) recommends the use of the mixed methods of research since it enables a researcher to capitalize on the key strengths of the two methods.

3.2. Population

Population may be categorized in terms of gender, age, geographical location or any other common characteristic. It is "a complete set of individual, cases or objectives with some common observable characteristics" (Mugenda & Mugenda, 2003, p.41).In this research, data was collected from the population in three districts, which include Phalombe, Nkhotakota and Dowa.

3.3. Target Population

Target population was made up of all potential participants that could be used for study purposes (Mugenda 2003) In this research target populations consisted of single women, women from male-headed households, women from female-headed households and because the research focuses on female smallholders. Furthermore the target population will include men since it would have be

biased to use one sex and leave the other. The target population was selected on the judgmental basis due to accessibility and understandability of the topic in question.

3.4. Sample Size

Kothari (2004) define sampling to be a procedure that a researcher uses to gather people, places or things in order to study. It is a way of selecting a portion of population so as to draw some conclusion about the entire population. In this research, the sample size consisted of 250 male and female smallholders from every district who are adopters and non-adopters, two focus groups from every district was also included. The sample size was entirely selected from the target population. The sample size was selected based on the ration of 60% women and 40% men. From the 60% of women, the sample was divided further into 60% women who are adopters while 40% who are non-adopters. In addition the 40% men sample was divided in to 60% who are adopters and 40% who are none adopters.

3.5. Sampling design or techniques

There are two types of sampling designs: probability and non-probability sampling. Probability sampling concept is based on the random selection with a major assumption is that each population element is given equally known chance to be selected (Cooper& Schindler, 2003). Four main techniques can be used to select a probability sample. These includes simple random sampling, systematic random sampling, cluster sampling, and stratified random sampling (Saunders, Lewis, & Thornhill, 2003). Non-Probability can be described as a sampling is a method in which observations are not selected in a randomly manner but rather based of the objectives the researcher wants to achieve. Example of non- probability are purposive sampling, convenient sampling, quota sampling and snowball sampling (Bryman 2012).

Since the study was using mixed methods, the study used non-probability sampling design by using purposive sampling techniques to select the respondent for the interviews, questionnaires and focus groups. The purposive sampling is a method where the researcher selects the subjects based on specific characteristics. The sample is usually selected with a purpose in mind (Bryman 2012). The purposive sampling helps the researcher to select a sample that had knowledge on the researched area and this helped to reduce the chances of biasness.

3.6. Types of data

According to Cooper and Schindler (2003), data can be classified as primary and secondary data. Primary data is a data which is collected and captured for the first time for a specific reason and it's gathered from the original sources who are respondent. Secondary data is data which is gathered from existing sources such as journal, magazines, books and this type of data was usually meant for other purpose other than the researched area. A qualitative methodology deals with non-numerical data, whereas quantitative methodology deals with numerical data. A good research is one that uses both qualitative and quantitative data (Bryman 2012). In this research, I used both the primary and secondary sources. Primary sources was through key interviews with female smallholders and focus groups in Malawi. While on the secondary data, I used journals, books, magazines, reports and research that has been done on the CSA technologies.

3.7. Data Collection Tools

Cooper & Schindler (2003) stated that, data collection tools are tools that are used in gathering empirical evidence in order to gain new information about a situation and been able to respond to the questions that led to the carrying of a research. Data collection tools include questionnaires, interviews, observations which include survey research, field research, unobtrusive research, evaluation research and experiments.

Sommer (1987), defines questionnaires as series of written questions on topics about which respondents' views and perceptions are sought. Questionnaires maybe made up of both open-ended and closed-ended questions. Open-ended or unstructured questions are those for which alternatives are provided while closed-ended or structured questions do not provide alternatives for the respondent to choose from (Berge, 2001)

According to Robson (2002), interviews assist the researcher to confirm and clarify some items and also allow interactions with interviewees in order to make observation. Berge (2001), defines interview as a conversation between two or more with a purpose of gathering information, and provide further information that could have been missed out in questionnaires in a study.

3.8. Collections Procedures

In this research I used self-administered questionnaires with both open-ended and closed-ended questions for collection of data. Since Malawi is a new country and I was not familiar with culture and norms, I used research assistant to administer the questionnaires. The questionnaire was administered by the research assistance who were well trained prior to the data collection dates. The questionnaire was distributed in both the three districts. The researcher also carried interviews and interact with the focus groups in order to gather information. Data was recorded using audio recorders and video was used where possible in order to assist the researcher to understand better.

3.9. Data Analysis

Data was analyzed using descriptive statistics. Initially the questionnaire was edited and coded before the analysis. Analysis was done using SPSS software and Microsoft excels. The data was also analyzed using percentages, tables and graphs. The Interviews recorded and data from the focus group was separated, coded and analyzed.

3.10. Ethical considerations

Bryman (2012) recommends that a researcher should be careful when carrying out research by ensuring all ethical aspects of the research are mentions. This is to avoid causing harm to the respondents through asking embarrassing and irrelevant questions, making use of threatening language or making the respondents nervous. During the research period, I explain the purpose of the study to the respondents and interviewees and I assures them of confidentiality of their responses and identities. I also inform them that the research was intended for the purpose of the ongoing project on adoption of CSA technology and it was part of student dissertation for the completion of my master program. The information and data collected was handle with due diligence so as to maintain confidentiality.

3.11. Expected outcomes

The results of the research was to be used as a guidance in policy making and implementing of climate change adaptation programs. Also I am using this outcomes to complete this master's dissertation for the purpose of graduation.

Chapter Four

4.0 Data Analysis, Presentation and Interpretation of Findings

In this chapter the data collected is analyzed and discussed in details. Data analysis results was done from the semi structured interviews that were randomly issue to farmers in the three districts (Phalombe, Nkhotakhota and Dowa). In addition to the interviews conducted there was focus group discussion (FGD) were conducted on the three districts. In each district there were two FGD in which one was for men and the other women. The main purpose of FGD was to get opinions and information about the adoption of CSA technology among the female small holder's farmers in Malawi. By using FGD, I would be able to get the exact information from the farmers about the adoption of CSA technologies. Research indicates that FDG are normally used to enhance the validity of data since it encourages faces to face interactions with the respondents (May, 2001). This section is divided into different parts as per the key questions on the questionnaires.

4.1. Participants in the three districts

Participants in the three districts were selected randomly through the help of the agriculture extension workers. This was because the extension workers were in a position to identify both the adopters and the non-adopters smallholder's farmers. A total number of participants in the survey of smallholder's farmers was 250 however from table 1.0 only 229 responded. The researcher opted to for both the male and female small holders farmers because the research is gender oriented and for the results to be valid there is the need to include both genders. In addition to the inclusion of both genders, Malawi has both the matrilineal and patrilineal system of marriage hence I found it to be wise to have both genders responding to the questionnaires.

Table 1.0: Gender of the participants

Districts	**Adopters**		**Non-Adopters**		**Total**		**Overall Total**
	Male	**Female**	**Male**	**Female**	**Male**	**Female**	
Phalombe	17	23	4	16	**21**	**39**	**60**
Nkhotakota	16	36	5	50	**21**	**86**	**107**
Dowa	12	30	12	8	**24**	**38**	**62**
							229

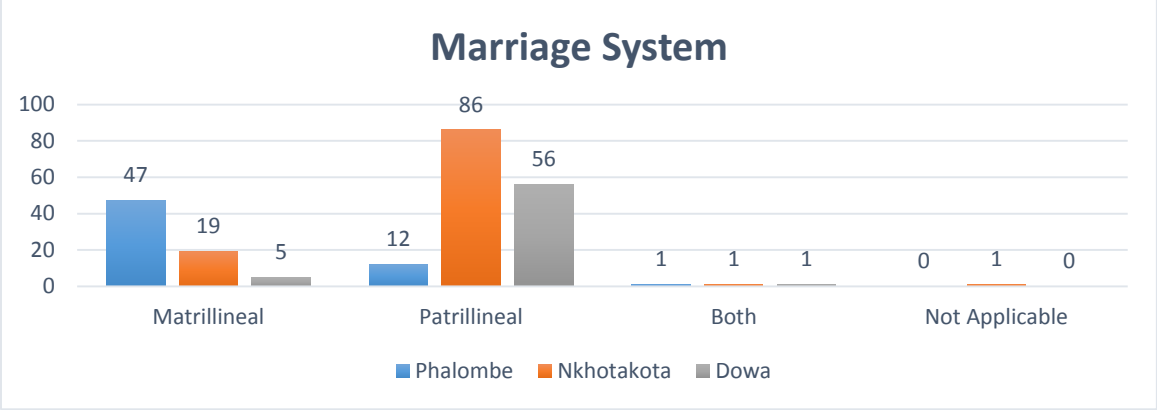
The number of smallholder's farmers in the 3 districts varied due to the fact that some districts had more farmers a compare to others. The time in which the researcher went to the field was a farming season hence the availability of farmers to come for the interviews posed to be a challenge. Nkhotakota had the highest number of farmers who showed up for the interviews and the researcher managed to interview 107 small holders' farmers. Both Phalombe and Dowa had a total of 60 and 62 smallholder farmers respectively.

4.2. Marriage System

In Malawi they practice both the patrilineal and matrilineal marriage system. The marriage system was important in the analysis since it helps me to understand who has access and control of the household land. According to Lunduka (2009)

> "Customary land rights offer access to land and security of tenure to many poor households in sub-Saharan Africa (SSA). These rights differ according to cultural and matrimonial residence practices, providing different property rights and land ownership. The ways in which access to land is regulated, property rights are defined and land ownership conflicts are resolved have broader implications beyond agricultural production".

Graph1.0: Marriage System

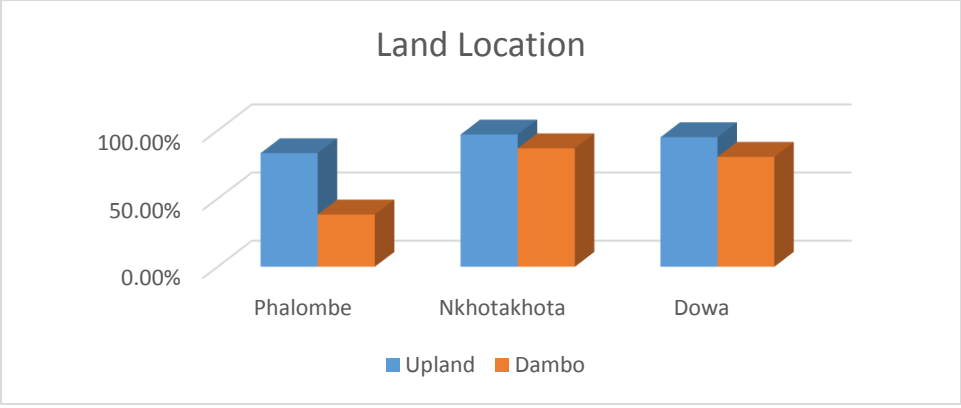


From graph 1.0 the 3 districts practice both the matrilineal and patrilineal marriage system. However, Phalombe had the highest number of matrilineal marriage of 47 participants practicing it while Dowa had the least of five as per the survey.

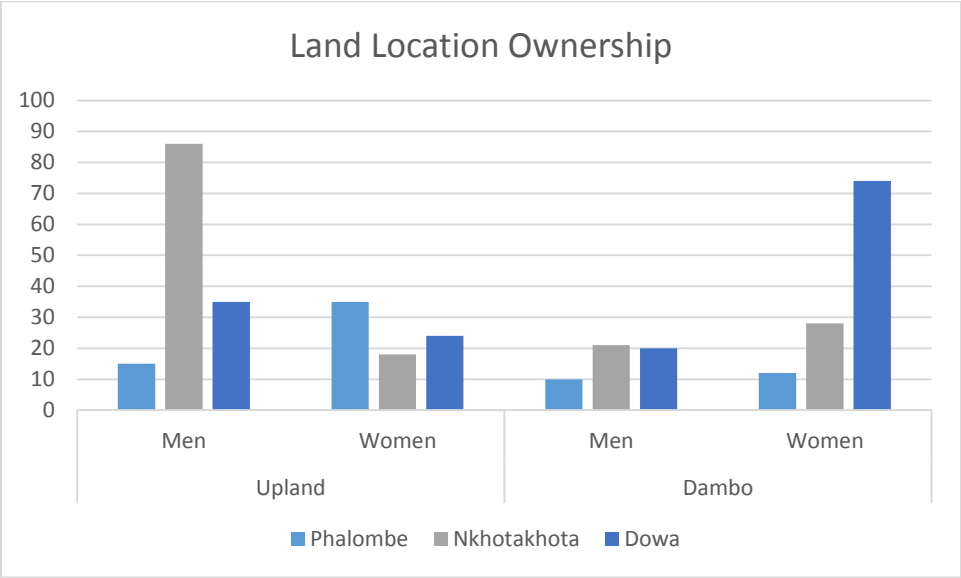
This comparison was important for the survey since it tell on who has influence on land ownership. In Malawi Men tend to have control over lands and they determine what to grow on those lands (Citation needed). This plays a critical role when it come to the adoptions of CSA technologies on female smallholders. In Nkhotakhota, 86% of the households farmers are practicing patrilineal marriage meaning that the men have a control of the land. However in Phalombe, even though there is the highest number of matrilineal marriage system, men are still in control of the land.

4.3: Land Ownership

Graph 1.1: Land Location



Graph1.2: Land Location Ownership



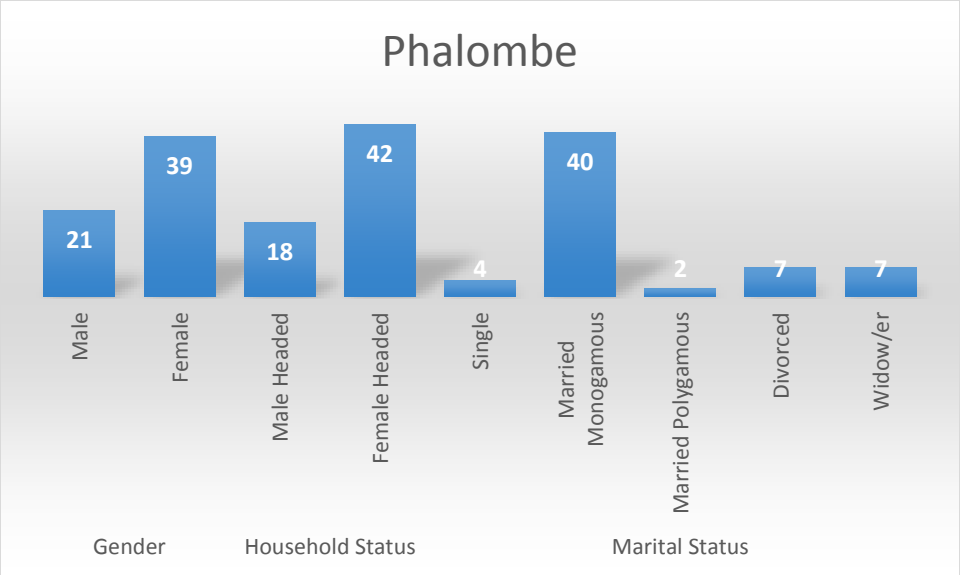
From the table 1.2 based on the survey both districts have lands in the upland areas as well as the Dambo. The Upland is a type of the land that is far away from the water based system and hence it relies the rainfall for crop production. Dambo on the other hand is a land that is located closers to a river or a lake. Most farmers with a dambo land they grow rices with other crops.

The table above shows that for both the 2 districts (Nkhotakhota and Dowa) they have an almost equal location of pieces land in the upland and dambo. However phalombe has less access to land the dambo

4.4 Household characteristics

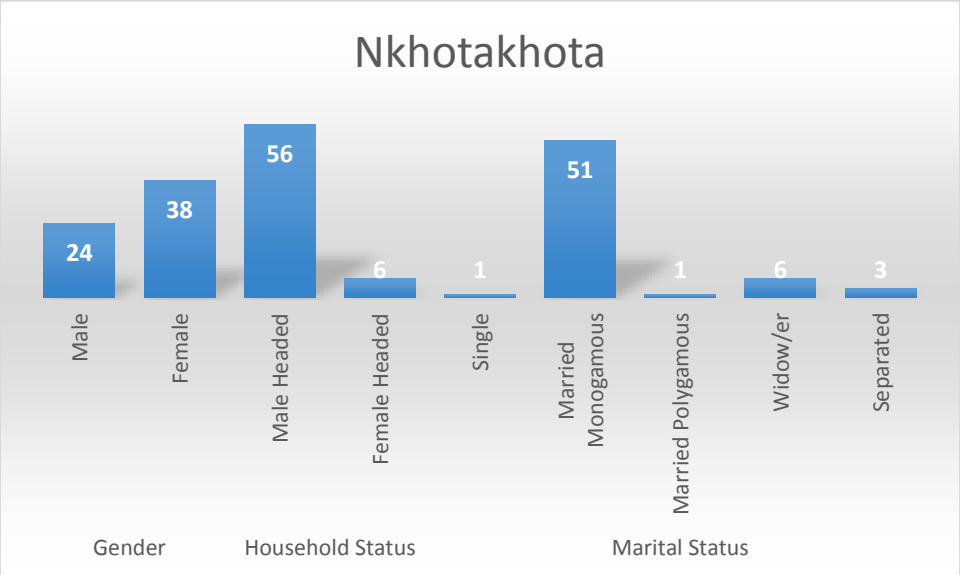
As part of the research, it was important for the researcher to identify the key household characteristics that may have influence on the adoption of CSA technologies among female smallholder's farmers in Malawi. This was intended to help the researcher know on what influence this characteristics have on the farmers.

Graph1.3: Phalombe Household Characteristics



From the graph 1.4 above, out of 60 households who participated on the survey, there were 42 households that were female headed. This is due to the fact that Phalombe is a district that practices matrilineal marriage system. This can be a positive factor for the female smallholder's farmers who wants to adopt CSA technologies.

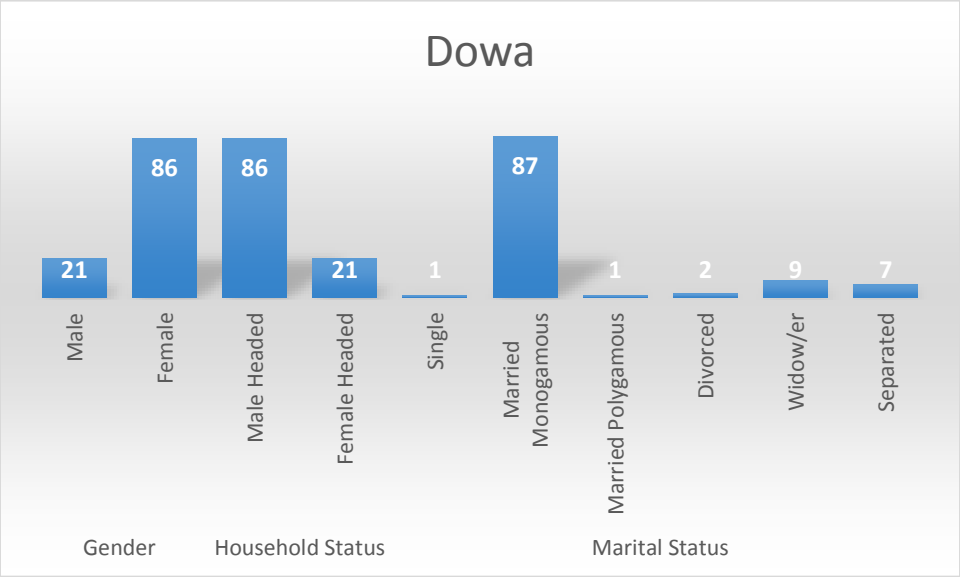
Graph1.4: Nkhotakhota Household Characteristics



In Nkhotakhota district, most of the households were practicing patrilineal marriage systems. The graph 1.4 above shows that 56 out of 62 households that participated in the research were male

headed. Since in Malawi land is controlled by male, for this households its important for the male to have full knowledge of CSA technologies in order to increase the adoptions rate among the female farmers. Only 6 of the households were female headed.

Graph1.5: Dowa Household Characteristics



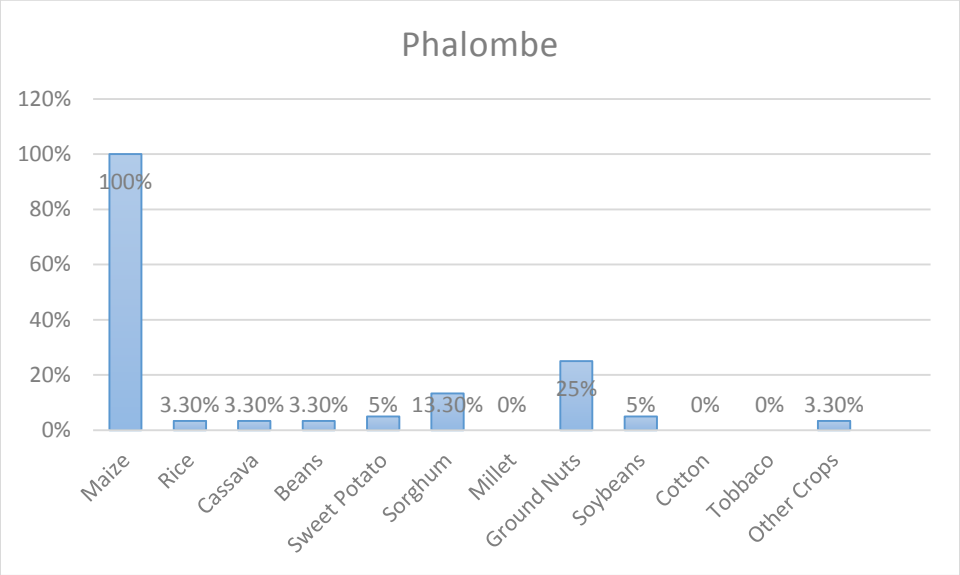
From the graph 1.5 above, Dowa is a district that practices both matrilineal and patrilineal marriage system. According to the data collected there were 86 out of the 107 households that were male headed. The remaining 21 households were female headed households.

4.5 Crop system for subsistence and sale

The researcher tried to find out the crops that were grown for food consumption and for sale purposes. This analysis helped me to understand the reason behind the adoption of CSA technologies among the female smallholders farmers in Malawi and to what scale are farmers adopting these technologies in small scale farming. In most of the African countries, Maize is the main staple food and used its used as a source of carbohydrates in daily dietary. As a results many of the households have to grow maize every season. The second most preferred crops in all 3

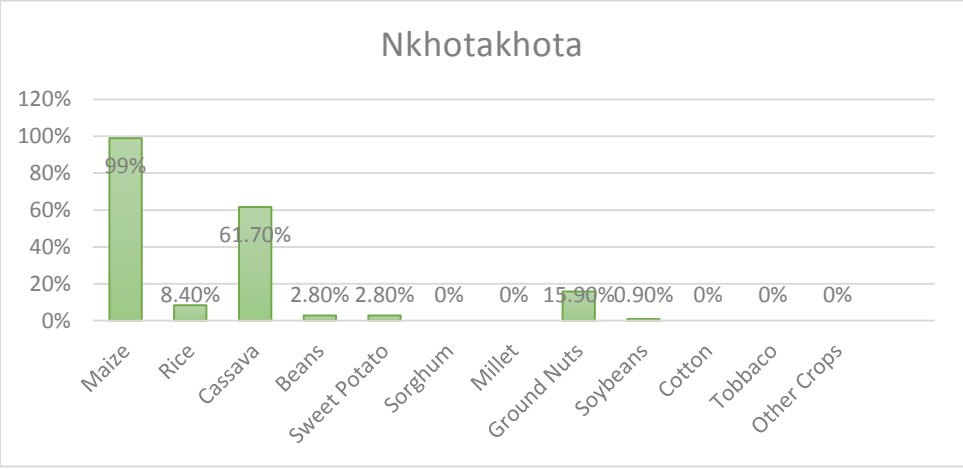
villages is ground nuts however Dowa has the highest percentages (51.6%) of households growing groundnuts.

***Graph 1.6: Phalombe* Crop system for subsistence**



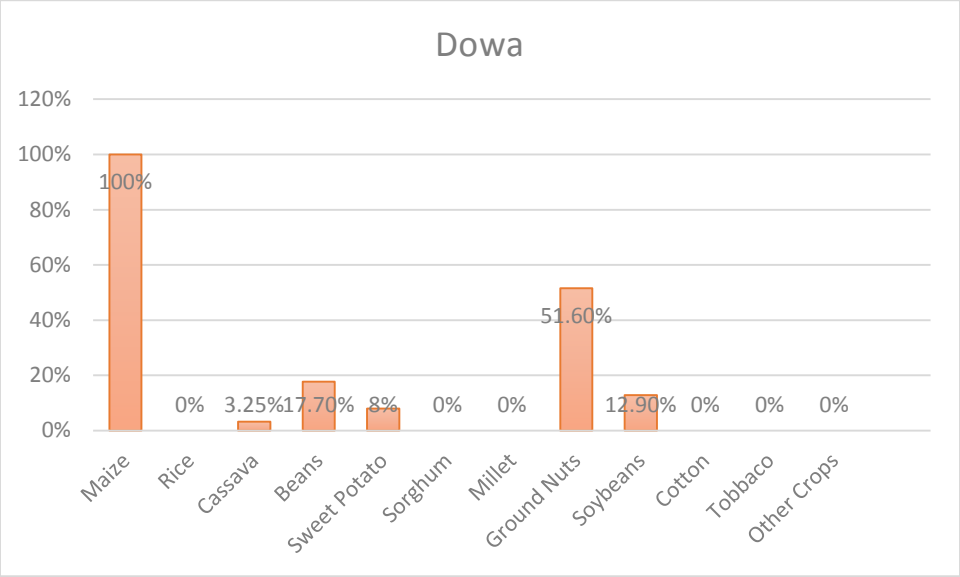
In phalombe, maize is the most preferred crop for consumption purposes followed by groundnuts and sorghum. Other crops that were grown by smallholder's farmers amounted to 3.3%. These included simsim, sunflower and pepper. In addition, the graph shows that no farmer was growing cotton or tobacco for subsistence use.

Graph 1.7: Nkhotakhota Crop system for subsistence



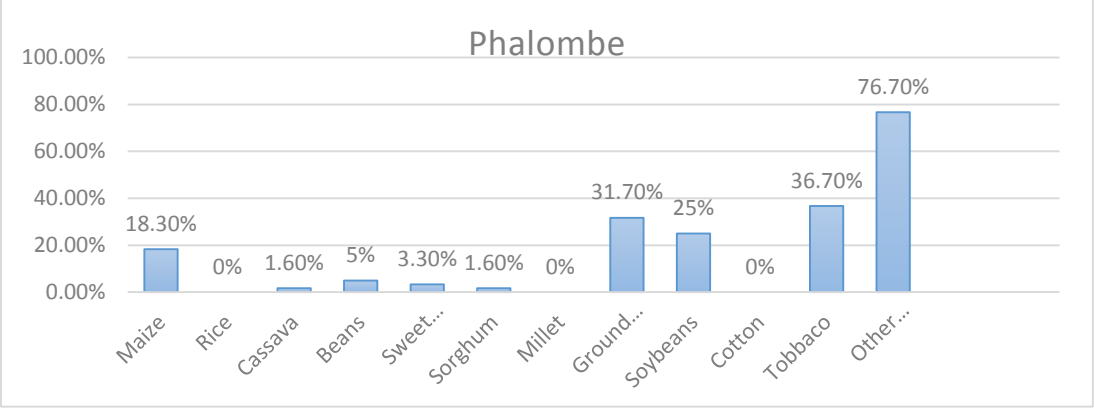
In Nkhotakhota the most grown crops is maize at 99%. In addition, the study shows that in addition to those crops mention above, 61.7% of the farmers grow cassava as a crop for consumption as compare to 2/3 % in the other two villages, Furthermore, the farmers were growing groundnuts and rice. Most of the farmers in this region had a piece of land that was closer to water base (Dambo/Dimbo). This was because Nkhotakhota district is located closer to Lake Malawi.

Graph 1.8: Dowa Crop system for subsistence



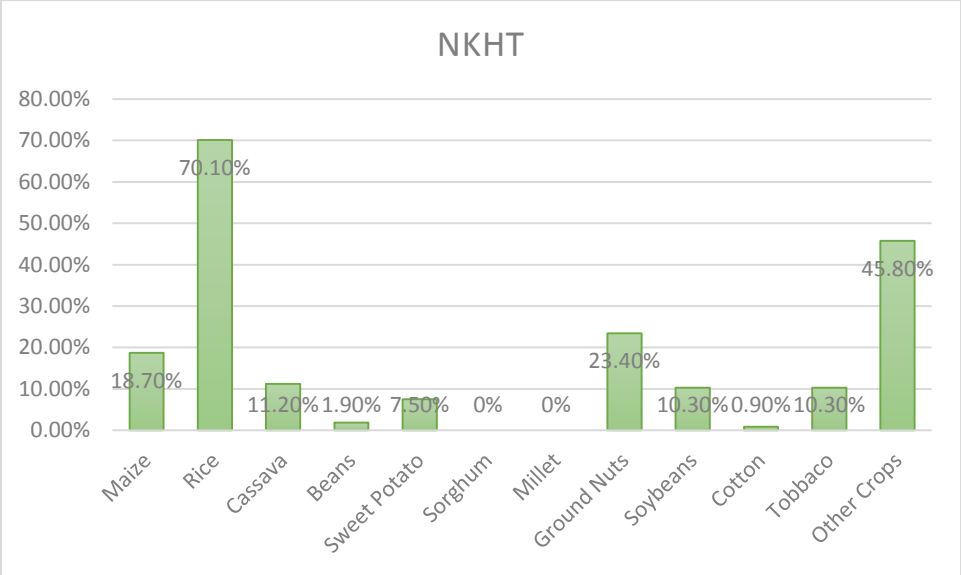
In Dowa district, the smallholder's farmers were growing maize and groundnuts at the rate of 100% and 51.6% respectively. In addition, the farmers were cultivating beans and soybeans. The farmers did not grow rice, sorghum, millet, cotton or tobacco for their personal use.

Graph 1.9: Phalombe Crop system for sale



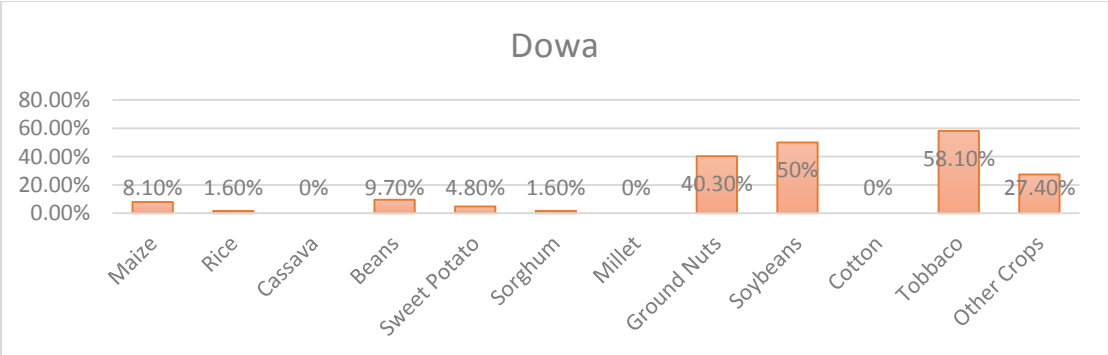
From the above graph 1.9, In Phalombe 76.7% of the participants were grown other crops for sale purposes. These crops included sunflower, simsim and pepper. The farmers were also growing tobacco, groundnuts, soybeans and maize and the rate of 36.7%, 31.7%, 25% and 18.3% respectively.

Graph 2.0: Nkhotakhota Crop system for sale



According to the graph 2.0 above, in Nkhotakhota crops for sale differed as compared to phalombe, as the most preferred single crops for sale was rice at the rate of 70.1% followed by other crops (Simsim, Sunflower and Pepper) at the rate of 45.8%. There was other crops such as groundnuts, maize, cassava, soybeans and tobacco that were grown for commercial purpose. This was because Nkhotakhota is closer to Lake Malawi and as shown in table 1.2, where 86.7% of the households hold lands which was located in the dambo areas which is suitable for rice cultivation.

Graph 2.1: Dowa Crop system for sale

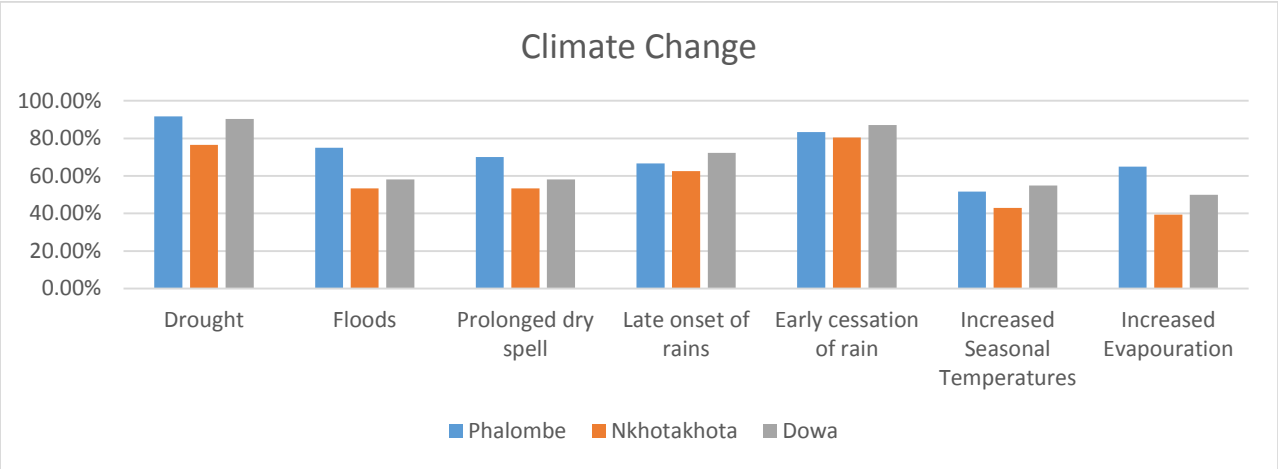


In the third district of the survey, Dowa, the most preferred single crops for sale were tobacco and Soybeans cultivated by 58.1% and 50% of the households. In addition, the survey shows that smallholder's farmers preferred others crops by 27.4% of the household. These other crops were similar as to other districts.

4.6 Climate change and its impact on agricultural production and livelihoods

In order to understand the rate of adoptions of CSA technologies among female smallholder's farmers, the survey analyzed the climate change effects in the 3 districts for the last 30 years. According to the graph 4.6 above, Phalombe has been experiencing the impacts of climate change followed by Dowa. Even though Nkhotakhota is experiencing the same challenges of climate, according to the research done, the impacts are a bit low as compare to the other 2 district. Phalombe and Dowa is experiencing highest impact of drought and early cessation of rainfall. The researcher further FGD in the 3 districts. This report represents opinions of community members from the focus group discussion (FGD) that was conducted to uncover information regarding climate change and related responses to create resilience of smallholder farmers to the impacts of climate change. The FGD were intended to get collective opinion of the community regarding climate change related issues and adoption of Climate Smart Agriculture (CSA) practices being promoted and adopted in the community.

Graph 2.2: Climate Change



4.6.1 Phalombe

The male farmers from Phalombe indicated that over the past 30 years there has been a noticeable change in the climate of the area. The community members cited that increased pattern of floods from 1991 to 2015 as the main challenge that has hit their area as well as the district. They also cited increasing pattern of prolonged dry spells over the recent years as another is climate related challenge. I asked the male FGD to cite what were the current indicators of the climate change in the area. According to the male farmers within the community indicated that floods, stormy rainfall and prolonged dry spells are the climate related changes that they are experiencing in the area. They further ranked the climate related impacts depending on their frequency in the following ascending order: Floods, Prolonged dry spells, Stormy rains that cause lodging of crops

According to the farmers their ranking is justifies as follows:

Floods: It was reported that the area has been experiencing floods since 1991 to date. It was due to the increased intensity of floods that gave the community a consensus that this is a climate related challenge and the community needs to deals with. The severity of the floods have been varying in the years they have been occurring but the ultimate results have been washing away of crops during the agricultural season. *Prolonged dry spell*: The community ranked this as second on the list because although it has had devastating impacts evidenced by severe decline in quantity of harvest to complete crop failure the frequency thereof is relatively low. *Stormy rains:* This was equally recognized as the climate related challenge however farmers indicated that the result are not as devastating as the first two because of the alternatives and simple adaptation measures that can counter such an impact once it occurs. For instance farmers can take advantage of the high levels of moisture in wetland and grow other crops as well as restore the lodged crops once the rains have ceased.

According to the female smallholder's farmers, sometimes they receive a lot of rainfall and sometimes dry spell which result in wilting of crops. They were planting in December in the past days but now they are still planting. When the rain comes very late, it also stops early. According to them, the following changes related to climate were listed. They said that sometimes, they receive a lot of rainfall which destroys crops in their fields, experience prolonged dry spell, erratic rainfall, early cessation of rainfall, high temperatures, drought and late rains. They said in the past, in January they were weeding in their fields but nowadays, they still plant crops in January which

shows that climate has really changed. After we discussed the effects of climate change, this is how they ranked according to seriousness: Late onset of rainfall; High temperatures; Drought; erratic rainfall.

It was reported that majority of the community members in the area predominantly depend on smallholder farming. Given that smallholder, farming is associated with small land holding size high dependency on natural resources, the majority of the people solely dependent on yields from rain-fed agriculture. It was thus reported that occurrence of floods or prolonged dry spells decreases agricultural output especially for rain-fed. Because of their high dependency on rain-fed agriculture most of the households run short of food (Maize as a staple food). One of the vulnerability factors that has also affected the farmers in the area is small parcels of land on which they practice farming. The land holding size for the area is very low because of the population density of the area as such most of the agricultural proceeds play a vital role for survival of some smallholder farmers.

On how the changes have affected their agriculture productions, they said that their crop productivity has been decreased and their crops have been attacked by pests and diseases. High temperatures has led to existence of certain pests and diseases that cannot be treated easily. Livestock's in this area is used as a source of proteins as well as economic gain. These changes has affected their livelihoods, they said that there has been food insecurity. They added to say that increased temperatures has affected their health leading to certain diseases hence they do not have energy to go and work in the field. They also added to say that it has resulted in malnutrition for some children in their homes.

4.6.2 Nkhotakhota

The men indicated that over the past 30 years there has been a noticeable change in the climate of the area. The community members were quick to point out that they have observed change in the rainfall patterns. It was reported that in the past rains could start early November (Chizima Lupsya – First rains that fall indicating onset of rain season) and the strong rains that could signal as the planting rains (Chikukula tsano) could come end of November. They pointed out that rains could usually stop in May – about seven months of rains. However they have noted that the onset of rains

has shifted from November to December and that the rains now cease in the month of March, shrinking the rain season from about seven months to about 4 months.

The community members ranked the climate related impacts depending on their severity in the following ascending order: early cessation of rains; prolonged dry spells; stormy rains that cause lodging of crops; late onset of rains and decline in amount of rains.

The farmers indicated their justification of the ranking to be as follow: Early cessation of the rains was the first because previously the farmers could take advantage of the long rain season and grow other crops which could grow through winter and mature at the end of the winter. This could provide extra food because they could harvest twice in the year. This will guarantee them of food throughout the year while at the moment they will only grow once and the winter rains (June – July) are not falling anymore thus food production has been limited to one growing period which has resulted into shortage of food.

Prolonged dry spells were ranked second because of the serious challenges they equally pose on crop production. Prolonged dry spells occur during growing/rain season while crops are in the fields as such if they occur it may result into either wilting or complete drying of crops in the middle of the season. If that happen farmers cannot plant again given that within a short period rain season will be over and replanted crops will equally dry up. This will therefore entail serious food shortage or complete hunger in area if crops dried up.

Stormy rains were ranked third because of their relative low frequency compared to the first two and that farmers can restore/raise their crops if they fell due to stormy rains.

Late onset of rains was fourth because if such a phenomenon occurs the farmers can just wait until the rains start then they plant. It was however considered as a challenge because if the rains start late it may equally mean further shortening of the growing period.

Decline in the amount of rains was the lase because farmers indicated that despite that the quantity might have declined, if evenly distributed throughout the growing period, the harvested is still high as maize does not need too much rains thus it was a concern but not a grave as the other indicators.

Concerning the impact of the indicators on livelihood the community in which the interviews were conducted is located less than two miles from Lake Malawi. This lake has for a long time been a reliable source of livelihood as most of the people would engage in small scale fishing and sale of fish to either traders from major centres or random buyers along the tarmac road. However due to

decline in stocks of fish in the lake the community member shifted from primarily fishing to smallholder farming. The community members indicated that the stated indicators have had negative impact on agricultural production as well as on their livelihood. It was reported that farmers grow Cassava as another staple food along with Maize (main staple food crop in Malawi). The challenge with cassava varieties they grow is that it takes 12 months for the tubers to be ready for consumption as such maize still plays a critical role in balancing food security in the area.

Female smallholder farmers also shared views on climate smart agriculture technologies. According to them, the following changes related to climate were listed. They said that sometimes, they experience floods, little amount of rainfall, late rains which result in late planting, early cessation of rainfall, dry spell even for two to three weeks, heavy wind storms, heavy winds and erratic rainfall. After we discussed the effects of climate change, this is how they ranked according to seriousness: .Late onset of rainfall; little rainfall; dry spell; early cessation of rainfall; heavy wind storm; Floods

On how the changes have affected their agriculture productions, they said low productivity when the rain stops early, change in sowing seasons (late harvest), pests and diseases when there is dry spell, wilting of plant crops, heavy wind storm destroys crops and houses and it also results in late rains. Cassava farmers do not harvest because the cassava rot when there are floods and crops are washed away. On how the effects have affected their livelihoods, they said that there has been low food security, low income levels due to low crop yield, shortage of water, wilting of crops due to lack of water for irrigation, heavy wind destroy buildings and other properties and spend a lot of money for maintaining their houses.

4.6.3 Dowa

According to male smallholder farmers, the following changes related to climate were listed. They said that they receive late rains, early cessation of rainfall before crops get mature, high temperatures, floods which lead to soil erosion, heavy wind storm and prolonged dry spell. After we discussed the effects of climate change, this is how they ranked according to seriousness: Late onset of rainfall; prolonged dry spell; early cessation of rainfall; floods; heavy wind storm; high temperatures

Concerning how the changes have affected their agriculture productions, they said that when they experience late rains, they do not harvest enough crops and harvest very late, wilting of plant crops hence low harvest when there is dry spell, floods lead to soil erosion hence crops are destroyed, heavy wind storm destroy crops and buildings which injure some people who in turn cannot return to their farms and high temperatures lead to pests and disease attack as a result crops die in the farm. On how the changes have affected their livelihoods, they said that food stored from previous cropping season finish early when there is late rainfall. They also said that there is always food insecurity and they spend a lot of money buying expensive food. They added to say the children suffer from malnutrition in their homes. When they are high temperatures, their crops are attacked by pests and diseases.

Following the findings of the survey, female farmers indicated that changes related to climate have been experienced for a number of years. They said that they experience floods, late rains, early cessation of rainfall, and little amount of rainfall. After we discussed the effects of climate change, this is how they ranked according to seriousness: 1.Little amount of rainfall was ranked number one while others argued that late onset of rainfall should be on number one; 2. Floods which increase soil erosion 3. Early cessation of rainfall

The farmers indicated that the changes have affected their agriculture productions, they said low productivity. On how the effects have affected their livelihoods, they said that there has been low food security in their homes.

4.7.0 Adoption of CSA technologies

From the research the researcher started by finding out how many farmers were practicing CSA technology. As earlier indicated a total number of 60 farmers were interviewed. This included both women and men with 33% and 65% respectively stating that they were aware of the CSA technologies. This results showed that a number of the farmers have heard about CSA technologies in one way or another. Only 1.67% of the farmers interviewed has no clear understanding of what the CSA technologies was all about.

In a further analysis, 26.67% of the total interviewed farmers were female who stated that they are not practicing CSA technologies while 36.67 of the female farmers are practicing. This analysis is

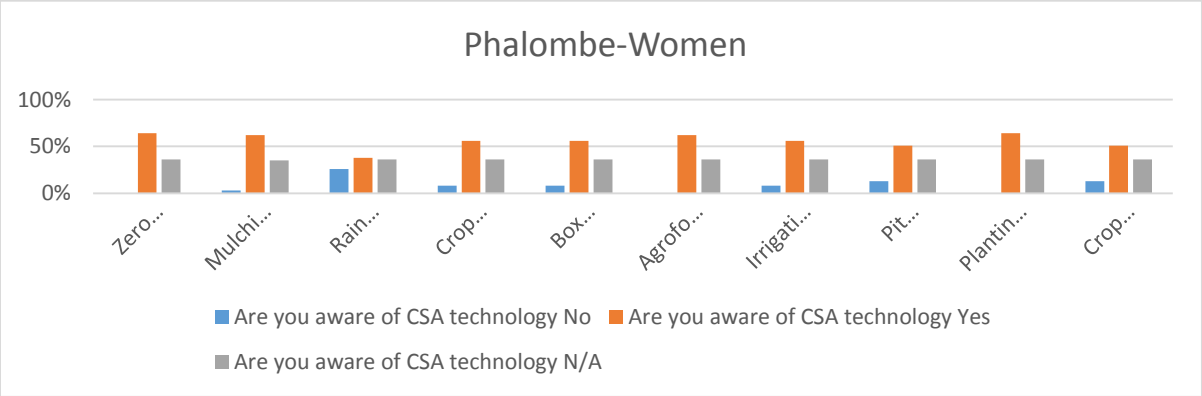
important since it helped the researcher to understand the adoption rate of climate smart technologies among female smallholder's farmers in that area.

4.7.1.0 Adoption rate of CSA Technology in Phalombe District

Out of the 39 respondents from Phalombe who are smallholder's farmers, 59% (23 farmers) do practice CSA technology while 41% (16) did not practice CSA technology.

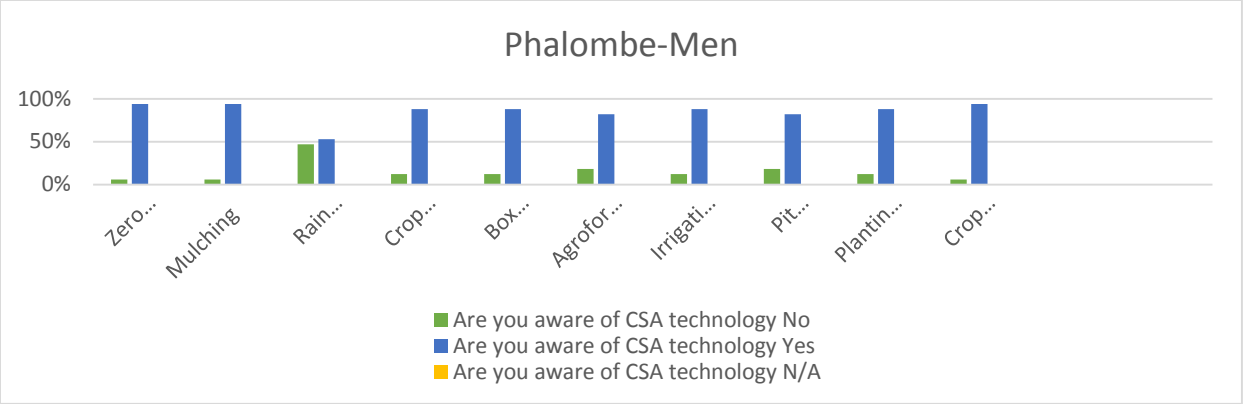
4.7.1.1Are you aware of CSA technology

Graph 2.3: Phalombe-Women



Female smallholder farmers said that they have heard about climate smart agriculture technologies and they got the information from Extension workers and Lead farmers. However from the focus group discussion even though most of this farmers have adopted some CSA technologies, they stated that there are some technology that they had not heard about them. They gave an example of rain water harvesting. From the graph above most of the female interviewers indicated they were aware of CSA technology. Zero tillage, mulching, planting hybrid and agroforestry show that most of the farmers were more familiar about them than other CSA technologies. However it was clear that most of the female farmers were not aware about rainwater harvesting. In addition an average of 38% of the respondents in Phalombe did not practice CSA technology hence, this question was not applicable to them.

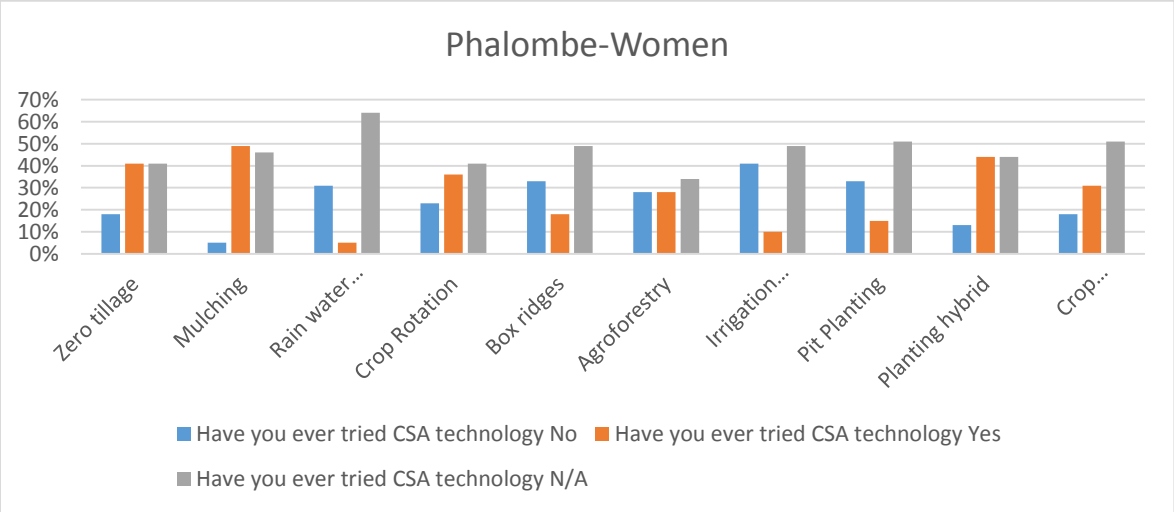
Graph 2.4: Phalombe-Men



According to the male farmers FGD in Phalombe, climate smart agriculture technologies were introduced through the CABMACC project in the area. The project works through the government extension system and lead farmers to work with farmers who show interest in the technologies. It was noted that lead farmers are frontline personnel that are actively facilitating implementation of the project on the ground. As a results this project made most of the farmers to be aware of the CSA technologies. From the graph above, it is clear that most of the men were aware of CSA technology with an average of 80% as compare to the women who represented an average of 58%. Zero tillage, Mulching and crop diversification are the most prefer CSA technologies by the male farmers.

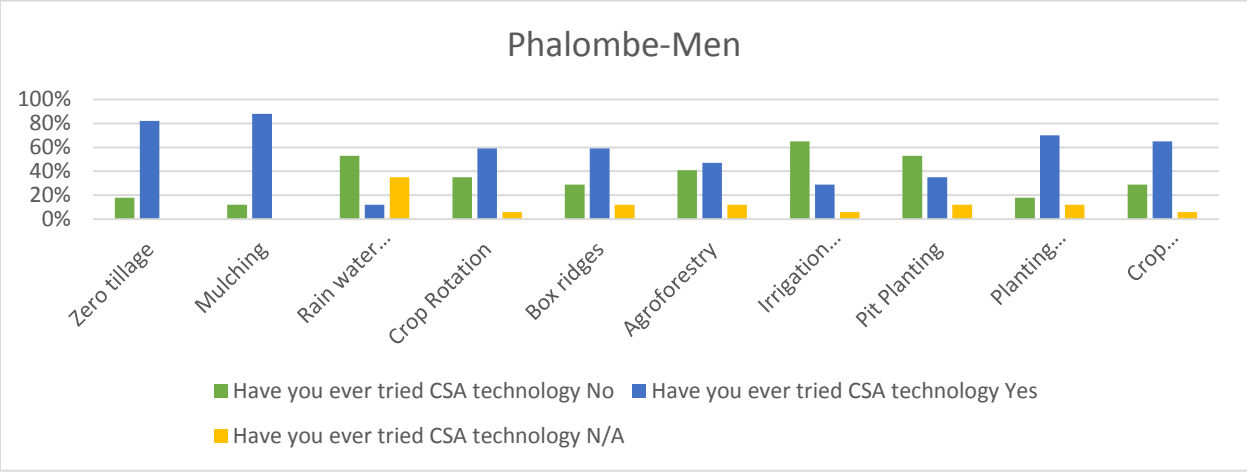
4.7.1.2 Have you ever tried CSA technology

Graph 2.5: Phalombe-Women



On whether the female farmers have ever tried the CSA technologies, most of the farmers had not tried the CSA technologies except the most common one which included zero tillage, mulching and planting hybrid which had a rate of 41%, 49% and 44% respectively. However there was an indication that agroforestry, crop rotation and crop diversification were slowly being tried by the female farmers even though it was at lower percentages. Only 5% of the female farmers had tried rain water harvesting.

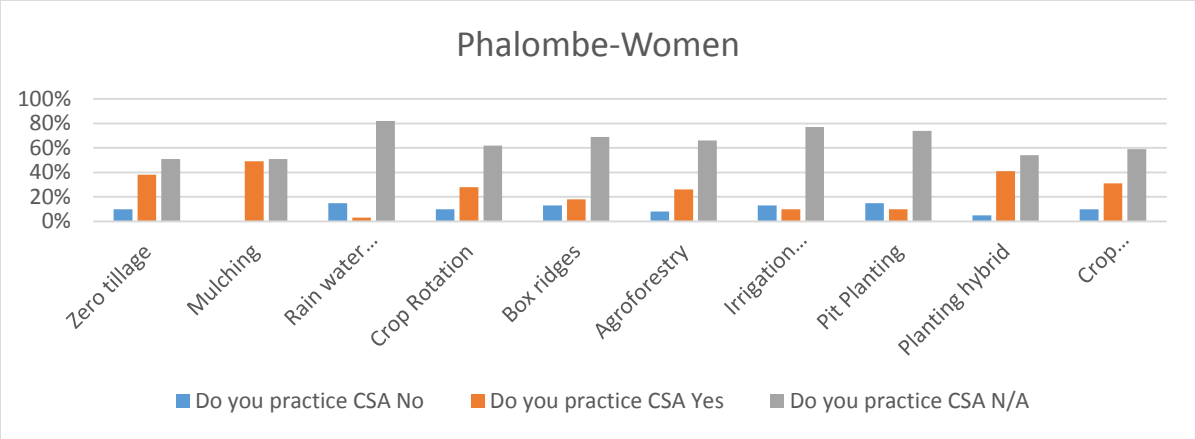
Graph 2.5: Phalombe-Men



According to the research, most men had tried zero tillage, mulching, planting hybrid and crop diversification with the rate of 82%, 88%, 70% and 65% respectively. In addition, crop rotation, box ridges and agroforestry were also being tried by some of the male farmers. Rain water harvesting had been tried by only 12% which was higher as compare to women.

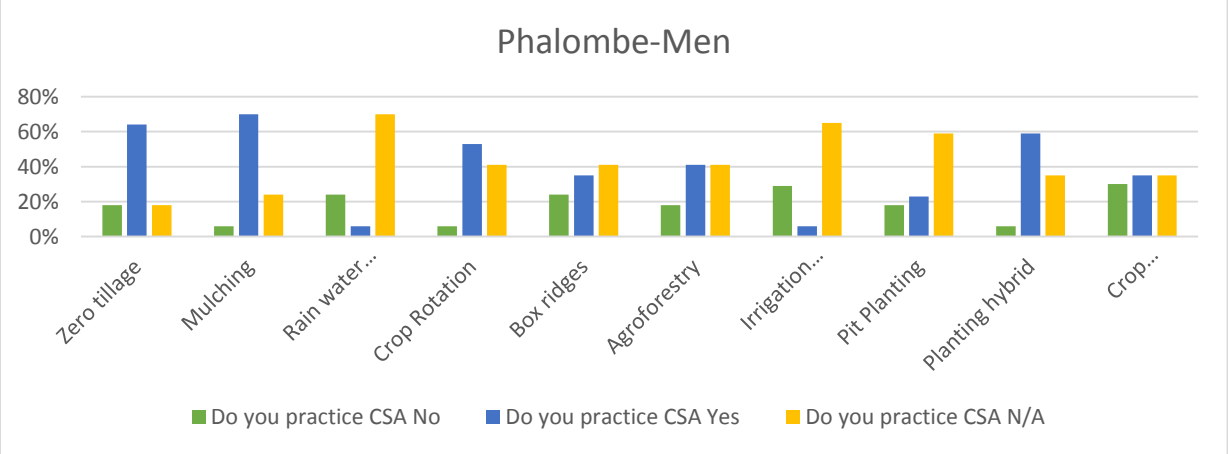
4.7.1.3 Do you practice CSA

Graph 2.6: Phalombe-Women



The research also tried to find out if the farmers were currently practicing these CSA technologies. From the survey carried out, the female farmers in Phalombe indicated that they mostly practice mulching followed by planting hybrid and zero tillage at the rate of 49%, 41% and 38% respectively. Rain water harvesting remain to be the least practiced CSA technology with only 3% of the female farmers practicing it.

Graph 2.7: Phalombe-Women



From the male farmers, the research show that mulching remained to be the most popular CSA technology with the rate of 70% followed by zero tillage and planting hybrid with the rate of 64% and 59% respectively. Rain water harvesting had the least number of users who had practice it.

4.7.2.0 Farmers Adoption of CSA technologies in Phalombe

The community members indicated that most of the adopters have adopted multiple technologies given that they are complementary and that farmers have the ability to handle them all together. Common CSA technologies in the area include mulching, zero tillage, pit planting, box ridges,

agroforestry and manure making. Farmers are implementing the first three technologies to counter the impact of prolonged dry spell although on secondary basis the technologies enhance soil fertility. Box ridges are a means of controlling erosion while enhancing water infiltration in the soil. Agroforestry (especially fertilizer trees) and manure making are primarily for fertility enhancement although they can equally play other vital roles like minimizing evapotranspiration and controlling soil erosion.

During the period of data collection farmers indicatedin the FGD that it had taken about three weeks since they had rains so they indicated that mulching and pit planting in such a scenario saved the crops from wilting. There was a remarkable difference in terms of crop health and general outlook as the crops grown under convention (ridges) were wilting. Farmers therefore cited that mulching and pit planting were of great importance to the given that the technologies not only minimize evaporation of water in the soil but they also enhance soil fertility.

Phalombe is predominantly occupied with the Lomwe tribe that follows matrilineal system of inheritance. Under this system, men move and settle in the village of the woman they are marrying as such they have user rights of the land on which they cultivate but not ownership rights (Takane & 高根務 2007). In the FGD Men reported that under this arrangement decision to allocate technologies and crops to particular field is not solely for them rather they base it on the consensus with their wives. Men do not have problems to undertake long term investment in the village of their wives especially when they have children because they believe that even if they are to get a divorce their children will benefit from such investments. Because of such an assurance men do not hesitate adopt CSA technologies including agroforestry as one of the technologies that take time to produce desirable results. For those that have adopted mulching they indicated that they get maize stalks from the fields of non-adopters – who at times they are ridiculed by the non-adopters. However, the adopters can access the stalks free of charge and they are not prevented in any way from collecting the stalks for mulching as long as the owner of the field in which they are collecting the stalks doesn't need them. Access to financial resources, formal and informal institutions were not reported as playing significant roles in the adoption decision.

Weather variability especially occurrences of prolonged dry spells has significantly influenced adoption of mulching and pit planting because farmers are able to distinguish the roles of these two practices in instances where they are undergoing dry spells. It was also reported that crop health and yields were notably higher for adopters as such they considered it a worthy while

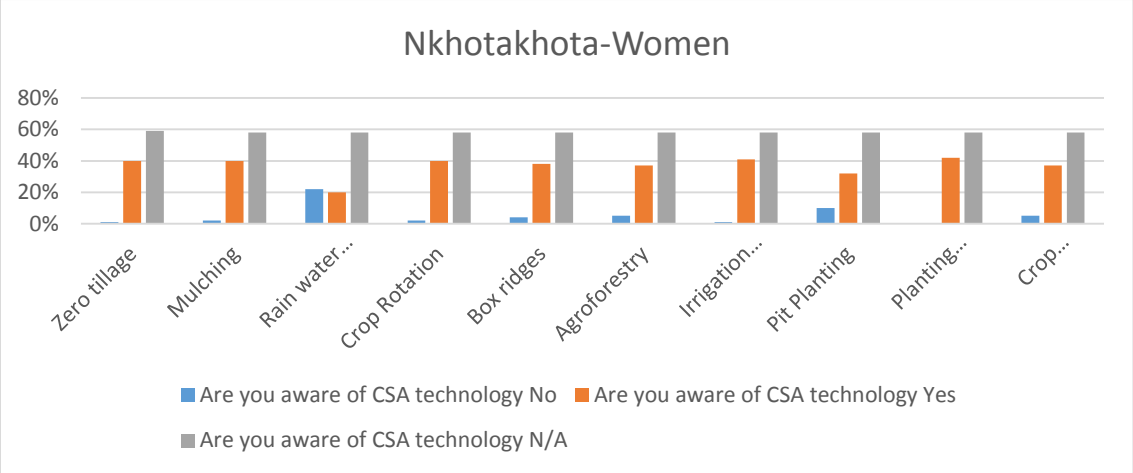
investment given that within a small piece of land an adopter could harvest more than a non-adopter under similar circumstances.

4.7.3.0 Adoption rate of CSA Technology in Nkhotakhota District

In Nkhotakhota the researcher interviewed 86 female s farmers. 58% of the farmers interviewed stated that they do practice CSA technology while 42 % of the farmers stated that they don't.

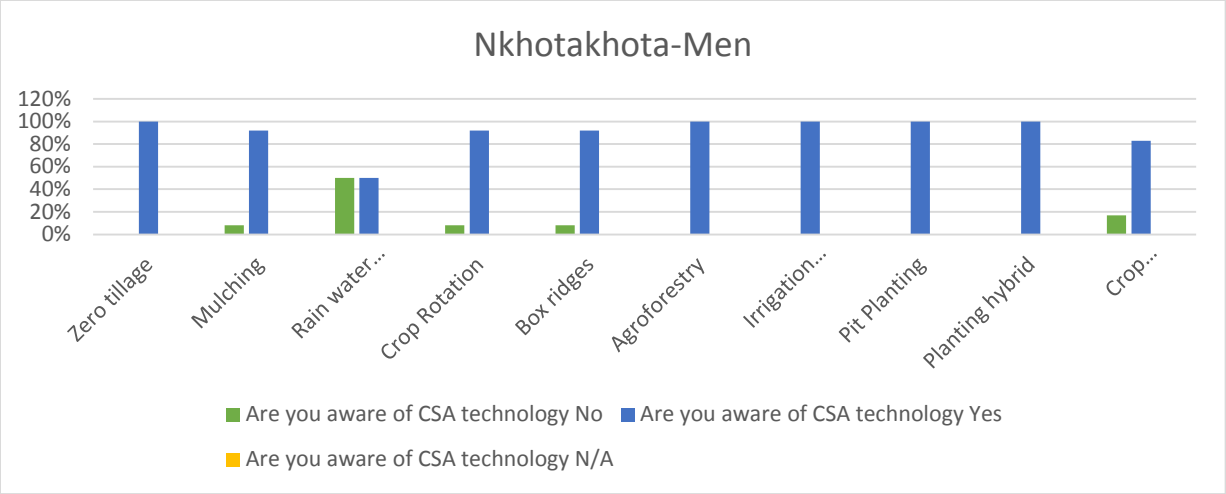
4.7.3.1Are you aware of CSA technology

Graph 2.8: Nkhotakhota-Women



Female smallholder farmersin the FGD had said that they have heard about climate smart agriculture technologies and they got the information from Extension workers, Lead farmers and NGO such as Total land care, Concern and Nasfam. However some women indicated that they are not aware of some technologies like rain water harvesting. From the Graph 2.8 most of the female farmers indicated that they were aware of the CSA technologies. An average of 40% of female farmers in Nkhotakhota show their awareness. However it was clear that most of the female smallholder farmers in this area had a little awareness on rain water harvesting as a form of CSA technology.

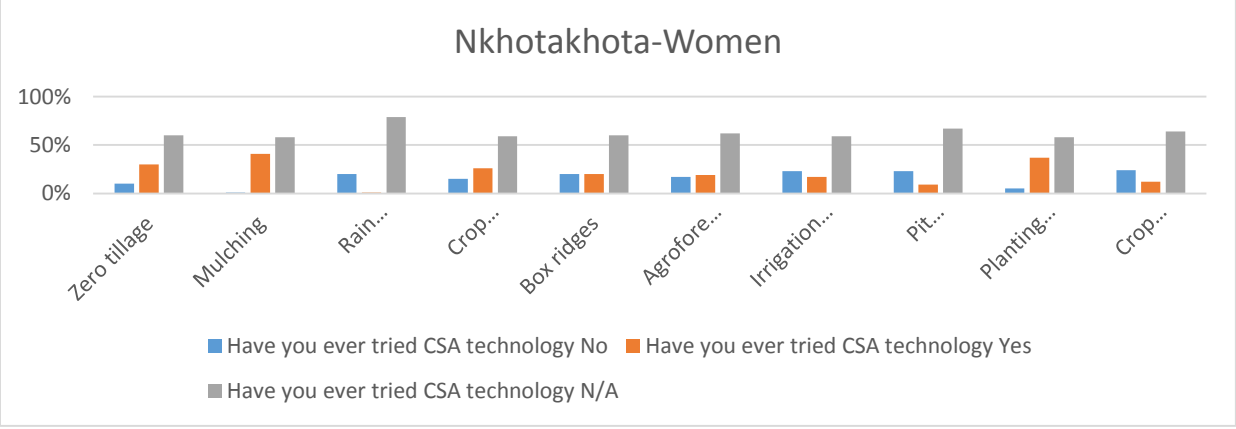
Graph 2.9: Nkhotakhota-Men



From the graph 2.9, it is evident that men smallholder's farmers had a lot of awareness on the CSA technology as compare to women from the graph 2.8. In most of the CSA technology there was over 80% awareness except for the rainwater harvesting in which the awareness was of an average of 50%. Male farmers indicated in the FGD to have known Climate Smart Agriculture (CSA) through an organisation called Total Land Care (TLC). This organisation started its activities in 2005 and it trained the farmers particularly in Conservation Agriculture. The organisation introduced use of inputs such as seeds, herbicides and fertilizer. As a results most of the farmers became aware of technologies like planting hybrid.

4.7.3.2 Have you ever tried CSA technology

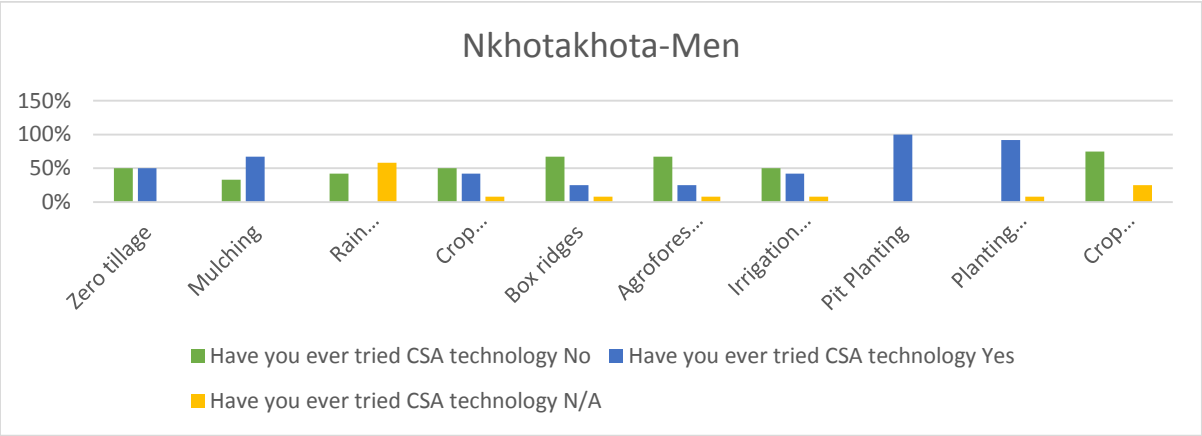
Graph 3.0: Nkhotakhota-Women



On whether if the female farmers have tried CSA technologies, the survey show that the farmers have in one way or another tried these technologies. However mulching was the leading technology that had been tried with the rate of 41% followed by planting hybrid and zero tillage

with the rate of 37% and 30 % respectively. Rain water harvesting had the lowest number of farmers who had practice it with the rate of 1%.

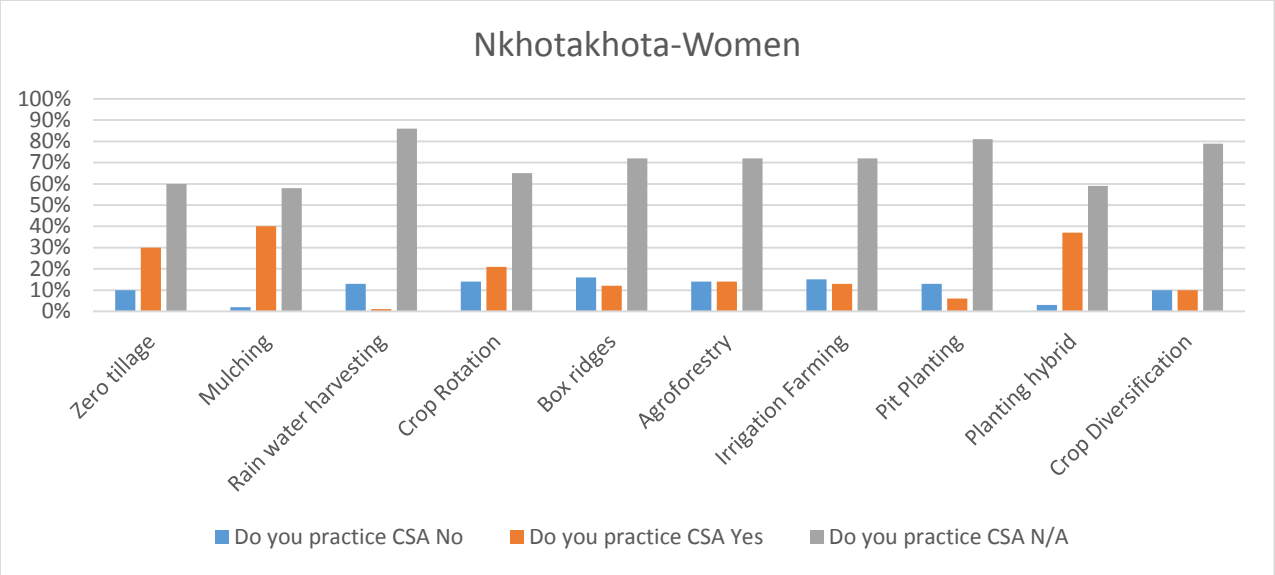
Graph 3.1: Nkhotakhota-Men



The male smallholders farmers in Nkhotakhota indicated that they had tried most of the CSA technologies except for rain water harvesting which none of the participants in the survey had practice it. Pit planting and planting hybrid had the highest number of users who had practice it with the rate of 100% and 92% respectively. Mulching and zero tillage aslo had a good number of male farmers practicing it.

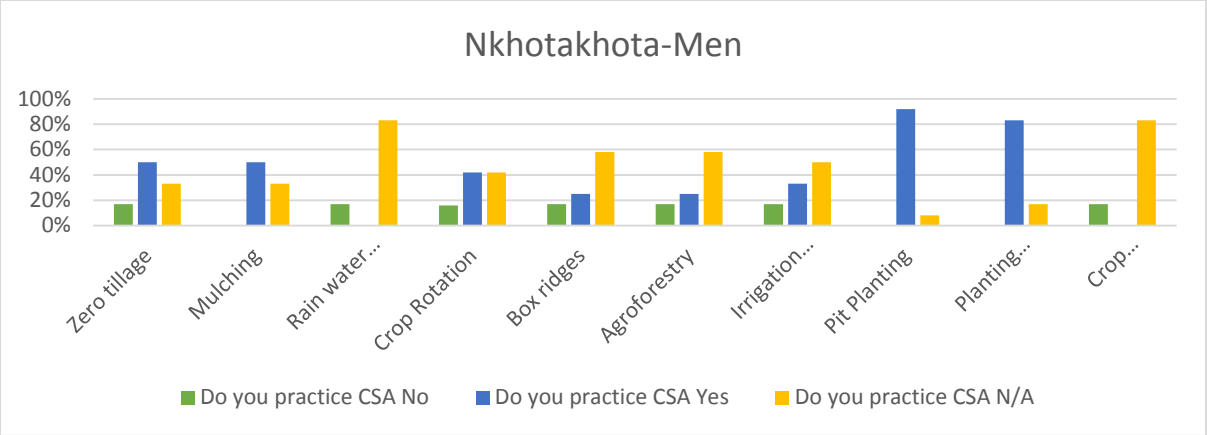
4.7.3.3 Do you practice CSA

Graph 3.2: Nkhotakhota-Women



From the above graph 3.2 Mulching and planting hybrid had the highest number of users of over 30% while rain water harvesting had the least. They said that they are not using harvesting water because they do not know how to use the technology. The female farmers indicated in the FGD that the CSA technologies they use in their farming systems are as follows: mulching, pit planting, crop diversification, box ridges, sasakawa, planting hybrid, irrigation and agroforestry. Furthermore the female farmers stated that their reasons for practicing there technologies to be as follows: (1) Mulching: holds soil moisture, increases soil fertility and high productivity on a small piece of land. (2) Pit planting: They said that they harvest water to hold soil moisture even if the rains stop coming. (3) Crop diversification: high productivity because if one crop does not grow well, other crops can grow well. (4) Box ridges also hold soil moisture. (5) Sasakawa: health crops hence high crop yield. (6) Planting hybrid: crops mature early and the crops are strong compared to local crops. (7) Irrigation: surplus food. The women said that some of them belong to a farmer club called Ndondera where they use treadle pumps and watering canes for irrigating their crops. (8) Agroforestry: increases soil fertility, reduces soil erosion, and reduces heavy winds and source of firewood.

Graph 3.3: Nkhotakhota-Men



The male farmers indicated that in 2005 an American [White man] working with Total Land Care (TLC) came and identified a farmer in the village which it invested in him knowledge, skills and inputs in order for him to be conversant with the technology. The organisation/American trained the farmer in Conservation Agriculture (CA) practices including mulching, zero tillage, herbicide use, pit planting and manure making. Through the discussion it was not possible for the researcher to find out the philosophy behind the decision (by TLC/White from America) to training one farmer in community however, it was speculated that the organisation hoped that through this one farmer, the entire community may eventually know and adopt the technology. This can be seen from the graph 3.3 that shows most of the male farmers were practising the technologies said above with an average of 50%.

4.7.4.0 Farmers Adoption of CSA technologies in Nkhotakota

The male farmers indicated that the provision of inputs stopped abruptly and most of the farmers did not continue with the technology because they had developed dependency on the inputs especially herbicides thus they were frustrated to continue. Most of the community members however did not adopt the technology citing that they could not afford the inputs. Asking them why they did not try to learn from the other farmer in which TLC invested in they argued that they felt the extension agent for the community should have trained them and upon asking the farmer who was trained he said that some female farmers approached her to learn the technologies but most men resented it and because men have control over land women could not continue with the technology. Men cited the following as barriers to adoption

1. Weak extension services hence they do not get information on CSA technologies
2. Dependency on external support (Inputs) such as fertilizers and seeds
3. Availability of inputs: the has been shortage in supplying of inputs
4. Poverty: Most farmers have to work in other jobs to generate income
5. That the technologies demand more labour in which most on the farmers are busy on other work
6. That there is no market to sale products from Agroforestry trees

The adopter as well as non-adopters indicated that there were noticeable differences in health of maize in the field of the adopter and non-adopters. The maize in the adopter's field looked healthier, stronger and greener than in the fields on non-adopters. The adopter also indicated that he has surplus maize from the previous season indicating that he has been harvesting more than enough for his family in a growing season. This was sufficient proof that he is much better in terms of food security than non-adopters.

The only adopter in the focus group discussion cited mulching and zero tillage as the best practices that he has adopted. Despite the excuses that most of farmers stopped it because of failure to access necessary inputs such as herbicides, the adopter indicated that he has implemented mulching and zero tillage without the use of the inputs such as herbicides. There are other factors which might have affected the success of the CSA technologies in the area as pointed out, women showed some interest as per the admission of the only adopter during the discussion but because they do not have user or ownership rights over the land they could not implement the technologies. Most of the non-adopters lamented that poverty is the main drive of their failure to adopt the technology as they said that CSA need capital investment. Fertilizer Input Subsidy Programme; belonging to financial groupings such as Village Savings and Loans (VSL) as well as general groupings in the village seemed not to have any influence on the decision to adopt any of the CSA technologies. As indicated the Patrilineal marriage system being followed in the area affected the women who were interested in CSA technologies as they could not control how the land was to be used.

Generally from the discussion it was noted that both men and women have a positive attitude towards the CSA technologies especially the ones being implemented by the only adopter present during the discussion. Men cited indicated that mulching and zero tillage conserve moisture during prolonged dry spells, they also cited enhancement of soil fertility, control of soil erosion and savings on labour as benefits of conservation agriculture.

The female farmers ranked the CSA technologies they use in their farms in the order of importance as follow: **(1)** Mulching**; (2)** pit planting; (3) box ridges; (4) planting hybrid; (5) Sasakawa though they said this technology did not have to be in the category of CSA technology because in mulching, pit planting they use sasakawa (planting one seed in the field instead of three seeds, i.e. maize seed); (6)Irrigation; (7) agroforestry; (8) crop diversification.

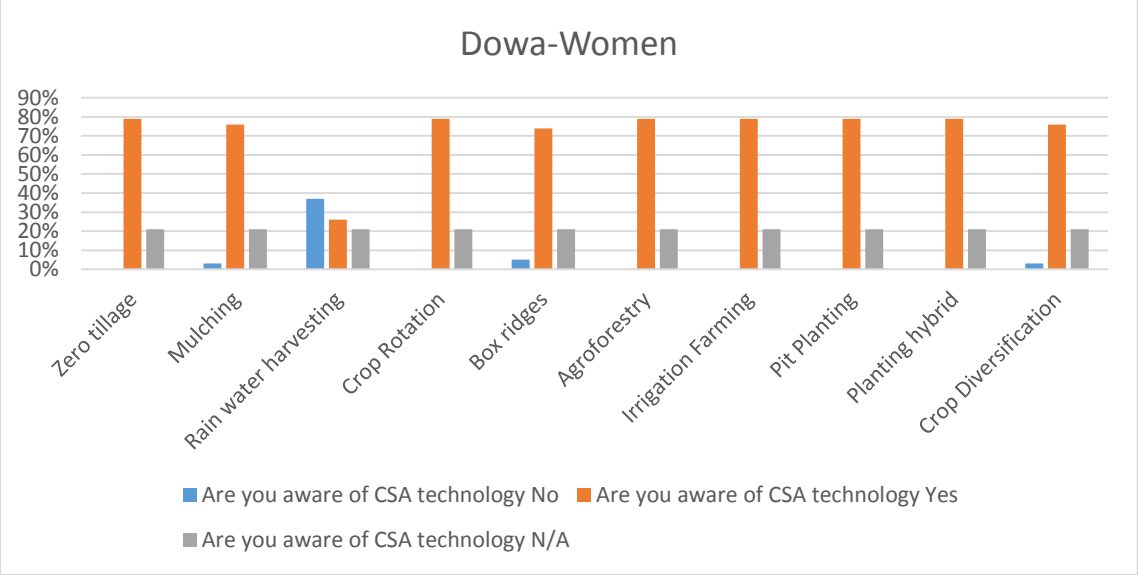
Concerning the risk factors influencing adoption decision, farmers indicated that conservation agriculture is relatively more risky to implement than convention agriculture. The argued that if they are to grow maize on the ridges, they will plant cassava on the same ridges before maize mature thus will benefit twice from the same piece of land. However if they are to implement CA for example, it will solely be for maize as such if maize failure it will increase their vulnerability to hunger. For this reason most of the farmers rather opt for a relatively lower risk farming (convention) that high risk farming (CA).

4.7.5.0 Adoption rate of CSA Technology in Dowa District

For Dowa district there were 62 participants of which 68% were female and 32% were male farmers. On the female farmers50% were adopter while 18.5% were non adopter. For the male farmers adopters and no adopter were 18.5% and 13% respectively.

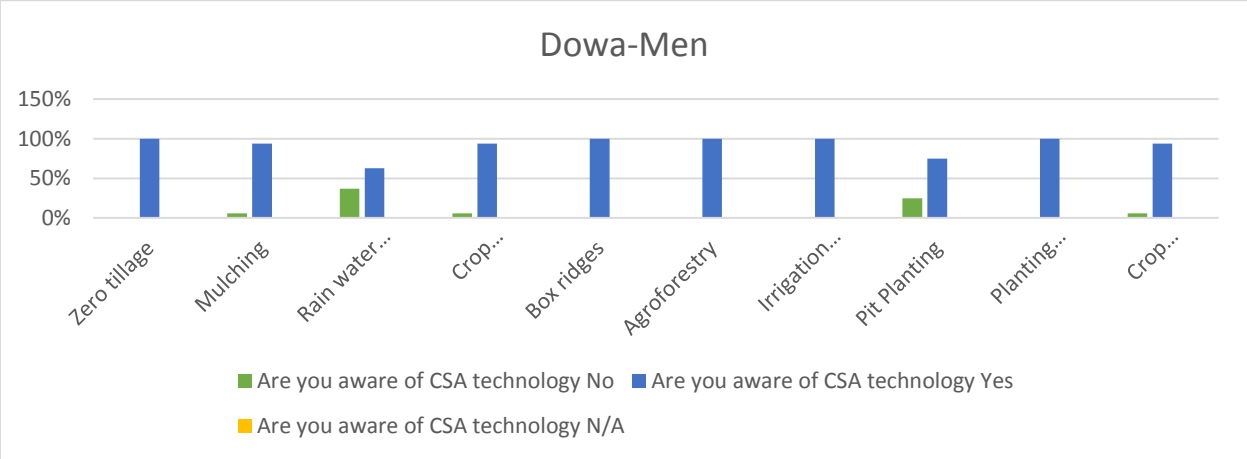
4.7.5.1 Are you aware of CSA technology

Graph 3.4: Dowa Woman



The survey tried to find out if the female farmers were awareness of CSA technologies .Female smallholder farmers said that they have heard about climate smart agriculture technologies and that they are aware of most of the technologies with the rate of over 70% except for rain water harvesting that had a rate of 26% on the awareness.

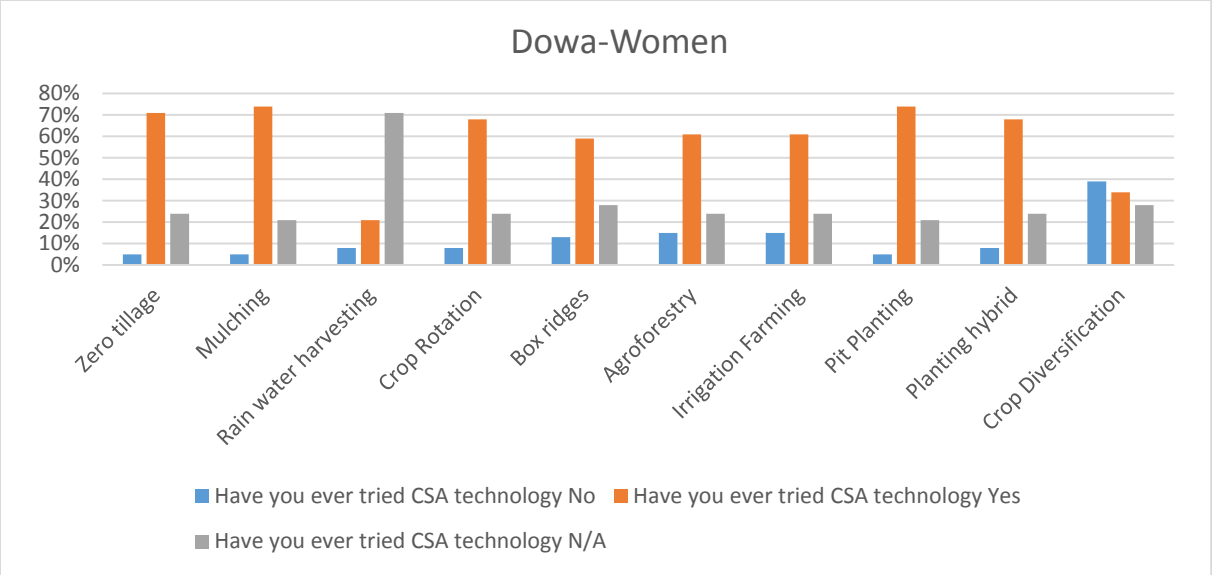
Graph 3.5: Dowa Men



Male smallholder farmers said that they have heard about climate smart agriculture technologies and they got the information from Extension workers, radios such as Malawi Broadcasting Cooperation (MBC radio 1), cell phones, meetings and plot demonstrations. The average rate of 75% of the farmers know about this technologies except for rain water harvesting which had a rate of 63 %.

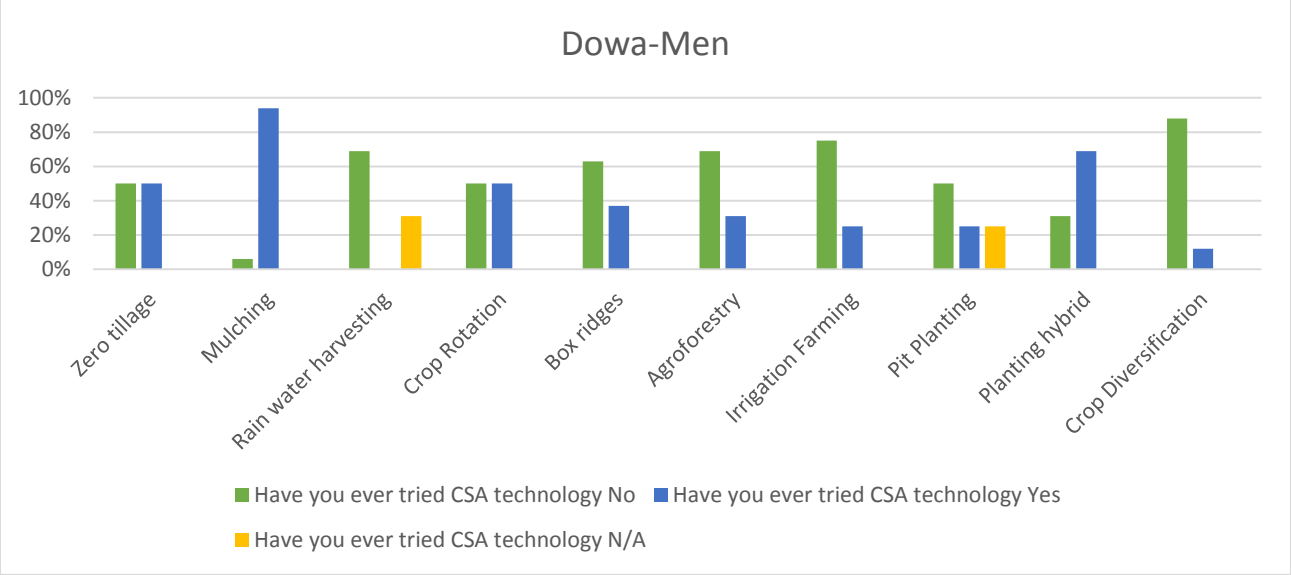
4.7.5.2 Have you ever tried CSA technology

Graph 3.6: Dowa Women



From the graph 3.6 above, the female farmers were asked to state if they had tried the CSA technologies. The results showed that most of the female farmers had tried the CSA technologies as compare to the other two districts. Over 50% of the farmers have tried all the technologies except for rain water harvesting and crop diversification which had a rate of 21% and 34% respectively.

Graph 3.7: Dowa Men

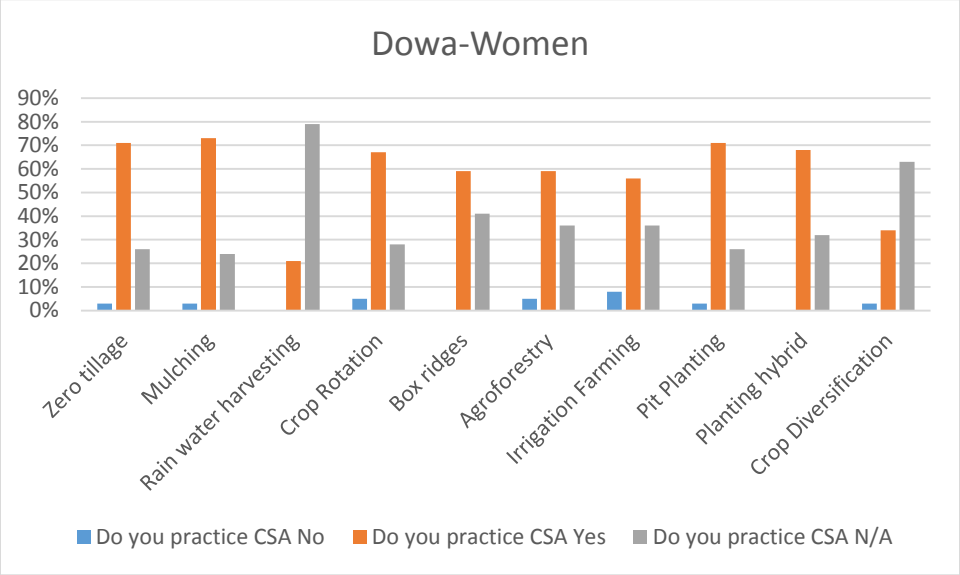


The male farmers indicated that they have tried the CSA technologies but the most tried ones was mulching, pit planting, crop rotation and zero tillage which had a rate of 94%, 69%. 50% and 50%

respectively. There was no indications if the rain water harvesting has ever been tried by the male farmers in this district

4.7.5.3 Do you practice CSA

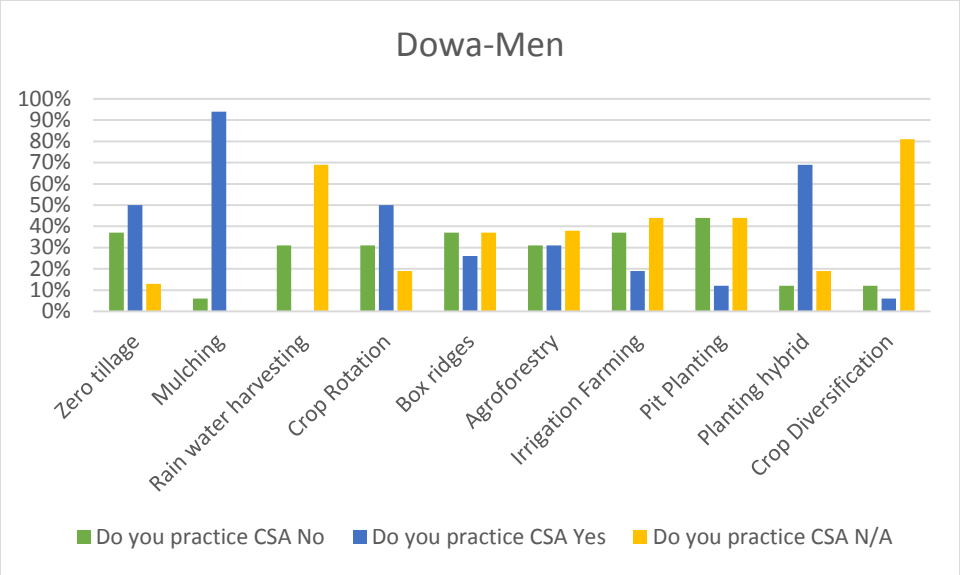
Graph 3.8: Dowa Women



The survey tried to find out if the farmers were practicing CSA technologies. Female smallholder's farmers said they use in their farming systems are as follows: manure, zero tillage, mulching, pit planting, crop diversification, sasakawa, irrigation and agroforestry. Muching had a rate of 73% of the users followed by zero tillage and pit planting which had 71%. Rain water harvesting had the least user's rate of 21%. They said that they are not using harvesting water because they are not aware of this technology

The female farmers indicated their reason for using these technologies as follows: (1)-Manure: increases soil fertility. (2)- Zero tillage: holds soil moisture (3) -Mulching: holds soil moisture, increases soil fertility and high productivity on a small piece of land. (4) -Pit planting: holds soil moisture. (5)-Crop diversification: harvesting different types of crops which result in food security (6)-Crop rotation: maintains soil fertility (7) -Sasakawa: high crop yield. (8) -Irrigation: surplus food and generate income after selling some of the produce. (9) -Agroforestry: They said that when leaves fall in the farm, they decompose and make manure which increases soil fertility.

Graph 3.9: Dowa Men



The male farmers indicated that they use CSA technologies their farming systems are as follows: mulching, zero tillage, pit planting, irrigation, sasakawa, agroforestry, planting hybrid, crop diversification and crop rotation. 94% of the farmers preferred Mulching while planting hybrid and crop rotation had a rate of 69% and 50% respectively.

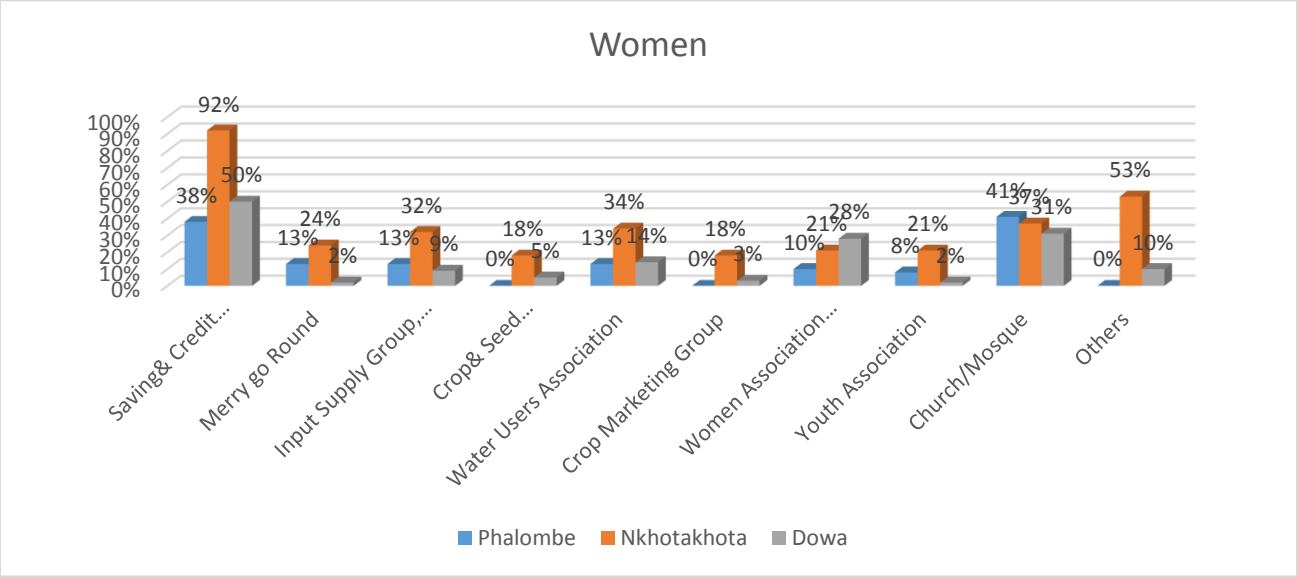
4.8.0Farmers Adoption of CSA technologies in Dowa

They further indicated their reason for usage to be as follows: (1) Mulching: holds soil moisture, increases soil fertility and high productivity on a small piece of land. (2) Zero tillage: maintains soil fertility. (3) Pit planting: holds soil moisture. (4) Crop diversification: high productivity. (5) Box ridges also hold soil moisture. (6)Sasakawa: high productivity on a small piece of land. (7) Planting hybrid: crops mature early and they added to say that some people do not use this technology because it is expensive to buy hybrid seeds. (8) Crop diversification: They said that if one crop does not do well, they survive with other crops. (9) Irrigation: surplus crop yield. (10) Agroforestry: increases soil fertility, reduces soil erosion and sustainability of trees (11) Crop rotation: maintains soil fertility.

4.9.0 Membership of any rural institution

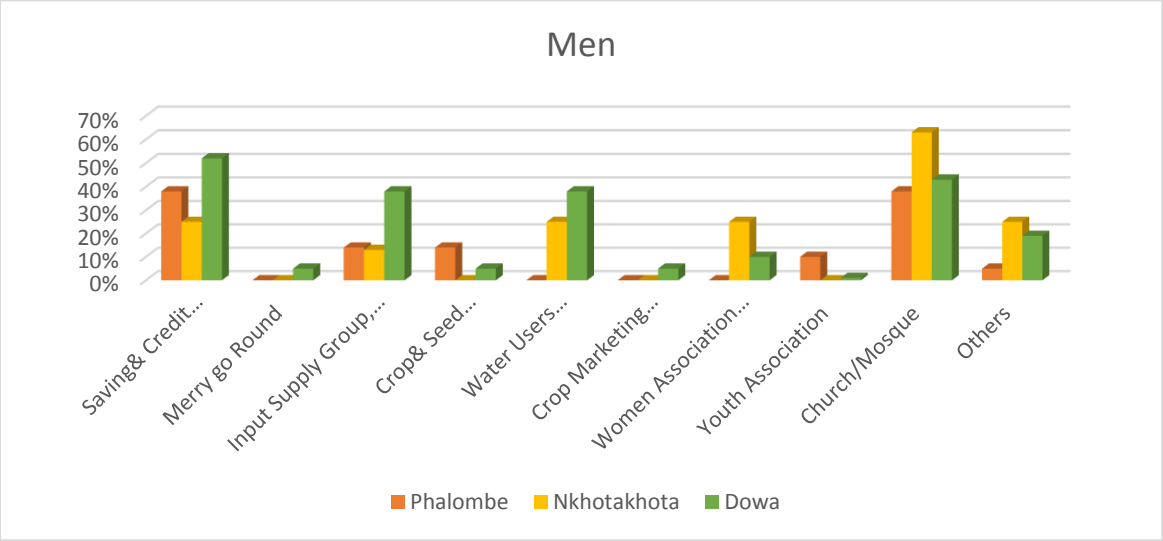
The researcher tried to find out if the farmers were members in any rural institutions. Rural institutions have been known to be a source of developments since they are usually used to encourage the local communities into development.

Graph 4.0: Membership of any rural institution



From the above graph, the female farmers were members of the saving and credit society. Most of the farmers indicated that, they were members in this society because they are able to save their income and they can borrow loan at the same time. Nkhotakhota had 92% of the female farmers in saving and credit society which was the highest as compare to Dowa that had 50% and Phalombe with 38%. It is clearly shown that in Malawi most of the people belong to a religious organization. Dowa female farmers were leading members of the women association with a rate of 28% followed by Nkhotakhota and Phalombe with 21% and 10% respectively. It can clearly been seen that even though Nkhotakhota district is located in water area 34% of the farmers are members to the water users association as compare to Dowa and Phalombe with the rate of 14% and 13% respectively.

Graph 4.1: Membership of any rural institution

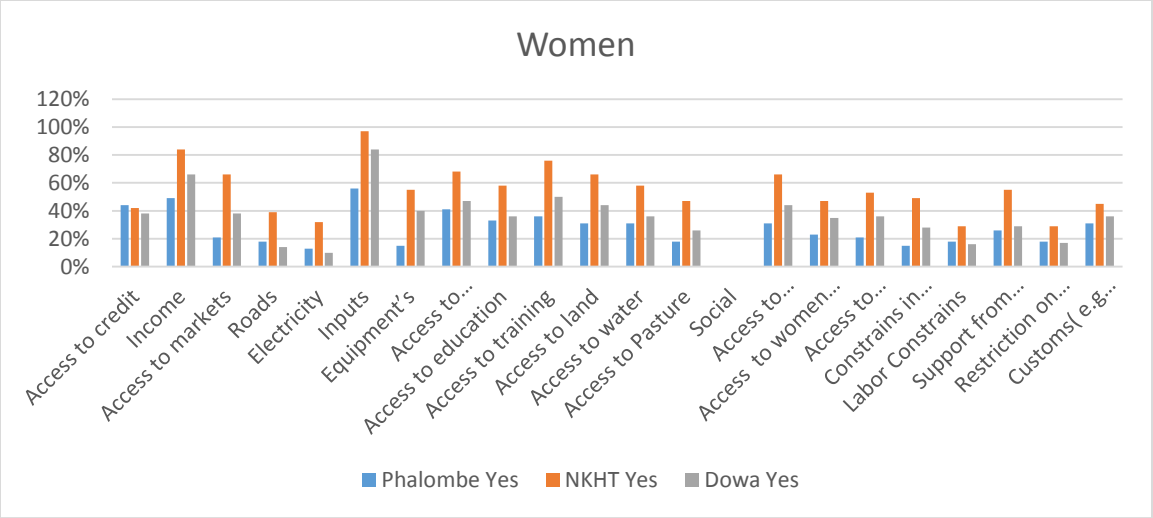


According to the survey carried out on male farmers as per the graph above, It can clearly be said that majority of the male farmers are members to saving and credit societies, input supply groups, water users association and religious organizations. However the male farmers from Dowa district seems to be on the frontline as compare to Phalombe and Nkhotakhota. Comparing the two graphs above for the male and female farmers, the survey showed that most of the men are actively involved into the rural institutions as compare to women.

4.10.0 Gender differentiated barriers for adoption of CSA technologies

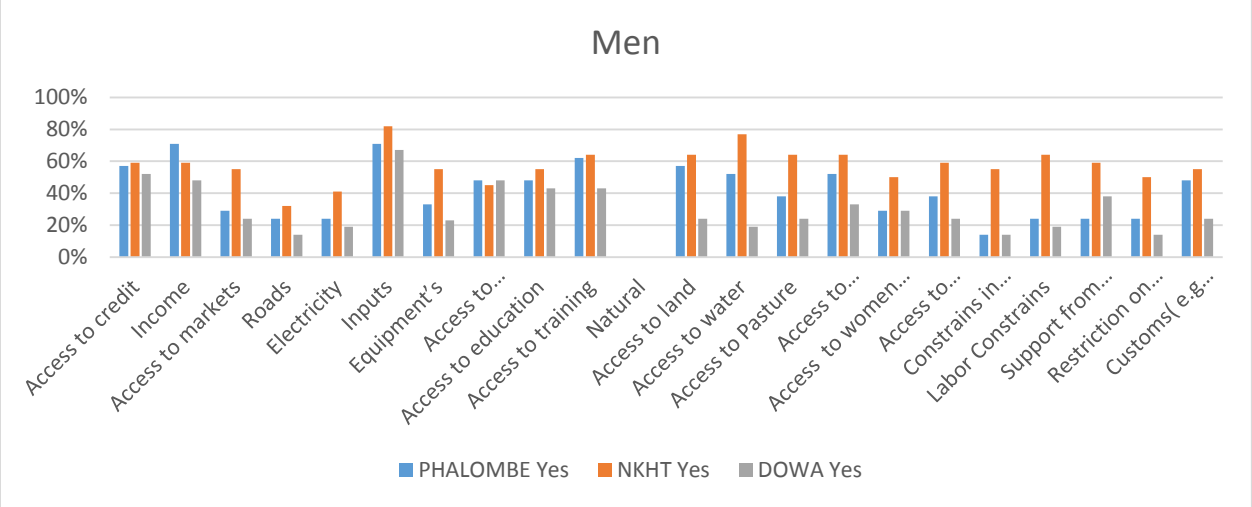
The researcher tried to analyze and see if there barriers were different between the men and women. The results were as follow below**:**

Graph4.2Women barriers for adoption of CSA technologies



From the above graph, access to inputs was one of the major barriers for adopting CSA technology. Most female farmers indicated that for them to be able to practice CSA technologies, there should first have access to seeds that are meant to be drought resistance. They also need fertilizer in order to improve soil fertility. However, there were other barriers that were affecting the female farmers in the 3 districts. These barriers included lack of income, inaccessibility to information, training, land and water. Clearly it can been also seen from the above graph that Nkhotakhota and Dowa are the most affected by the barriers as compared to Phalombe.

Graph 4.3 men barriers for adoption of CSA technologies



According to the graph above, most of the male farmers were affected by lack of access to inputs, income, land, water, information and training. In addition, inaccessibility to credit facilities posed to be a barrier in both of the 3 districts with average of 55%. The male farmers listed other barriers that were not included in the survey as listed below through the focus group discussions.

4.11.0 Barriers to adoption of CSA technologies by districts through the FGD

4.11.1 Phalombe Focus Group Discussion

The CSA technologies used in their farming systems are as follows: mulching, agroforestry, pit planting, manure making and application, box ridges and sasakawa (planting of one seed per hole). The female farmers indicated that the reasons for adoption of these technologies to be:

a. Mulching is preferable to most of the farmers because it holds soil moisture and increases soil fertility. This happens when the farmers covers the entire cultivated land with the maize stalks that they had preserved from the previous season.
b. Agroforestry is another CSA technology in which the farmers plants trees in the piece of lands they own. This is useful because trees bring about rainfall
c. The female farmers indicated that pit planting system is used it to collect water by dig the holes. In doing they are able to hold moisture.
d. Manure also adds soil fertility and the women said they use manure because of lack of fertilizer
e. Box ridges also hold soil moisture and help in prevent soil erosion.
f. Sasakawa: 25cm spacing between crops. They use this technology for three years and leave the residues to decompose in the fields which increases soil fertility

The women also said that some are using irrigation farming, others are not because they do not have sources of water like dams. They also added to say that everyone is planting hybrid seeds. They also said that they are not using harvesting water because they do not have inputs to use for water harvesting. Part of the survey question was asking on the farmers to rank the CSA technologies. According to the farmers they ranked the CSA technologies they use in their farms in the order of importance: (1). Mulching; (2) pit planting-they had an argument on which

technology should be ranked the second between pit planting and agroforestry and they agreed that pit planting should be ranked second; (3) agroforestry; (4) crop diversification;(5) sasakawa

Table 1.1: Perception of males and females on the technologies (Rank)

Men (Preference)	Women (Preference)
Mulching	Mulching
Manure	Pit planting
Pit planting	Box ridges

It was noted that both males and females prioritize mulching because it saves a lot on labor for both land preparation, weeding and banding. This technology also offers multiple benefits namely enhancement of soil fertility and preventing soil erosion. However, the two differed on pit planting where males consider it of third priority while females consider it second priority. This technology demands relatively higher labor in digging the pits as such males felt it was too demanding on them unlike manure making while females opted for box ridges as of third importance given their concern to conserve their land unlike men who reported only to have user rights over the land.

The male farmers indicated that there were several barriers that affects most of them when it comes to adoptions of CSA technologies. However they indicated the below barriers to be a major challenges within the community:

Laziness: The farmers indicated that most families that have not adopted CSA technologies was due to laziness since these technologies requires a farmer to be a hard worker. Technology like mulching needs time of the farmer to collect that stalks or grass; however, most of the people are too lazy to devote their time.

Labor constraints: The farmers indicated that labor constrain is one of the challenges in adopting CSA technology. This is because most of them they have to do other income generating activities (Ganyu) so as to meet their immediate needs. They stated that both men and women have to work in order to feed the families. This affect their level of adoption since Most of the CSA technologies required a good amount of time.

Loss of stalks during dry season as they are eaten by large ruminants (Cattle, goats etc.) The farmers mostly adopted the mulching in their farmind

Dependency syndrome (some farmers still look up to external help/ assistance): Due to the harsh climate condition in Malawi there are several programs that provides community with food such as maize and beans. As a results some farmers have not adopted the CSA technologies since if they have a bad harvest the will still get food. This has created a dependency syndrome for not wanting to try other farming methods.

The farmers indicated that due to several factors they have not been able to adopt CSA technology. Their reason was:

a. The first thing they said was that they are not receiving coupons for fertilizer and they have big farms and because of lack of fertilizer, they are using manure.
b. Lack of seeds to plant in their farms.
c. lack of equipment's e.g. wheelbarrows for carrying sand somewhere for planting trees because trees need certain soil which is fertile and carrying manure to the farms.
d. They also said that diseases are also a barrier because if someone is sick they cannot go to the farm and look for residues and work.
e. Lack of pesticides to kill pests which destroy crops in the farm.
f. They also said that some people burn the residues for spreading in the field.

In addition to the barriers the female farmers indicated that women have a large portion of land compared to their husbands and said this was not a barrier to them. They both make decisions and sometimes is the husband who starts making the decisions and they discuss which technology to use.

On how access to and control over land and other natural resources affects adoption of CSA technologies, they said that they have enough land but water is not enough, they decide which land to use for mulching. When the livestock visit their field to destroy residues, they take the livestock to the chiefs. They also said that they have livestock like goats, chickens and pigs, so when they want to use the land for cultivating, they divide the land for grazing and CSA technology. In addition the FGD stated that access to and control over financial resources affects the adoption of CSA technologies, they said that it does affect the adoption if they do not have money because everything needs money. One member from the group also said that sometimes financial resources do not matter but what matters is the training on CSA technology. They also said that they sit down and discuss with their husbands on how the money will be used after selling the produce.

The other member from the group said that it is the wife that controls how the money should be used because she is the one who looks for the family if the husband is the drunkard. They added to say that they have access to credits from Village Savings Loans (VSLs) and divide the money for home usage and for CSA technologies, for example if they have ten thousand kwacha they divide half. They also said that the organizations which are money lenders should also be visiting their area for them to have access to micro-loans. They also said that they have small businesses and some of them sell sweet potatoes and banana flitters. But they said that they do not have organizations which can lend them some money. Some of the women said that they belong to farmers' cooperatives but do not get any benefits from it, and the name of the group is Titukulane Club. They practice patrilineal type of marriages and they work together with the husband. The women said that some of them come from polygamous type of families and the husband moves around but said they work together with their husbands.

They only listed two risk factors. They said they decide the adoption of CSA technologies they experience late rainfall because they said they cannot continue using traditional methods which can no longer benefit them and because they harvest a lot when they use the technologies. They said that CSA technologies are good and that they will continue using them because they are getting benefits from the technologies and said men also encourage women to adopt and continue using the technologies. Furthermore, the women said that those who use CSA technologies produce high crop yield than those who are still using traditional methods and the one who uses CSA also looks happy because everything at home is fine with them. They also added to say that they were only two women in the group who had received training for manure making and agroforestry technologies.

Both the male and female farmers indicated that the adoption of CSA technologies has help them as farmers to: increase their crop productivity through the usage of technologies that can overcome the effects of climate change. They also said that agroforestry has benefited them a lot and it helps in reducing deforestations. This is because before they use to cut down trees to get charcoal and firewood. However since they are planting their own trees they are able to get firewood from the trees they plant in their field and generate income after selling the firewood and charcoals. In

addition, the farmers stated that mulching is preferable to them because it holds soil moisture, increases soil fertility when it decays while at the same time it helps to prevents pests and diseases.

Due to the benefits of mulching the farmers gave an example of two fields one with mulching and the other with fertilizer. So the one with mulching, they said the crops looked very green and health than the field with fertilizer. In addition, they said that they use sticks for measuring the spacing between the crops which is 25cm apart, also use bottle tops for fertilizer application. They added to say that they organize the residues at one place and leave them to decompose before spreading in the farm.

4.11.2 Nkhotakota Focus Group Discussion

Male stated that the main barriers for adopting new technologies as follows:

1. The first thing they said was lack of inputs such as seeds, pesticides and fertilizer
2. Lack of income
3. Some people burn the residues in their farms
4. Lack of training on how to use manure
5. Diseases
6. Lack of markets

The farmers said that there is high productivity on a small piece of land while mulching maintains soil moisture, reduces soil erosion and increases soil fertility. According to the farmers in order to achieve good results on CSA technologies they said that they prepare their land for cultivation early then decompose manure and apply in the farm.

On how access to and control over land and other natural resources affects adoption of CSA technologies, they said that when they want to use CSA technology on grazing land, they take their livestock to other places for grazing. They also added to say that in times when water is scarce, it becomes difficult for them to use irrigation farming. On how access to and control over financial resources affects the adoption of CSA technologies, they said that they find it difficult it difficult to use CSA technologies when they do not have enough money. Some of them do small businesses and get little money which they use to buy fertilizer for their farms. They also added to say that

some of them use village banks where they can borrow money and use it for CSA technologies. The farmers also said that they are in different farmers club where they get knowledge on the use of CSA technologies. On informal institutions, they said that there are a lot of polygamous families and practice patrilineal type of marriages and the husband is the one who makes decisions because he is the head of the house. They following risk factors were listed: (1) weather variability like high temperatures (2) Shortage of land (3) Crop productivity.

From the FGD, the farmers said that more women are practicing the CSA technologies which is a positive thing but they also said some women are not practicing due to lack of farm inputs. Men on their perception, they said that they work hard to use CSA technologies because the technologies are good. In addition the men smallholder farmers said that the female smallholder farmers prefer using agroforestry, crop rotation, sasakawa, pit planting, mulching and irrigation

The female farmers indicates the following to be the barriers

1. The first thing they said was lack of inputs e.g. pesticides to kill pests and unwanted plants because they cannot use hoes when they are practicing mulching and also they lack fertiliser.
2. Lack of residues hence they use a small portion of land for mulching
3. Lack of hybrid seeds to plant in their farms
4. shortage of manure because they said some of them do not have livestock
5. Expensive seeds and they use seeds from the previous cropping seasons
6. lack of markets because they sell their produce at a cheaper price
7. Some women do not use irrigation because they do not have equipment like treadle pumps

One member said that she measures the spacing between the ridges which is 75cm apart while in the past it was 90cm apart which was not a good practice because it left a large space for the ridges so the large portion of land was not being used , they apply manure and spread the residues in the farm. They added to say that they apply manure in the pits before planting the seeds.

On how access to and control over land and other natural resources affects adoption of CSA technologies, they said that they discuss with their husbands on how to use CSA technologies.

They also said that they find another place for grazing at the rivers and use the land for cultivation. Furthermore access to and control over financial resources affects the adoption of CSA technologies, they said that they borrow money from micro-loans and they make decisions on whether to use the money for CSA technology and for other usage. They added to say that others belong to Village Savings Loans (VSLs) where they get a lot of interests and loans and divide the money for home usage and for CSA technologies. The women said that they practice patrilineal type of marriages and some practice monopoly while others polygamy and as a family, the husband and wife discuss about which CSA technology to use. But the women are the ones who take large part in using CSA technologies like carrying residues to the field.

In the discussion, they only listed three risk factors which include (1) diseases; (2) Lack of support from their husbands, they feel jealousy when they see a woman going out and be in farmer groups with their friends; (3) Lack of access to women groups

They said that CSA technologies are good and that they will continue using them and said men are also taking part in CSA technologies. The men indicated that they encourage female farmers to adopt new technologies while women emphasizes that those who use CSA technologies have extra time to rest while those who do not use CSA technologies are always busy weeding in their farms. The women smallholder farmers said that the male smallholder farmers prefer using box ridges because they find it difficult to look for residues for mulching and they also prefer using sasakawa because it does not take much time for them to plant in the farm. Maize cassava and rice are the crops that male smallholder farmers grow like to grow.

4.11.3 Dowa Focus Group Discussion

In this district, the farmer stated that it is difficult to find residues and sometimes livestock eat the residues in the field and hence they could not practice mulching. Other barrier include Lack of inputs such as fertilizer, Lack of equipment like oxcarts to carry the residues to the farm and treadle pumps for irrigation and the communities have to go long distance to get water for irrigation
In addition, the farmers in the FGD said that they have access to land and divide the land for grazing and use other land for CSA technology. They also have access to credits because they

belong to VSLs called Mgwirizano and Tikondane clubs. They also said that they also use the credit for supporting the implementation of CSA technologies. They also belong to different types of formal institutions such as TAPP and Clinton which provides seeds like beans. The female farmers also said some of them practice polygamous type of marriage while others practice monogamy. There were two female farmers who came from such marriages and both said they do practice CSA technologies such as mulching. They added to say that they practice patrilineal type of marriage while very few people practice matrilineal. They said that the husband starts making decisions but they discuss which CSA technology to use in their farming practice.
The research had asked them to only listed three risk factors on CSA. According to the farmers, the factors were; (1) The amount of rainfall (2) Lack of land (3) Soil infertility

In their discussion they further indicated that when they use irrigation, they have surplus food which they can sell and generate income; Mulching does not require more labor; Agroforestry help in manure making and get medicine from other trees they plant; Crops do not wilt when using pit planting since it holds soil moisture; They also said that when they use crop diversification, some crops do not require more water such as beans hence they benefit from those crops which mature early. Lastly I had asked the farmers to rank the CSA technologies on the order of importance. The male farmers ranked the CSA technologies they use in their farms in the order of importance as follows:Crop rotation, Mulching, Agroforestry, pit planting, sasakawa, Irrigation, Crop diversification, planting hybrid, zero tillage. However it is important to note that the female farmers ranking was quite different from the male farmers as follows: Sasakawa**,** crop rotation**,** crop diversification**,** pit planting**,** agroforestry**,** Irrigation**,** Mulching**,** zero tillage

Chapter Five

5.0 Discussion, Conclusion and Recommendations

5.1 Introduction

The purpose of this study was to find out the adoption of CSA technologies among female smallholders farmers in Malawi. This was done through identification of different CSA technologies that were available to the farmers and the rate at which each technology was adopted. The objective of the study was to explore how gender is affecting the uptake of CSA technologies and find out the gender related barriers to the diffusion and uptake of CSA technologies among female smallholder's farmers in Malawi. The main research question was does gender affects the uptake of CSA technologies and what are the gender related barriers affecting the diffusion and uptake of CSA technologies among female smallholder's farmers in Malawi. The research question was formulated in relation to the objectives of the study. In this chapter I will summarize the findings of the research in order to be able to answer the research question.

5.2 Discussion of the key research findings and Challenges

The key findings of this research study are studied in light of the research question and purpose of the study. From the study different gender related barriers were identified and there were different technologies that the farmers had adopted as follows;

5.2.1 Marriage Systems

Marriage system have in influence on decisions making. It is clear that men in Africa had influence on land ownership irrespective of the type of marriage system that was being practice within the community (Whitehead & Tsikata 2003). Phalombe had the highest number of matrilineal marriage system while Nkhotakhota had the highest patrilineal marriage system. For Dowa district the results were balancing since in that district they were practicing both kind of a marriage system. The results showed that the type of marriage system affected on household heads. This is because the marriage system according to the farmers in Malawi gave both Men and women to occupy their position as the head. In Phalombe, most of the households were female headed. This was due to the fact that matrilineal marriage system was being practice in this district. However most of the smallholder's farmers were practicing a monogamy system of marriage. This was different in Nkhotakhota district since the households were male headed. However they also practice a

monogamy system of marriage. Even though in Dowa district they were practicing both the matrilineal and patrilineal marriages, the households were female headed and they also practice monogamy.

5.2.2 Land Location and Ownership and cropping systems

Most farmers had land located in the upland area but farmers in Nkhotakhota and Dowa had other lands located in the water area (dambo). On comparing of men and women, the results showed that most men had land ownership in the upland area while women had land on dambo area. The results also showed how land location affected the types of crops that were grown. According to the FGD the farmers indicated that in Malawi there are crops that are grown by men in which women cannot dare to grow such as pepper and tobacco while sweet potatoes and ground nuts are consider to be female crops. Since most men had land on the upland areas, it was reported that they focus on crops such as maize so as to provide food for the family and tobacco and pepper so as to generate income. The female farmers indicated that they mostly cultivate rice, sweet potatoes and ground nuts. There were other crops that were grown for the purpose of generating income which include sunflower in addition to the pepper.

5.2.3 Climate Change in the last 30 years

The three districts reported that they have been experiencing climate change for the last 30 years and their crops productivity has gone down. The major climate change in both of the districts were drought, early cessation of rains, and prong longed dry spells. This has caused the farmers productivity to go down and has led to food insecurities within the households. In Phalombe, the farmers had indicated that when the rains comes they do experience a lots of floods in many areas which causes crop destruction at the same time soil erosion. From the research the farmers indicated that, due to the effects of climate change, they were trying to adopt technologies such as box ridges and agroforestry so as to counter this challenges.

5.2.4 Membership in Rural Institution

In relations to membership in rural institutions, majority of the farmers had indicated that they belong to some certain groups or organizations. The popular groups that the farmers belong to were saving and credit societies, merry go rounds, input supply groups, water users associations and women groups. Since the smallholders farmers rely on rains for their agriculture activities, they three districts had water user's association groups so that they could benefit from them. According to the FGD, these waters users associations were mostly found in places where there was a dam, rivers or lakes. In the discussion, I found out that farmers were really complaining about the availabilities of inputs such as seeds and fertilizers. The farmers indicated that there were some projects that used to provide these inputs but later they stopped. They gave an example of CABMACC projected and stated that "during the onset of the project CABMACC used to provide inputs like fertilizer hence some farmers adopted were motivated to adopt the CSA technologies. However after sometimes they did stopped and as a results the dependent farmers have disadopted the CSA technologies. They argued that since the number of adopters had increased under this (giving fertilizer) arrangement CABMACC should rather introduce loans that will help farmers access them and pay back at the end of growing the season". According to the farmers in the FGD, the CABMACC project initially started by providing fertilizer to the adopters so that they can complement the nutrients farmers get from the biomass added into the soil either through compost manure or through mulching. It was not known as to whether the approach of giving them fertilizer was to act as a motivation; however farmers indicated that this year fertilizer has not been given out as it has been before. Regardless of the availability of fertilizer the farmers have retained a significantly higher number of adopters who are currently implementing the practices and indicated that they intend to continue with the CSA technologies since they have joined other input supply groups.

5.2.5 CSA Technologies

Research has shown that for farmers to adopt agriculture technologies, it all depends on land availability and economic status of the farmer. This is because CSA technologies may require a large portion of land for it to be effective while at the same time it needs huge capital for the inputs (Chirwa 2004). From the research, there was a clear indication that in both of the three districts, some CSA technologies were preferred as compared to others. The most commons technologies were mulching, zero tillage, crop diversification, agroforestry, pit planting, intercropping and crop

rotation. These technologies were preferable because they were consider to holding moistures and improving soil fertility. A good example is agroforestry that the farmers stated helps in mitigating the effects of climate change. The farmers indicated that these technologies help them to counter the effects of climate change such as early cessation of rains, prolonged dry spell and soil erosion. However, most of the farmers had lamented that some of the technologies seems to be good but they were expensive to implement. This is further capture in the next sections.

5.2.6 Barrier for Adopting CSA technology

Since the research was focusing on adoption of CSA technologies among female smallholder's farmers in Malawi, I was interested to know in what makes the farmers not to adopt these technologies. Both the female and the male farmers stated similar barriers that is affecting them. Accessibility to inputs was the number one barrier because the farmers needed seeds for hybrid planting. The seed to them have to be able to counter the effects of climate change and ones that do not require a lot of water to mature. They further stated that these is a challenge to them because such kind of seeds were a bit expensive and due to poverty most of them could not affect them. Due to the changes of climate, pest and diseases have been affecting the crops and the farmers indicated that the seeds preserved from the convectional way can no longer work in such kind of climate.

Education and training is key when it comes to adoption of the technologies. However research has shown that the farmers in developing countries can access this facilitates due to lack or required resources (Wheeler & Von Braun 2013). It was evident as I was carrying out these research that there was shortage of the extension workers with a ration of extension worker to the farmers being 1: 180 within a community (Mr. Patrick- Dowa extension worker). The extension worker further indicated that they use demonstration plots and field day to educate the farmers on CSA technologies but still there is a challenge because they have a wider area for them to cover.

Customs and land ownership was also raised to be a barrier since men are the final decision makers when it comes to land usage. However from FGD it was clearly stated that most of the households are working as a team and decisions on what should be cultivated is made by the family at large. For both the farmers sounded to be comfortable on the types of crops they are growing on individual plots. In McCarthy et al (2011), they had indicated that lack or markets and credit facilities is a major barriers for smallholders farmers to adopt CSA technologies. In this research

Lack of access from financial institutions, cooperative societies was mention to be another barrier for adoption of CSA technologies. The farmers stated that since they have low income, such institution would help them to save and be able to borrow at a lower interest rate. This could facilitate them in buying of inputs. Farmers equally requested for exchange visits to learn from other farmers on how they are managing the technologies.

5.2.7 Challenges

As a research, I experience some few challenges though they did not affect the research itself. However these challenges will act as a guide to me in future research. One of the challenges was the language barrier. Since I was interviewing the local farmers in the villages, most of them could not speak English. And even though there were a times that I felt I could have asked the research question better, I had to rely on the research assistants. Lastly due to the change of climate, I got to be affected in terms of health. This was a challenge because I had limited time and hence I had to push myself despite being sick.

5.3 Recommendations

There are several recommendations that the researcher would wish to highlight them based on the findings of the research study that would assist further research. The study concentrated on finding out the adoption of CSA technologies among female smallholder's farmers in Malawi. A detailed research on how customs and culture are affecting women to access land would be helpful in finding out how the adoption rate is affected by this customs and cultures. With such kind of a study it will be possible to find out if indeed this customs and cultures are the reasons as to why many women are not adopting the CSA technologies.

There may also be a need to carry out a research on how women empowerment and revenue generating activities in this districts. This is because one of the barriers that was highlighted by the farmers was in accessibility to inputs due to lack of income and cost of the inputs is too high. It is also advisable that a future research on adoption rate of CSA technologies to include the major projects that are focusing on CSA technologies in the study. This will also assist the researchers to get opinion of these projects organizations as to why there is a low adoption rate of CSA technologies among female smallholder's farmers in Malawi.

5.4 Specific recommendations

The following specific recommendations can be made out of the study:

1. Based on this study there is a need of provision of education to the farmers so that, farmers can understand and get more knowledge on CSA technologies such as rain water harvesting, pit planting and other types of CSA technologies. The respective authorities should create a public websites where farmers can receive information concerning these technologies.
2. It is evident that a lot of research should be carried out concerning CSA technologies and smallholder farmers. Respective authorities should encourage research to enhance accurate information to be available.
3. Institutionalization of land reforms in Malawi should be given priorities by the government so as to encourage female smallholder's farmers to have access to land. Equality could help in the distribution of customary land.
4. Training, education and empowerment should be given a key priority by the government and its agency to ensure more farmers get enlighten on the CSA technologies. This will help the female smallholder farmers to adopt more CSA technologies.
5. The Government should ensure there are reforms on how the scarce resources can be distributed. This will enable the small holder farmers to access them leading to high adopters of CSA technologies.

5.5 Implications for future research

The findings of this research have several implications for future study. This research study had sought to find out the adoption of CSA technologies among female smallholders farmers in Malawi. A major finding of this study was that most of the female farmers do not have access water due to water shortages. Since water is key when it comes to agriculture there is a need for more research to be done on how farmers can be trained on water harvesting. In addition, Researchers should in future look at other issues that are affecting farmers such as lack of markets for farmers to sell their produce, customs and cultures that are affecting women in land ownerships and women empowerment through training and access to information.

Table 1.2 Work Plan

Time Frame	**Activity**
June	Submission of the proposal
July	Reviewing of literature
August	Reviewing of literature
September	Going on field work and data Collection
October	Data collection
November	Data collection and data processing
December	Thesis Writing
January	Thesis writing
February	Thesis editing
March	Submission of first thesis draft to the supervisor
April	Submission of final thesis draft to the supervisor
May	Submission
Note	***Field work and data collection is subject to change***

Table. 1.3 : Budget

Items	**Costs**
Air ticket	8000 Kroners
Accommodation& Food	5000 Kroners
Research Assistant	600 Kroners
Fuel-Local Transport	1000 Kroners
Transport to and from Airport	300 Kroners
Research Materials	100 Kroners
Printing Costs	300 Kroners
Binding	200 Kroners
Vaccination	500 Kroners
Total Amount	***14,000 kroners***

Appendix1.0: **Questionnaire**

1. What is your marital status?
2. What is your primary occupation?
3. What do you understand about climate?
4. What are the effect of climate change on the people live hoods?
5. What are your perceptions about the effects of climate change?
6. How have you adopted to those effects?
7. Has the farming system changed due to the climate change? What was before and what is now?
8. What is the role of a woman in the agriculture systems? What was before and what is now?
9. Are you a member of any social groups (savings/credit, Women association, Merry go round…)?
10. How long have you been a member?
11. Why did you join the group?
12. Distance to the nearest agricultural extension office from residence …… ?
13. Do you have any government support (Subsides….)?
    - What kind of subsides do you receive?
    - Extension services?
14. Is your farming land rented or owned?
15. Who in the household own the land?
16. What is the size of your land?
17. Do you know what CSA technologies are?
18. Do you use CSA technologies?
19. What type of CSA technologies do you use?
20. Who in the households make the decision about the use of CSA technologies?
21. What types of CSA technologies do you know about?
22. What types of CSA technologies do you use?
23. Why do you choose to use those type of CSA technologies?

24. What sources of finance do you to acquire the CSA technologies?
25. Do you have accessibility to credit services?
26. Distance to the nearest credit services?
27. What type of labor do you use (Family (Men, female, children) , Hired)?
28. What is your primary source of information of CSA technologies?
29. Do you get adequate information on CSA?
30. Are you familiar with extension services available?
31. Do you use the extension services about CSA?
32. Who in the household received the extension services/ training?
33. Do you receive any support from the non-governmental organizations?
34. Of late have you experience climate change?
35. How have you responded to climate change in terms of CSA technologies?
36. Has the farming techniques changed?
37. What are the changes?
38. What challenges do you experience with using CSA technologies?
39. What should be done to increase the opportunities of female smallholders farmers usage of CSA technologies?

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Figure 1.1 Women Focus Group Discussion-Phalombe

Source: Researcher (2016).

Figure 1.2 Men Focus Group Discussion-Phalombe

Source: Researcher (2016).

Figure 1.3 Women Focus Group Discussion-Nkhotakhota

Source: Researcher (2016).

Figure 1.4 Men Focus Group Discussion-Nkhotakhota

Source: Researcher (2016).

Figure 1.5 Focus Group Discussions Members in Dowa- Demonstration of manure making

Source: Researcher (2016).

Figure 1.6 A Male adopter demonstration on cultivation of tobacco

Source: Researcher (2016).

Figure 1.7 The Researcher learning on mulching in Phalombe

Source: Researcher (2016).