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Socio-Economic Factors Associated with the Adoption of Conservation Agriculture Among Women Farmers in Balaka District, Malawi

For the degree of Master of Science

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Date

SOCIO-ECONOMIC FACTORS ASSOCIATED WITH THE ADOPTION OF
CONSERVATION AGRICULTURE AMONG WOMEN FARMERS IN BALAKA
DISTRICT, MALAWI

A Thesis

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of

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Chimwemwe M. Chisenga

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ABSTRACT

Chisenga, Chimwemwe M., M.S., Purdue University, May 2015. Socio-economic factors associated with the adoption of conservation agriculture among women farmers in Balaka District, Malawi. Major Professor: Brian A. Talbert

The study was conducted in Balaka District, Malawi among women farmers. The study focused on three research questions: What socio-economic factors are associated with the rate of adoption of conservation agriculture among women farmers in Balaka District, Malawi? What are the levels of adoption of conservation agriculture among women farmers in Balaka District, Malawi? What are the main sources of information for conservation agriculture among women farmers in Balaka District, Malawi that lead to adoption of CA?

Quantitative data were collected using a door-to-door survey. The survey was verbally administered to 60 women farmers. Qualitative data were collected through informal interviews with five women farmers, which provided more in-depth data.

Findings revealed availability of farm labor, access to farmer trainings on CA, farm size, source of information, education level, access to farm inputs, age, membership to a farmer group and visits by the Extension worker are positively associated with adoption of CA. Conversely, inadequate knowledge on CA, inadequate number of Extension workers in the area, inadequate resources to buy farm inputs and small land holding sizes are negatively associated with adoption of CA. Among these women farmers, 47% adopted CA with the major sources of information on CA being Extension workers, village meetings, friends and the radio. The six major themes that emerged from the informal interviews were grouped into two categories of factors that are positively associated with adoption of CA and those that are negatively associated with adoption of CA. It was found that the qualitative results were related to those found quantitatively. It was found that regarding adoption of conservation agriculture an inadequate number of Extension workers and lack of inputs affect women farmers negatively.

Four recommendations were made. First, the Malawi government should recruit more Extension workers to reduce the knowledge gap present among farmers. Second, there is a need for subsidizing the price of the inputs package for CA in order to increase its adoption. Third, the Malawi government should help communities gain access to loan facilities. Fourth, Extension workers should increase utilization of the farmers' groups in order to facilitate dissemination of information about new technologies. More training on CA should be provided to the farmers through their groups in order to increase the adoption rate.

CHAPTER 1: INTRODUCTION

1.1 Background and Justification

Malawi is a landlocked country that relies on agriculture to drive its economy. The sector remains important for achieving economic growth, which benefits the poor. Therefore, increasing agricultural incomes is the key source of poverty reduction (Chirwa, 2005). About 80% of the workforce is employed by the agricultural sector on the farm, in agricultural related industry, or indirectly through marketing and processing farm products. Agriculture contributes “over 80% of the foreign exchange earnings. It accounts for 39% of Malawi’s gross domestic product (GDP) and contributes significantly to national and household food and nutrition security. More than 85% of rural households derive their livelihoods from agriculture” (Malawi, 2003, 2012). “Although it is an important sector of the economy, gender disparities and Human Immuno-deficiency Virus (HIV) issues are among the major constraints that hinders its contribution to sustainable development in the country” (Malawi, 2012). Malawi’s economic reliance on the export of agricultural commodities leaves it vulnerable to external factors such as droughts. This is compounded by the reliance on rainfall to supply the water needs for crop production.

The agriculture sector in Malawi is facing environmental challenges, among which are soil erosion, low soil organic matter, nutrient deficiency and drought –induced

water shortage (Mlamba, 2012). These challenges are caused by Malawi's main activity of poor farming practices e.g. growing crops, which is associated with making fresh ridges every growing season where the crops are planted.

Continuous ridging leads to soil erosion and as the soil is drained; important soil nutrients needed for the crops are lost (Chirwa, 2005; Mlamba, 2012). Climate change has also led to farmers experiencing droughts and erratic and unreliable rains making technologies that help harnessing water in the soil while at the same time retaining soil nutrients very important (Malawi, 2013). It is because of the above mentioned reasons that the Malawian Government has promoted alternative crop production methods to enhance productivity, while at the same time conserving soil and water. One of the agricultural technologies being promoted is conservation agriculture (CA).

CA is defined as “a system of crop production, which is based on three principles: minimum soil disturbance, continuous soil cover, and, crop rotation with either agroforestry or legumes” (FAO, 2006). The objectives of CA are to increase crop production, while at the same time protecting and enhancing land resources on which production depends. It integrates ecological principles with modern technologies (FAO, 2006).

In many parts of the world, women play a major role as main farmers or producers in agriculture (Juergen, Marcela, & Cooke, 2009). In Malawi's agriculture sector, women provide 70% of the workforce and produce 80% of the food needed for home consumption. However, there is disparity between men and women in access to and control over agriculture production resources such as land, credit, Extension services,

farm implements and inputs (Malawi, 2012). The participation of women in decision-making is limited as men dominate the process.

Women, especially widows, are the main victims of agricultural-related property-grabbing including land, oxen, ploughs, and inputs. They also have limited access to agricultural markets due to lack of transportation, technology and price negotiation skills (Malawi, 2012). These factors have also been found to contribute to low rate of adoption of agricultural technologies including conservation agriculture.

This study is significant in three ways. Firstly, it will help in achieving agricultural development, economic growth, and food security. The findings of this study will inform the Malawian Government through the Ministry of Agriculture of the limitations to female farmers' adoption of conservation agriculture. "Efforts by national governments and the international community to achieve their goals for agricultural development, economic growth and food security will be strengthened and accelerated if they build on the contributions made by women and take steps to reduce their constraints" (Juergen et al., 2009).

Secondly, it will help the government ensure equal participation of men and women. Knowledge of the factors that are associated with adoption of CA will enable the Ministry of Agriculture to promote technologies that ensure equal participation of male and female farmers because it is the government's role to ensure gender mainstreaming in agriculture (Juergen et al., 2009; Malawi, 2012). Promoting these technologies will ensure equal participation leading to improved food security at the household, community and national levels. With both men and women involved, adoption of improved

agricultural technologies would also increase leading to improved efficiency and production levels.

Thirdly, it will help The Ministry of Agriculture and non-governmental organizations (NGOs) project planners as they promote similar technologies. The findings from this study will help in future-related efforts for other technologies with similar characteristics which may be implemented with less difficulty because “there is a need to ensure that the gender concerns and women participants are integrated in all relevant projects by planners, policy-makers as well as organizations involved” (Sulo, Koech, Chumo, & Chepng’emo, 2012).

1.2 Problem Statement

Previous studies on the factors influencing adoption of various agricultural technologies have been conducted both outside and within Malawi. Those conducted in Malawi have targeted farmers in general. However, little information is available on women farmers and adoption of agricultural technologies and no study has been conducted in Malawi targeting the socio-economic factors that influence the adoption of CA among women farmers. This study will identify the factors associated with adoption of CA among the women farmers of Malawi, which will enable the Ministry of Agriculture to develop a strategy to improve adoption of CA among women farmers while promoting equal access to agricultural technologies by both male and female farmers.

1.3 Purpose of the Study

1.3.1 Purpose

The purpose of this study was to identify the socio-economic factors associated with the adoption rate of conservation agriculture among women farmers in Balaka District, in Malawi. The study used the Gender and Development Theory (Malawi, 2012) which looks at the role of women in agriculture and the Diffusion of Innovation Theory (Rogers, 2003) which addresses the rate of adoption of an innovation.

1.3.2 Research Questions

Three research questions guided this study.

- a. What socio-economic factors are associated with the rate of adoption of conservation agriculture among women farmers in Balaka District, Malawi?
- b. What are the levels of adoption of conservation agriculture among women farmers in Balaka District, Malawi?
- c. What are the main sources of information for conservation agriculture among women farmers in Balaka District, Malawi that lead to adoption of CA?

1.4. Assumptions, Limitations, and Delimitations of the Study

1.4.1 Assumptions

The study was conducted under three assumptions. First, that the respondents were selected randomly and every female farmer had an equal chance of being selected. Second, that all the female participants completing this survey were the head of the

households during the time of the survey. Third, that the transcriptions are accurate responses from the participants.

1.4.2 Limitations

This study was conducted under four main limitations. First, most of the female farmers are illiterate, so the questions were read to them and the responses were recorded verbatim. However, there could be a misunderstanding of the respondents to some of the terms. But, the researcher checked for respondent understanding and explained the questions where necessary. Second, it was possible that someone rather than the female farmer may have answered the questionnaire due to absenteeism of the female farmer who is the target, however, this was minimized by ensuring that the participant was indeed the head of the household before commencement of the survey. Third, the location of the study was very specific; therefore, data collected cannot be generalized to other districts in Malawi or other locations. Fourth, researcher bias on the qualitative data was minimized by showing the transcript to two other people to review and provide feedback. Researcher background bias was minimized through self-reflection on researcher identity (See Appendix D).

1.5 Definition of Terms

In this study, the major terms used are defined as follows.

Adoption: “a decision to make full use of an innovation (CA) as the best course of action available” (Rogers, 2003, p.21).

Adoption Level: for purposes of this study, adoption level is the phase of adoption at which the participants are during the time of the study. These levels are adopted, not adopted or adopted and discontinued.

Agriculture: “the art/science or occupation concerned with cultivating land, raising crops and feeding, breeding and raising livestock; farming” (Malawi, 2003).

Agriculture Season: for the purpose of this study, the agriculture season is normally associated with the rainy season because the country relies on rain fed agriculture. The season involves land preparation, planting, weeding, pest and disease control, and harvesting. Typically, the season begins in the month of September and ends in April (Malawi, 2003).

Child-Headed Household: for purposes of this study, a child-headed household is a household that contains children of less than 18 years of age whose parents are deceased.

Conservation Agriculture (CA): “a system of crop production, which is based on three principles: minimum soil disturbance, continuous soil cover, and, crop rotation with either agroforestry or legumes” (FAO, 2006). The objectives of conservation agriculture are to increase crop production, while at the same time protecting and enhancing land resources on which production depends. It integrates ecological principles with modern technologies (FAO, 2006).

Discontinuance: “a decision to reject/abandon an innovation after it has previously been adopted” (Rogers, 2003, p. 21).

District: an administrative division of the government; Malawi has 28 districts (CIA, 2012). It is an area demarcated by the government and it is where the

administrative offices for various governmental departments at district level are found (Malawi, 2003).

Extension Planning Area (EPA): an area within the district in which Extension services are planned and implemented. An EPA contains sections in which an Extension worker resides to assist farmers on various Extension services. EPAs are defined according to agro-ecological zones. In Malawi, a district is divided into several EPAs (Malawi, 2003).

Female-Headed Household: for purposes of this study, a female-headed household is a household where the leader of the house is a woman; she might be widowed or separated. In this household, there is no man as husband.

Gender bias: “a preference or prejudice toward one gender over the other. Bias can be conscious or unconscious, and may manifest in many ways, both subtle and obvious” (Malawi, 2012).

Gender mainstreaming: “an organizational strategy to bring a gender perspective to all aspects of an institution’s policy and activities, through building gender capacity and accountability” (Reeves & Baden, 2000; Malawi, 2012).

Gender sensitivity: “awareness of the difference between men and women’s needs, roles, responsibilities and constraints and being able to take action to address them” (Malawi, 2012). It takes into consideration the impact of policies, and programs on women, men, boys and girls.

Household: “individuals who comprise a family unit and who live together under the same roof; individuals who dwell in the same place and comprise a family,

sometimes encompassing domestic help; all those who are under the control of one domestic head” (FAO, 2002).

Innovation: “an idea, practice or object that is perceived as new by an individual or other unit of adoption” (Rogers, 2003, p. 12).

Male-Headed Household: For the purposes of this study, a male-headed household is a household where there is a husband who acts as a leader of the house.

NGO: for the purposes of this study, NGOs are non-governmental organizations that work with the agriculture sector to implement agricultural activities in Balaka District. The NGOs are Concern Universal, Goal Malawi, Self Help Africa, World Vision International, NASFAM (National Association of Smallholder Farmers in Malawi), Chinansi Foundation and National Youth Organization (NAYORG).

Pit planting: “it is one of the techniques under conservation agriculture (also called basin planting) which ensures prolonged moisture in the root zone which in return ensures continued growth during dry spells. The plants are grown in pits, which are filled with soil combined with manure, the pits help in collecting water and letting it infiltrate into the soil slowly even after the rains have stopped. The pits are dug in the first year and continue being used for the next three to four years” (Maher, J. 2012). “Measurements for the pit are 40 cm wide; 70 cm long while depth is 60 cm, the spacing between pits is 75 cm” (Malawi, 2012).

Rate of adoption: “the relative speed with which an innovation is adopted by members of a social system” (Rogers, 2003, p. 23).

Rejection/ Non-adoption: “a decision not to adopt an innovation” (Rogers, 2003, p. 177).

Smallholder Farmer: “a farmer who has less than three hectares of land” (Malawi, 2003).

Socio-Economic Factors: for purposes of this study, these are social and economic experiences and realities that mold a farmer’s actions. Examples are education level, income level, access to information, land holding size, marital status, and household size.

Women Farmers: for purposes of this study, these are women who are from female-headed households and are involved in agricultural activities for most of their time.

Women in Development (WID): “the WID (or Women in Development) approach calls for greater attention to women in development policy and emphasizes the need to integrate them into the development process” (Tasli, 2001). In contrast, “the GAD (or Gender and Development) approach focuses on the socially constructed basis of differences between men and women and emphasizes the need to challenge existing gender roles and relations” (Reeves & Baden, 2000; Tritz & Martin, 1998).

CHAPTER 2: LITERATURE REVIEW

The literature review was carried out to examine the general information on women and agriculture, role of women in agriculture, women and adoption of farm technologies, women and adoption of agricultural technologies, adoption of soil management practices, adoption of soil conservation practices, and conservation agriculture (CA). The initial search was conducted using Purdue Libraries. The key terms used to search for information were: women and agriculture, women in agriculture, adoption of agricultural technologies, adoption of innovations, adoption of soil conservation practices, sustainable land development practices, gender and agriculture, women participation in development, role of women in agriculture, role of women in crop production, and adoption of agricultural innovations. The following databases were used: Pro-quest, EBSCO, Google Scholar and inter-library loan. Journals searched included *Journal of Agricultural and Extension Education*, *Journal of Agricultural Economics*, *Journal of Sustainable Agriculture*, *Journal of Extension Systems*, *Journal of Agricultural Research*, *Journal of Marketing*, *Journal of Emerging Trends in Economics and Management Science*, and *American Journal of Sociology*.

Other articles were retrieved from the Association for International Agricultural and Extension Education while the policy strategies from Malawi were sourced from Malawi literature. The dates for the literature ranged from 1995 to 2013.

2.1 Conservation Agriculture

Conservation Agriculture (CA) is defined as a system of crop production which is based on three principles (FAO, 2006). Firstly, CA is being promoted as one way of minimizing soil disturbance, using no-till to control weeds while at the same time conserving the soil's structure. Nyanga, Johnsen, and Kalinda (2012) compared tilled soil to no-till. "Bare or tilled soil encourages weed seeds to become active and sprout whereas no-till helps prevent sprouting of weed seeds. No-till preserves the soil's structure because the soil is not disturbed. Finally, tilled soil requires 50-70 person days of labor per hectare whereas no-till reduces the labor time to 10-20 person days per hectare" (Nyanga et al., 2012). Soil disturbance can also be minimized through pit planting. The making of pits/basins minimizes soil disturbance by filling the pits with manure, then crops are grown on top of the manure/soil mixture in the pits. The process is labor intensive in the first year; however, "pits/basins reduce labor in subsequent years and they are useful in conserving moisture content in times of drought. Once a pit is made, it can be used for approximately three to five years before needing to make a fresh one" (Nyanga et al., 2012).

Secondly, CA is being promoted as continuous soil cover using mulching. The mulching in this case can either be crop residues or it can be live mulching e.g. intercropping maize/corn with legumes or agroforestry (Chomba, 2004). Mulching can be done soon after harvesting the crops, the crops residues are left in the field to allow the mulch to make a continuous cover on the land. At the same time, some of the mulch decomposes to form humus, which adds fertility to the soil. During planting time, the

mulch acts as soil cover to preserve soil moisture. In the case of cover crops like legumes (e.g. Groundnuts), a natural cover is created by the cover crops hence still protecting the moisture while at the same time; the legumes fix nitrogen in the soil. The crops under this practice survive during drought because there is still enough moisture for the crop to grow (Chomba, 2004).

Thirdly, as crop rotation with agroforestry or legumes i.e. the crops/plants are rotated every year. This helps in improving the soil structure because the legumes fix nitrogen in the soil which is an essential nutrient for maize and the agroforestry trees with their leaves/biomass used as green manure to increase the organic matter in the soil (Meinzen-Dick et al., 2011).

The objectives of conservation agriculture are to increase crop production, while at the same time protecting and enhancing land resources on which production depends. It integrates ecological principles with modern agricultural technologies (FAO, 2006). However, adoption among female farmers is very low. Although CA has been introduced for almost seven years now, it still encounters a problem of low adoption rate among farmers especially women farmers (Nyanga et al., 2012). Women play a major role in agriculture as explained in the next section.

2.2 Role of Women in Agriculture

Women living in the rural areas do much of the farm work. In the developing world, where more than a third of the total population is rural and female, women produce most of the food for domestic consumption (Sulo et al., 2012). “The sustainable production of food is the first pillar of food security. Millions of women work as farmers,

farm workers and natural resource managers. In doing so, they contribute to national agricultural output, maintenance of the environment and family food security” (Huerta, 2006). In Malawi, women are very important in agriculture; 70% of Malawi’s fulltime farmers are women (Malawi, 2003), but their contribution to productivity is very low due to use of poor agricultural technologies and limited access to resources. However, Juergen et al. (2009) found “if women farmers from developing countries were given the same access to resources and opportunities as men, yields on their farms would increase by 20-30% and improve food security by 12-17% in terms of reduction in people facing hunger.”

Land holding size, increased household income, head of household, access to credit/loans, education level, access to Extension services, length of residence in the village, membership to a farmers’ group/association and land ownership affect farmers’ adoption of improved agricultural technologies (Fashola, Oladele, Alabi, Tologbonse, & Wakatsuki, 2007; Namwata, Lwelamira, & Mzirai, 2010; Thi, Chi, & Yamada, 2002). However, these researchers generalized their studies because they did not study women farmers to identify factors that are associated with adoption of these technologies, which include CA.

Although CA has been utilized in Malawi for almost eight years, its adoption rate among farmers especially women farmers is low. Some researchers have suggested “that women’s adoption rates are affected by their specific needs and their access to resources” (Rathgeber, 2011). Adoption rates differ between men and women farmers because they have different preferences. A study of male and female farmers in Malawi concluded that “women farmers were quicker to adopt a new bean variety because it had qualities that

women valued such as shorter cooking time and good taste” (Masangano, Miles, & Taylor, 2008). “In Vietnam, an IFAD project found that although both male and female farmers wanted high yielding and high value rice varieties, men were equally concerned with pest resistance while women placed greatest value on the characteristics associated with easier post-harvest processing and taste” (Mugwe et al., 2009; Peterman, Quisumbing, Behrman, & Nkonya, 2011). This may be true with maize varieties, where women adopt a variety because of its poundability while men will look for a variety that will provide high income after selling. However, in CA, there might be specific socio-economic factors that lead more male farmers to adopt CA than female farmers.

2.3 Socio-Economic Factors Affecting Adoption of Agricultural Technologies

Studies on socio-economic factors that constrain women farmers from adopting agricultural technologies found the factors to be lack of access to land, lack of capital and credit facilities, non-membership of women’s group, non-provision of information by the agricultural officers on agricultural production technologies, and ineffective Extension services and coverage. However, it is not yet known which factors prevent women farmers from adopting conservation agriculture in general (Davis et al., 2010; Doss & Morris, 2001; Mohamed, Aly, & El-Haliem, 2001; Peterman et al., 2011).

“Farmers’ access to labor (family or hired) critically impacts their ability to adopt new technologies and increases overall production.... In this case, female-headed households may be at a disadvantage as they have fewer male family members and fewer resources to buy outside labor” (Menale, Zikhali, Pender, & Kohlin, 2011). Menale et al. (2011) noted that in Ethiopia, women who do not have adolescent or adult sons must hire

additional labor to plough their fields because their culture prevents them from doing such work. However, culture differs from one country to another as Doss (2001) noted in her review of designing a technology for African female farmers. She found that there was enormous diversity and complexity between different African villages and countries and interventions differed according to context, culture, or country.

One major constraint to technology adoption is that women have less access to new technologies and the inputs necessary to utilize these technologies to the fullest. Quisumbing (1996) reviewed the economic evidence on gender differences in agricultural productivity throughout the developing world and concluded that women farmers' lower yields are attributable to lower levels of inputs and human capital than men. However, it was noted that women often have less access to credit with which to buy valuable assets precisely because they have less access to secure land and are less able to produce lucrative surpluses which require expensive inputs (Doss, 2001). Furthermore, similar studies in Ghana, Nepal and Malawi revealed that given equal access to inputs, adoption rates and output/yield are no different for men and women farmers (Doss & Morris, 2001; FAO, 2011).

Research has indicated that education and extension both play essential roles in determining adoption rates; however, women's access to these valuable resources is often limited. In a recent review of Extension services in Ghana, Ethiopia, and India, researchers found large gender inequalities in access to Extension services. Mean differences were especially prominent in Ghana and India, where female-headed households had less average contact with extension agents (Peterman et al., 2011). However, empirical studies have revealed that women participation in various

agricultural activities could increase adoption of new agricultural technologies. Furthermore another study found that Eastern African women who participated in Farmer Field Schools were more likely to adopt major technologies, including improved seed varieties, soil fertility management and pest control techniques (Davis & Nkonya, 2008). In Kenya, female farmers with little education were able to succeed in the uptake of soil fertility replenishment technologies when explanations were given in simple, concise terms (Kimenye, 2001). “Farmers’ access to labor (family or hired) critically impacts their ability to adopt new technologies and increases overall production” (Menale, Zikhali, Pender, & Kohlin, 2011). Even so, in addition to these structural constraints, there may be other constraints to women’s adoption of technologies that are more readily solved. Women may be unable to buy inputs because they are too expensive but a reduction in the size of packages can increase adoption (Wetengere, 2010). On the same note, Namwata et al. (2010) found that increased household income, head of household, age and access to credit/loans had an influence on adoption of improved agricultural technologies. In addition, there is a positive relationship between education level, income level, land size and access to Extension services and adoption of technologies (Thi et al., 2002). However, Fashola et al. (2007) found that length of residence in the village, membership to a farmers’ group/association, land ownership and educational level are the socio-economic factors that explain preference of Sawah rice production technologies.

It has been found the factors that constrain women from adopting agricultural technologies are lack of access to land, lack of capital, and lack of credit facilities, non-membership of women’s group, non-provision of information by the agricultural officers on agricultural production technologies, ineffective Extension services and coverage

(Sulo et al., 2012). However, little information is available concerning adoption of CA among women farmers.

2.4 Theoretical Framework

This study looks at two theories: Diffusion of Innovation (DOI) Theory and the Gender and Development (GAD) Theory.

2.4.1 Diffusion of Innovations (DOI) Theory

Rogers' (2003) Diffusion of Innovations (DOI) Theory is used to explain how an innovation spreads and why it is adopted or not. "Adoption of innovations refers to the decision to apply an innovation and to continue to use it (Rogers, 2003). A wide range of aspects which include; economic, social, physical and technical aspects of farming influences adoption of agricultural production technologies" (Oladele & Adekoya, 2006). Adoption has been determined through various variables; including "gender, level of formal education, household size, farm size and wealth level. The involvement of farmers in technology development process is central for success in the adoption of farm technologies, and the farmers' decision to adopt or not depends on their attitude towards the innovation, farming experience, household size and visits by extension agents" (Oladele & Adekoya, 2006).

"The rate of adoption is determined by five determinants, these include; attributes of innovation, innovation decision process, communication channels, social system norms and network interconnectedness, and efforts of the promotion agents" (Rogers, 2003, p. 222). The first determinant is attributes of innovation. The five attributes are

relative advantage, compatibility, observability, trialability, and complexity (Rogers, 2003). These are explained next.

The relative advantage of Conservation Agriculture (CA) practices reflects the extent to which farmers perceive advantages of using and implementing these practices. Advantages include increased profitability, decreased production costs, decreased discomfort, increased social prestige, and decreased time and effort (Byron & Shooter, 2005; Chigona & Licker, 2008).

“Compatibility is the extent to which farmers’ perceptions of implementing CA practices are consistent with their existing values, beliefs, past experiences and needs. If an innovation is incompatible with a grower’s social values and beliefs, it will not be adopted as rapidly as an innovation that is compatible. In previous studies, compatibility appears to have a significant impact on willingness to adopt” (Ghane, Samah, Ahmad, & Idris, 2011).

Observability is the “extent to which the results of an innovation are visible to others. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt it” (Rogers, 2003, p. 16). “Such visibility stimulates peer discussion of a new idea, as friends and neighbors of an adopter often request innovation evaluation information. Observability is an important founding principle of agricultural extension education, which has often used demonstration plots and field days to promote change among growers/farmers” (Ghane et al., 2011).

“Trialability is the degree to which an innovation may be experimented with on a limited basis. The more trialable the innovation, the more likely it will be adopted. Trying an innovation on a limited basis allows adopters to become familiar with how it works

and to evaluate its effectiveness while minimizing the risk of full adoption” (Rogers, 2003, p. 16). Rogers (2003) stated potential adopters who test out an innovation will feel more comfortable with it and more likely to adopt it.

The fifth attribute is complexity. This attribute has also been referred to as usability. “Complexity is the degree to which an innovation is perceived as relatively difficult to understand or use. New ideas that are simpler to understand by members of a social system are adopted more rapidly than innovations that require the adopter to develop new skills and understandings” (Rogers, 2003, p. 16). A low level of complexity or a high level of ease of use leads to higher adoption rates. In other words, complexity increases rejection rates. Rogers proposed a negative relationship between complexity and adoption rates.

Additional diffusion studies confirm the relationships posited by Rogers. “Rogers claims that at least half and as much as 87% of the variance in rate (speed) of adoption is explained by the five attributes” (Nancy & Zurbuchen, 1979). “Innovations which are perceived by individuals as having greater relative advantage, compatibility, trialability, observability and less complexity will have a greater adoption rate than other innovations” (Rogers, 2003, p. 16). In CA, a higher rate of adoption would be associated with farmers seeing CA as easy to implement and use.

The second determinant influencing the rate of adoption is the Innovation Decision Process. This is the process through which an individual passes from knowledge about the innovation to developing an attitude and finally adopting (Rogers, 2003).

The third determinant influencing the rate of adoption is Communication Channels. Communication channels are the source of information for the individual; it

can be interpersonal, mass media, and originating from specific or diverse sources. “Access to information about an innovation results in the formation of attitudes and perceptions regarding the innovation (Rogers, 2003). Exposure to information most often occurs through various communication forums such as extension meetings, on farm trials and agricultural trainings” (Masangano et al., 2008).

The fourth determinant influencing the rate of adoption is Social System Norms and Network Interconnectedness. These are the socio-cultural practices and norms that can inhibit or drive adoption. “Social networks have been shown in many studies to influence decision making at both the micro and macro levels. Examples include social influence on voting behavior and smoking behavior, as well as driving the propagation of innovations in social organizations” (Nancy & Zurbuchen, 1979).

The final determinant is Efforts of the Promotion Agents (Rogers, 2003). This determinant includes past and present efforts by Extension workers to promote an innovation. “The efforts of promotion agents can be through various communication forums such as extension meetings, on farm trials and agricultural trainings” (Masangano et al., 2008). Promotion agents are used for promoting CA and the more frequent the forums, trainings and trials, the higher the adoption rate among the women farmers. However, it is not yet known how effective CA trainings are for women farmers bearing in mind that women farmers have their own adoption preferences (Rathgeber, 2011).

2.4.2 Gender and Development Theory (GAD)

The GAD Theory focuses on changing the structures such as laws, systems of thought and socialization practices that help identify the disadvantages among women in

agriculture (Tritz & Martin, 1998). It offers a more holistic view of women's issues and believes that women's lives are shaped by relations with men and the people in their society (Young, 1993). "No study of women and development can start from the viewpoint that the problem is women but rather the relationships between men and women. Gender is a social and cultural construct, which refers to the relative position of men and women within the family as well as society. Due to its social and cultural characteristics, gender differs within and between cultures, and has a dynamic character, which makes it subject to change under the influence of a wide range of socio-economic factors" (Tasli, 2007). By looking at the gender perspective in terms of adoption of CA, it may lead to action by researchers, policy makers and the implementers of CA to integrate gender issues in their development efforts.

Although men and women have culturally been assigned with some agricultural tasks, "the demarcations on their roles have reduced due to factors like migration, HIV and AIDS and other intervening factors" (Malawi, 2012). This has resulted in an increase in the number of female-headed households with a heavier agricultural workload formerly done by men now being done by women (Rathgeber, 2011). "Female-headed households are often unable to mobilize additional labor when needed, because they tend to be poorer with fewer resources to pay for labor" (Rathgeber, 2011).

Regarding GAD and the role of women in agriculture, The Food and Agriculture Organization (FAO) found that there are eight crucial points to improving the quality of life for rural women in agriculture. These eight are access to land, credit, agricultural inputs, extension and training, education, technology, rural organizations, and services (FAO, 2011; Gender, 2011; Huerta, 2006).

Nakhumwa and Hassan (2012) described the importance of land and credit to agricultural production. Access to land is important for farmers to conduct long-term improvements that require investment of time and resources. Access to credit allows farmers to pay for inputs and hired labor. Access to agricultural inputs such as improved seeds, pesticides and fertilizers are a vital part of agricultural production. However, most women farmers lack the land or property needed as collateral for credit to purchase these agricultural inputs. On the same note, “women farmers seldom have access to extension services due to few women extension personnel and in some societies, cultural norms do not allow men to interact with women” (Malawi, 2012). Most rural women are illiterate because they had limited access to education, “education is human capital and it reduces poverty and encourages sustainable economic growth” (Nyanga, et al., 2012).

The focus of the previous studies has been on factors influencing adoption of various agricultural technologies conducted outside and within Malawi. Those conducted in Malawi have targeted farmers in general. However, little information is available on women farmers and adoption of agricultural technologies and no study has been conducted in Malawi targeting the socio-economic factors that influence the adoption of CA among women farmers. Roger’s DOI Theory provides the general lens of how an innovation such as CA is adopted, whereas GAD Theory addresses the context of women farmers. It is through these lenses this study looked at women farmers in Malawi and their adoption of CA.

The study’s conceptual framework illustrates how the two theories combined can be related to adoption of conservation agriculture.

2.5 Conceptual Framework

Based on the literature about adoption of CA, the conceptual framework is illustrated in Figure 1. The two theories have been linked together (DOI and GAD), using the eight crucial points/factors to improving the quality of life for rural women in agriculture which have been grouped according to what Rogers (2003) stated as determinants of adoption. The first category is related to attributes of innovation, followed by the type of innovation decision, communication channels, the nature of the social system, and extent of change agents' promotion efforts.

Adoption of CA depends on a number of factors, which include farmers' access to training. The farmers need to know how to do it through demonstrations by the extension staff. Therefore training farmers on the technology is very important for its adoption. In the case of herbicide use, farmers need to learn how to identify and use the herbicides in a correct way. The farmers also consider immediate benefits from the technology, such as high yield. As such, it is very important to follow the necessary procedures in order to prepare the land for CA. "A farmer needs to start with a small part of the farm" (FAO, 2012). However, "if the farmer does not have access to this knowledge and the extension agents, it becomes difficult to adopt CA" (Williams & Richter, 2008). It has also been found that "adoption of pit (basin) planting is being constrained by increased labor requirements for land preparation, compost making and weeding" (Grabowski, 2011). The high demand for inputs discourages CA adoption because either most adopters are those who can afford the inputs or the inputs have been provided by the NGOs.

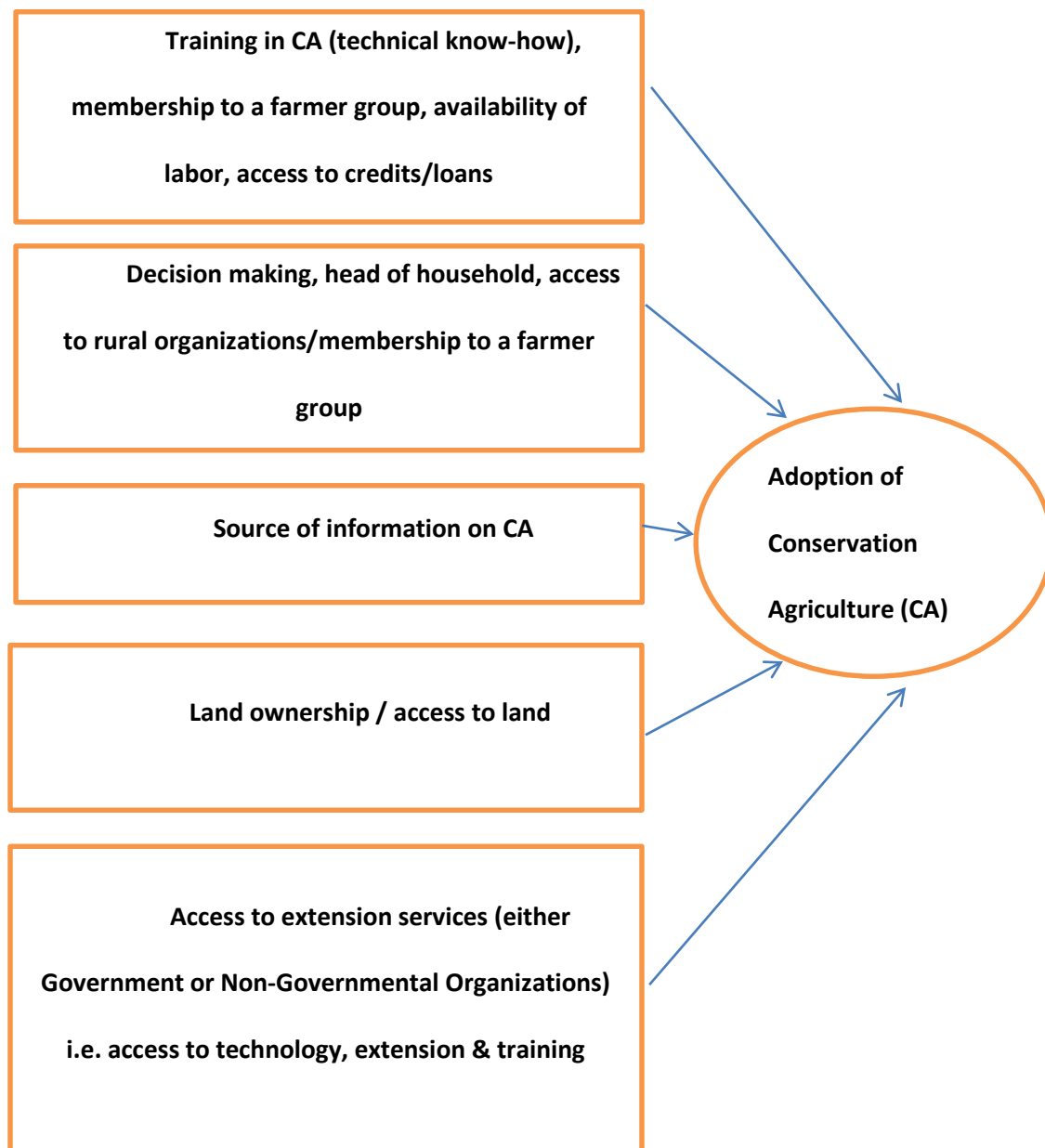


Figure 1: The conceptual framework on the basis of Roger's Framework on Determinants of Adoption. (Adapted from Rogers, 2003)

2.6 Summary

The sustainable production of food is the first pillar of food security. “Millions of women work as farmers, farm workers and natural resource managers. In doing so, they contribute to global agricultural output, maintenance of the environment and family food security” (Sulo et al., 2012). In Malawi, “women are very important in agriculture with 70% of Malawi’s fulltime farmers being women” (Malawi, 2012). However, their contribution to agricultural productivity is very low due to use of less effective technologies because of limited access to resources. “If these women farmers have access to the same resources and opportunities as men, yields on their farms would increase by 20-30% and improve food security by 12-17% in terms of reduction in people facing hunger” (Juergen et al., 2009). While women in developing countries are the major contributors to the agricultural sector, they are the last to benefit from the prevailing economic growth and development processes. “Gender bias and gender blindness persist: farmers are still generally perceived as ‘male’ by policy makers, development planners and agricultural service deliverers” (FAO, 2002, 2011; Huerta, 2006). “Agricultural productivity in women farmers increases significantly when women have the same access to inputs as men do” (Huerta, 2006; Nyanga et al., 2012; Quisumbing, 1996). The Diffusion of Innovations (DOI) Theory and the Gender and Development (GAD) Theory have been chosen because women play a major role in Malawian agricultural production. Additionally, the factors associated with the rate of adoption of agricultural technologies needed to be explored by using the generalized Theory of Diffusion of Innovations through Determinants of Adoption combined with the Theory of Gender and

Development. The two theories have been utilized to identify the socio-economic factors that are associated with adoption of conservation agriculture among women farmers.

CHAPTER 3: METHODOLOGY

3.1 Purpose of the Study and Research Questions

3.1.1 Purpose

The purpose of this study was to identify the socio-economic factors associated with the adoption rate of conservation agriculture (CA) among women farmers in Balaka District, in Malawi. The study used the Gender and Development Theory to analyze the role of women in agriculture and the Diffusion of Innovation Theory to determine the rate of adoption of CA.

3.1.2 Research Questions

Three research questions guided this study. Regarding the adoption of CA among women farmers in Balaka District, the research questions focused on socio-economic factors, level of CA adoption, and main sources of information. Specifically, the research questions were as follows:

- a. What socio-economic factors are associated with the rate of adoption of conservation agriculture among women farmers in Balaka District, Malawi?
- b. What are the levels of adoption of conservation agriculture among women farmers in Balaka District, Malawi?

- c. What are the main sources of information for conservation agriculture among women farmers in Balaka District, Malawi that lead to adoption of CA?

3.2 Geographical Area

This study was conducted in Balaka District, which is in the southern part of Malawi. It is one of the 28 districts in Malawi and has a total population of 125,444 farm families comprised of 61,091 male-headed households, 63,475 female-headed households and 828 child-headed households (Balaka District, 2013). With these statistics, about 51% of the farmers in Balaka are from the female-headed households. The district also has Six Extension Planning Areas (EPA). This district was chosen because of the significant number of activities promoting conservation agriculture from non-governmental organizations (NGOs) and the government sectors.

3.3 Sampling Frame and Strategy

The sampling frame of this study was all the female-headed households in Balaka District. The district agriculture office maintains a list of all the farmers by gender. This list is updated annually to identify beneficiaries in the government's farm input subsidy program. Sixty women farmers were sampled from the population of female farmers in Balaka District. The names used in this survey were taken from the updated list in the 2012 - 13 agriculture season to ensure the sample truly represented the current female farmers in Balaka District.

Random sampling was used to select three of the six extension planning areas. The three EPAs selected were Bazale, Mpilisi, and Rivirivi, then in each EPA two villages were selected to represent the rest of the villages in the EPA. This made a total of

six villages selected. Stratified random sampling was used to get 20 female farmers from each EPA (i.e. 10 participants per village). The villages were as follows; Mpilisi EPA (Chiyendausiku and Saiwa villages), Bazale EPA (Hanjahanja II and Kusigala villages) and Rivirivi EPA (Lakalaka and Chimbalanga villages). This system was used to give the farmers an equal chance of being selected and to avoid bias of other farmers who were not selected for the survey.

For qualitative data, purposeful sampling was used to get a minimum of five female farmers who were interviewed. The five farmers were among the 60 sampled participants. This is an approach used for locating information – rich key informants or critical cases (Braun & Clarke, 2006). The farmers interviewed pointed out the names of their colleagues who had the necessary information for the interview. Out of the five participants under informal interviews, two were from Lakalaka Village, two from Saiwa Village and one from Kusigala Village.

3.4 Data Collection and Analysis

3.4.1 Development of Instruments

The data collection instrument (see Appendix A) was researcher-developed with reference to Bonabana-wabbi's (2002) questionnaire on assessing factors affecting adoption of agricultural technologies. The researcher-developed instrument questions were specific to women farmers, Malawian agricultural practices, and Conservation Agriculture (CA). The questionnaire was pilot tested with five individuals from Hanjahanja 1 Village (which was not among the sampled villages for the study) in Bazale EPA. The five participants responded to the questionnaire without any difficulties. The

pilot test results were not analyzed statistically, but were visually reviewed. With no outliers seen in the pilot test data and the pilot test participants not having trouble in understanding the questions, no changes were made to the questionnaire. Conducting the pilot test gave the researcher experience on how to ask the questions. This encouraged the researcher to proceed with the administration of the questionnaire.

For face validity, the researcher's graduate committee reviewed the instrument providing wording changes and question clarification. The pilot test provided some measure of face validity by asking the questions to participants similar to the study sample. No statistical analyses were conducted either a priori or post-hoc to determine instrument reliability.

3.4.2 Institutional Review Board Approval

Upon approval by the research committee, the application for authority to conduct research was written to Malawi (Ministry of Agriculture) and was approved. The approval letter, together with an application for exemption in conducting a study with human subjects was sent to the IRB. The exemption was granted on June 27, 2013 and the protocol number is 1306013715 (see Appendix B).

3.4.3 Data Collection Procedures

The data collection methodologies were a door-to-door survey and informal interviews. The door-to-door survey was used to collect quantitative data. This method was chosen because most of the farmers in Malawi are illiterate therefore other means like the internet and mail surveys could not be recommended.

In administration of the door-to-door structured questionnaire, the researcher read the questions to the farmers and recorded the farmers' verbal responses. For this study, door-to-door administration of the questionnaire meant the researcher met the selected 60 respondents in their homes. Informal interviews were conducted with five of the participants to obtain qualitative data collected on the four open-ended questions found in Appendix A. These interviews were recorded using a digital voice recorder and the interviews were transcribed into English.

3.4.4 Data Analysis

Chi-square test and Descriptive statistics from SPSS (Statistical Package for the Social Sciences Version 20.0) were used to analyze the data quantitatively. The significance level for Chi-Square test was set at 0.05 with any result below 0.05 being significant with those above not significant. The survey was translated into a codebook in SPSS for data analysis while thematic analysis was used to analyze data qualitatively (See Appendix C).

For the qualitative portion of this study, five interviews were conducted. Before the interviews, the researcher obtained consent from the participants to participate in the study. All five participants granted the interview to be recorded. Each interview lasted 5-10 minutes. An audio voice recorder was used to record the interviews, supported by field notes taken during the interviews. Data were stored on a computer, a flash drive, and a separate hard drive.

The verbal data were transcribed into written form to conduct a thematic analysis (Braun & Clarke, 2006). The interviews were conducted in the local language (*Chewa*)

spoken by both the interviewees and the researcher. The researcher transcribed the interviews into English to enable her research committee to review and confirm the findings.

Utilizing Braun and Clarke's (2006) method, the researcher familiarized herself with the data after the transcription; data were read and re-read while identifying the initial codes. Initial codes were generated by observing the interesting features of the data across the entire transcript; relating data to each code. Then the codes were compared to identify potential themes and matching. The naming of the themes was related to the topic being studied.

Credibility of the data was ensured by following Braun and Clarke's thematic analysis procedure so that someone could replicate the study (Braun & Clarke, 2006). Validity of the data is verified by triangulation of the data to the theory by referring to the two theories (DOI & GAD) as in Patton (2001).

CHAPTER 4: FINDINGS

The participants in this study were women farmers from female-headed households in the Balaka District of Malawi. Sixty participants were selected from three EPAs namely Rivirivi, Mpilisi and Bazale. In each EPA, two villages were randomly sampled namely Lakalaka and Chimalanga, Chiyendausiku and Saiwa, and Hanjahanja II and Kusigala, respectively. Each village provided 10 participants while the participants in the informal interviews were from Bazale EPA and Rivirivi EPA.

4.1 Farmers Awareness of Conservation Agriculture (CA) and Levels of Adoption

Tables 4.1 and 4.2 show the awareness of CA and adoption of CA by women farmers. Of the 60 women farmers interviewed, all responded with 59 (98.3%) aware of CA. One respondent was not aware of CA. Less than half of the women farmers (28 out of 60) have adopted conservation agriculture practices.

Table 4.1

Women Farmers' Awareness of CA (n=60)

Awareness of CA	F	%
Aware	59	98.3
Not aware	1	1.7

Table 4.2

Women Farmers Adoption of CA (n=60)

Adoption of CA	F	%
Yes	28	46.7
No	32	53.3

4.2 Factors Associated with Adoption of Conservation Agriculture (CA)

Table 4.3 shows results on socio-economic factors and whether the women farmers adopted or did not adopt CA. Of the sample of 60 women farmers, 28 (47%) had implemented CA practices. Adopters of CA were more likely to be members of a farmer group, have access to 4-6 laborers, have received farmer training on CA, have one to more than three hectares of land, have a household size of 7-9, and be age 40-49 years.

Table 4.3

Socio-Economic Factors and Their Association with Adoption of CA (n=60)

Socio-Economic Factor	Category	Total	Adoption of CA	
			Adopted	Not adopted
Membership to farmer group				
	Yes	19	10	9
	No	41	18	23
Access to labor				
	1-3	45	16	29
	4-6	15	12	3
Access to credits/loans				
	Yes	8	3	5
	No	52	25	27
Farmer training on CA				
	Yes	24	19	5
	No	36	9	27
Additional source of income				
	Yes	42	19	23
	No	18	9	9
Farm size				
	Less than 1 ha	28	8	20
	1 to 3 ha	26	16	10
	More than 3 ha	6	4	2
Household size				
	1-3	18	7	11
	4-6	30	12	18
	7-9	12	9	3
Age				
	18-19	1	0	1
	20-29	13	5	8
	30-39	17	6	11
	40-49	16	11	5
	50 or older	13	6	7

Only 32% (19 out of 60 women farmers) were members of a farmers group. However, 53% of those belonging to a farmers group did adopt CA. Of those not belonging to a farmers group, 56% (23 out of 41) did not adopt CA.

Regarding access to labor, 75% of the sample (45 out of 60) had access to 1-3 laborers while 25% (15 out of 60) had access to 4-6. Of those with access to 4-6 laborers, 12 (80%) adopted CA. Of those with access to 1-3 laborers, 29 (64%) had not adopted CA.

Of the 60 sampled, 24 (40%) had received farmer training on CA. Of those receiving training, 19 (79%) adopted CA. On the other hand, of those not receiving farmer training on CA, only 9 (25%) adopted CA.

Among the sample, those with less than 1 hectare in farm size were a plurality (47%) with those holding 1 to 3 hectares comprising 43% of the sample. There were only 6 (10%) female farmers with more than 3 hectares. Only 8 (29%) of those with less than 1 hectare had adopted CA. A majority of those in the other two categories adopted CA with 16 (62%) of those in the 1-3 hectare category adopting CA and 4 (67%) of those in the more than 3 hectares category adopting CA.

Household size was divided into three categories. Fifty percent (30) of the women farmers had a household size of 4-6, 18 (30%) had a household size of 1-3, with the remaining 12 (20%) having a household size of 7-9. Women farmers with a household size of 7-9 were the only category to have a majority (9 out of 12, 75%) to adopt CA.

Age was divided into five categories. Only 1 woman farmer was 18-19 years old. The other four age categories were evenly distributed. The 40-49 year old category was the only one to have a majority (11 out of 16, 69%) to adopt CA.

Regarding access to credits/loans, only 8 of the 60 (13%) had access. Neither category had a majority adopt CA. Also, 42 (70%) had an additional source of income. However, neither category had a majority to adopt CA.

Table 4.4 shows results on additional sources of income and adoption of CA among women farmers. Results show that the major source of additional income was small businesses followed by piecework (ganyu). The results show that 67% of the adopters of CA (19 out of 28) had additional sources of income.

Table 4.4

Additional Sources of Income and Adoption of CA (n=60)

Source of Additional Income	Adoption of CA		Total
	Yes	No	
None	9	9	18
Business	12	12	24
Piecework (ganyu)	7	8	15
Relatives	0	1	1
Other	0	2	2
Total	28	32	60

Table 4.5 shows results on women farmers' level of education and whether they adopted or did not adopt CA. Those with a Primary Education (41 out of 60, 68%) were the majority of the sample. This category was also the only one to have a majority (22 out of 41) to adopt CA. Those with no formal education were the second largest category with 10 (17%).

Table 4.5

Women Farmers Level of Education and Adoption of CA (n=60)

Level of Education	Total	Adoption of CA	
		Adopted	Not Adopted
Malawi School Certificate of Education (MSCE)	6	2	4
Junior Certificate of Education (JCE)	3	1	2
Primary Education	41	22	19
None	10	3	7

Women farmers (n=60) were asked their primary source for learning about CA (Table 4.6). The largest category had 18 (30%), who sourced from Extension workers with 13 (72%) adopting CA. The next largest category was 17 (28%) women farmers learning about CA from a village meeting with 9 (52%) adopting CA. The categories of from a friend and radio had 8 (13%) respondents each; however, only 1 (12%) from each category adopted CA. Although only 5 (8%) women farmers learned about CA from a field day, 4 (80%) adopted CA. In the three categories where adoption of CA was high, Extension workers organized the events (i.e. farmer visitations, village meetings, and field days).

Table 4.6

Source of Information and Adoption of CA (n=60)

Source of Information	Adoption of CA		
	Total	Adopted	Not Adopted
At a farmer group	1	0	1
From village meeting	17	9	8
At a friend's house	8	1	7
Visit to another village	2	0	2
From a field day	5	4	1
Extension workers	18	13	5
Radio	8	1	7

Table 4.7 shows the women farmers' (n=60) adoption of CA by the period of the year and number of Extension worker visits. Periods were grouped into the peak periods of rainy/growing season (December-February), harvesting season (March-May), soon after harvesting (June-August), and land preparation (September-November). Across all four periods, there were 12-14 women farmers who received no visits. A majority of women farmers during each period received one to three visits. Less than 7% of women farmers received more than three visits during any period. Sixty-seven percent (8 out of 12 and 4 out of 6) women farmers who received three visits during the rainy season (December-February) and soon after harvesting (June-August), adopted CA. However, of those receiving three visits during the harvest season (March-May) and land preparation (September-November) 33% and 50% respectively adopted CA. Visit timing appears to affect adoption of CA.

Table 4.7

Visits by the Extension Worker and Adoption (n=60)

Period	Category	Total	Adoption of CA	
			Adopted	Not adopted
Growing Season (Dec-Feb)				
	None	14	4	10
	Less than three times	33	15	18
	Three times	12	8	4
	More than three times	1	1	0
Harvesting Season (Mar-May)				
	None	12	3	9
	Less than three times	39	20	19
	Three times	6	2	4
	More than three times	3	3	0
After Harvest (June- Aug)				
	None	14	3	11
	Less than three times	37	18	19
	Three times	6	4	2
	More than three times	3	3	1
Land Preparation (Sept-Nov)				
	None	13	3	10
	Less than three times	33	16	17
	Three times	10	5	5
	More than three times	4	0	4

Table 4.8 shows visits by NGOs to women farmers (n=60) and adoption of CA. For the periods December-February and June-August, more than 50% of the women farmers received no visits from NGOs. Those who were visited more than three times received advice on cotton growing and management – not CA advice. Most NGOs do not visit the farmers on their own, but rather are in the company of a Government Extension

worker. If the NGO only visited the women farmers in the presence of a Government Extension worker, this was registered as no visit.

Table 4.8

Visits by NGOs and Adoption of CA (n=60)

Period	Category	Total	Adoption of CA	
			Adopted	Not adopted
Growing season (Dec-Feb)				
	None	31	15	16
	Less than three times	25	12	13
	Three times	4	1	3
	More than three times	0	0	0
Harvesting Season (Mar- May)				
	None	28	14	14
	Less than three times	31	14	17
	Three times	1	0	1
	More than three times	0	0	0
After Harvesting (June- Aug)				
	None	30	14	16
	Less than three times	28	14	14
	Three times	2	0	2
	More than three times	0	0	0
Land preparation (Sept-Nov)				
	None	28	14	14
	Less than three times	29	14	15
	Three times	3	0	3
	More than three times	0	0	0

Table 4.9 shows the results of a Chi-Square test for socio-economic variables and adoption of CA. Significance level was set a priori at 0.05. Significant ($p < 0.05$) differences within groups are discussed. Within age groups, women farmers who were 40

to 49 years old adopted CA at a higher rate. Those with a household size of 7 to 9 adopted CA at a higher rate than those in the other size categories. There were no significant differences in adoption rates among education levels. Households with 1-3 members working on-farm were less likely to adopt CA, whereas those with 4-6 members working on-farm were more likely to adopt CA. Regarding farm size, those with less than 1 hectare were less likely to adopt CA, whereas those with 1-3 and more than 3 were more likely to adopt CA. There were no significant differences in adoption rates regarding number of household members working off-farm.

Table 4.9

Chi-Square of CA Adoption Across Demographic Variables (n=60)

	Age	Household Size	Education Level	On-farm Household Members	Farm Size	Off-farm Household Members
Overall	5.25	4.84	2.56	8.93	6.96	2.73
Chi-Square						
df	4	2	3	1	2	3
Asymp. Sig.	0.263	0.089	0.464	0.003	0.031	0.435

4.3 Main Sources of Information for Conservation Agriculture (CA) and Adoption

Tables 4.10 and 4.11 show the source of information and adoption of CA. Of the 60 women farmers interviewed, 30% heard about CA from the Extension worker, 28% from a village meeting, while 13% heard from a friend and another 13% from the radio. Farmer groups in Balaka are focused mainly on cotton growing because Balaka is one of the Malawian districts where cotton is heavily grown; hence, messages on CA are not usually discussed. Due to an inadequate number of Extension workers in the area,

villagers are notified about various new technologies through a village meeting, which is called by the village head to discuss community issues. The Extension worker takes advantage of the meeting to disseminate a particular message. For those that heard about CA from an Extension worker, a village meeting, or a field day, more women adopted CA than those that did not adopt. For the remaining sources, there were more non-adopters than adopters.

Table 4.10

Major Sources of CA Information (n=60)

Source	F	%
Extension workers	18	30.0
Village meeting	17	28.3
At a friend's house	8	13.3
Radio	8	13.3
Visited another village	2	3.3
From a field day	5	8.3
At a farmer group	1	1.7
Other	1	1.7

Table 4.11

Source of CA Information and Adoption of CA

Source	<u>Adoption of CA</u>	
	Yes	No
Extension workers	13	5
Village meeting	9	8
At a friend's house	1	7
Radio	1	7
Visited another village	0	2
From a field day	4	1
At a farmer group	0	1

Table 4.12 shows access to credit, how it was used, and adoption of CA. Of the eight respondents who took loans, five used the loans for on-farm investment whereas the rest used it on business. Regarding adoption of CA, only one of the five who used the loan on the farm adopted CA while for those who used the loan for business, two of three adopted. Of the 60 respondents, 28 adopted CA, but only three of them had access to loans while the remaining 25 did not have access to loans but still adopted CA.

Table 4.12

Access to Credit, how it was used and Adoption of CA (n=60)

	<u>Borrowed money used for</u>			Total
	Did not borrow	On-farm	For business	
Adopted CA	25	1	2	28
Did not adopt CA	27	4	1	32
Total	52	5	3	60

4.4 Qualitative Results on Farmers' Adoption of and Views About Conservation Agriculture (CA)

Five participants were informally interviewed from the sixty participants. The participants were from Lakalaka, Saiwa and Kusigala Villages. There were five questions that were asked during the interviews and these were as follows:

- 1) What are your general views concerning conservation agriculture?
- 2) How did you learn about conservation agriculture?
- 3) What factors do you think influence adoption of conservation agriculture in women farmers?
- 4) What do you think are the constraints / barriers to adoption of conservation agriculture in women farmers?
- 5) What do you think should be done in order to increase the number of CA adopters?

Using thematic analysis to analyze the qualitative data, six major themes were identified. The themes provide a picture of the women farmers' general views and their socio-economic factors that influence adoption of CA. The themes have been grouped into positive and negative factors that influence adoption of CA. The themes are explained next.

4.4.1 Conservation Agriculture (CA) and Adaptation to Climate Change

The participants viewed CA as a good way for adapting to climate change because it retains the moisture content in the soil. They think that CA is the best agricultural technology that can help crops survive the poor weather conditions like

drought because most of the farmers that have adopted pit planting, used it as a drought mitigation strategy. One respondent commented:

In CA, moisture is conserved unlike in conventional farming where there is easy drying up of soil due to lack of soil cover.

Growing crops is associated with the fertility of the soil and if the soil is depleted, the yield obtained from the land is reduced. Looking at this factor, CA also helps in retaining the soil structure and nutrients. Having the disturbed soil structure could lead to soil erosion but with minimum soil disturbance/zero tillage, the structure is retained and soil nutrients are added to the soil through crop rotation or intercropping where the legumes or agroforestry adds nutrients to the soil (Nyanga et al., 2012). Respondents noted:

It is a good adaptation strategy on impacts of climate change and it is also better way of conserving soil and water while at the same time increasing production on a small piece of land.

I am one of the farmers who adopted this practice and since I started, I have been food sufficient even during droughts and dry spells. This means that CA is more productive than conventional.

4.4.2 Labor and Time Saving

The women farmers viewed CA as a labor saving technology. This is especially noteworthy as women have multiple roles to play (household work, reproduction and taking care of everyone at home, and productive work on the farm). CA is a better technology if combined with using herbicides for controlling weeds. With herbicides,

weeding is no longer required because the weeds are controlled during planting. This gives the farmers extra time to do other activities like income generation activities. This also becomes the second factor that influences female farmers to adopt CA. If the farmer was using hired labor for weed control in conventional methods, then in CA with herbicides that labor and money can be used for other purposes.

Despite being viewed as a better method with the positive influences described above, CA still meets negative influences, which are also viewed as challenges by the farmers as well as the Extension workers. These constraints are explained next.

4.4.3 Inadequate Extension Workers

Despite implementation by the government and non-governmental organizations, CA still faces the challenges associated with non-technical competent farmers. Because there is an inadequate number of Extension workers in the area, there are not sufficient resources to increase the farmers' knowledge about CA. With an inadequate number of Extension workers, messages on CA fail to reach the farmer. This comes as a constraint as well as a challenge to CA adoption. Respondents stated:

Mostly, women farmers do not adopt because they lack knowledge on how it is done.

Having inadequate extension workers in the area is also affecting adoption because even if you make an appointment with the extension worker to come and teach you how CA should be done and he/she doesn't come, it discourages others.

This becomes a constraint to adoption because the farmers rely on the Extension workers to assist them on the technical aspects to how it is done. Gender also plays a role in CA adoption as explained in the next section.

4.4.4 Gender Insensitive

From the study, it was found that CA is viewed as being gender insensitive, as a technology that favors men more than women especially the practice of pit planting. The practice is viewed as tiresome and requires masculine power especially for digging the pits. Due to this, most women farmers do not adopt pit planting. This results in an increased number of non-adopters. Pit planting also requires someone with more labor or someone who has access to hired labor. One respondent stated:

To me I feel like the technology itself is not gender sensitive. They did not consider the triple roles of women when introducing this technology that is why most women fail to adopt.

4.4.5 Competes with Livestock Production

Most farmers also own livestock such as cattle, which they need to feed on crop residues after harvesting. This is an issue as CA uses the same residues as mulch. This creates a competition between the two because there is no specific area for grazing apart from the same farmland. Farmers seem to view mulching as a waste of resources. Generally, farmers cannot afford animal feed; hence, the residues become the only alternative for feeding their animals. One respondent explained:

Most women think that the fertilizer and residues that they have is not enough for CA hence they think it is not necessary to adopt CA. This is so because the

livestock also feed on the crop residues and it becomes difficult to use the same residues for mulching yet the animals are hungry.

The competition between CA and livestock could be partially resolved by involving farmers during the planning stage. Consulting farmers before implementing a technology would allow farmers to provide perspective on competing needs.

4.4.6 Inadequate Resources to Buy Inputs

Inadequate resources are another major challenge for CA adoption. The technologies are perceived as very expensive especially when using zero tillage/no-till or dry mulching, which competes with feeding livestock. Pit planting, which requires extensive labor to be implemented, can also be perceived as expensive if labor must be hired. These expenses, as well as seed and fertilizer, can be too much for a smallholder farmer. Respondents suggested the Malawian government should subsidize the prices of inputs so even poor farmers can afford them, which would result in an increase in adoption of CA.

The government should also introduce a program of giving out loans to the farmers, which would enable them to purchase inputs without difficulties. I would also say that the government should subsidize the prices for fertilizers because most farmers fail to adopt because they cannot afford the higher prices.

CHAPTER 5: DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents discussion and conclusions from the study. It also presents recommendations for practice and for further research.

The purpose of this study was to identify the socio-economic factors associated with the adoption rate of conservation agriculture among women farmers in Balaka District, in Malawi. The study used the Gender and Development Theory, which looks at the role of women in agriculture and the Diffusion of Innovation Theory, which determines the rate of adoption of an innovation. Three research questions guided this study.

- a. What socio-economic factors are associated with the rate of adoption of conservation agriculture among women farmers in Balaka District, Malawi?
- b. What are the levels of adoption of conservation agriculture among women farmers in Balaka District, Malawi?
- c. What are the main sources of information for conservation agriculture among women farmers in Balaka District, Malawi that lead to adoption of CA?

5.1 Discussion

The findings indicate that the socio-economic factors studied have an influence on adoption of CA. Referring back to the two theories [Diffusion of Innovations (DOI) and

Gender and Development (GAD)], the factors found in this study to influence adoption are closely linked to DOI. Rogers (2003) wrote people will only adopt an innovation if they know how to do it, have enough inputs, have tried it and weigh the benefits of using it. He stated that if they know how to implement the innovation, but it is complex or difficult to do they will not adopt it. Rogers (2003) also stated Extension workers and promotion agents could have a positive effect on adoption rate, especially when they are able to work with opinion leaders. This study supports Rogers as women farmers fail to adopt CA technologies because CA is complex, the women farmers have inadequate knowledge, and there is an inadequate number of Extension workers. These factors contribute to messages about CA not getting to the women farmers as needed. This also agrees with the GAD theory that women will only succeed in adopting agricultural technologies if they have access to inputs, access to extension and training, and access to land. In this study, most women could not adopt CA because they do not have adequate knowledge, they do not have adequate inputs, and they do not have adequate land nor access to training.

The Malawian government and policy makers, including the Ministry of Agriculture, contribute to challenges in the adoption of CA. It was interesting to learn that the Ministry is promoting both livestock production and crop production while also presenting what the farmers see as conflicting practices. This affects the adoption rate of technologies like CA. The farmers owning livestock are relying on crop residues as feed while at the same time; CA requires the same residues to be left as mulch. This implies poor communication between the Ministry of Agriculture and the farmers. The Ministry

of Agriculture needs to implement bottom up approaches to ensure that farmers' adoption of CA and other technologies is enhanced.

Farmers do not want to implement a farming technology for which the benefits are unknown or uncertain (Chirwa, 2005). For the farmers to know the benefits, they need to be trained by Extension workers who are considered knowledge experts. In Malawi, Extension workers live close to the farmers so when farmers have questions on agriculture-related topics, the person to contact for information is the Extension worker. This study found that Extension workers play a major role in enhancing adoption of CA; however, with the inadequate supply of Extension workers there is need for more Extension workers. This is crucial for the adoption of CA and other agricultural technologies. Therefore, the government needs to make sure Extension workers are properly trained and that more Extension workers are recruited, hired, and placed in villages.

The findings of this study that inadequate resources to purchase farm inputs, inadequate number of Extension workers, and inadequate access to loans were major constraints to adoption of CA support those of Wetengere (2010). This similar study conducted in Kenya also found that women fail to adopt agricultural technologies because they have inadequate access to loans, inadequate inputs, and inadequate access to extension services due to not enough extension workers (Wetengere, 2010).

Extension workers and fellow farmers play a major role in sharing information about a new technology. However, to have an impact on CA adoption, government Extension workers must accompany NGO extension workers. This is because when NGO extension workers visit farmers, it typically has a purpose other than CA such as cotton

growing and management. These visits by Extension workers on CA should be intensified during the periods of March to May and June to August, because most CA adopters in this study were visited during these periods. This is also the time when farmers are harvesting and just finishing harvesting, which allows them to take care of the crop residues and use as mulch. During the other two periods of September to November and December to February, farmers are busy with other activities such as land preparation and planting respectively. By this time, the crop residues have either already been fed to livestock or incorporated into the soil.

Membership to a farmer group affects women's adoption of CA. However, a farmer group that contains women only will be difficult for male Extension workers to visit because of cultural/religious beliefs as a majority of these women farmers are Muslims. Therefore, farmer groups with a combination of male and female farmers should provide the most benefit.

5.2 Conclusions

Conclusions from this study can only be generalized to the population represented by this sample. Application to other districts in Malawi or other countries may not be appropriate.

Women are very important in agriculture but their adoption of agricultural technologies depends on various socio-economic factors. In this study, conservation agriculture (CA) is associated with several factors including availability of farm labor, access to farmer training on CA, farm size, source of information, education level, age, membership to a farmer group, household members working on the farm and visits by the

Extension worker. However, participants' level of education, number of household members working on the farm, and members working off-farm are the most significant variables followed by farm size, age of participant and lastly household size. In this study, 46.7% of the participants adopted CA while 53.3% did not adopt. For those who did not adopt, key reasons reported were not having knowledge on how CA is done, inadequate number of Extension workers in the area, and inadequate resources to buy inputs (such as fertilizers). These barriers to adoption kept the women farmers from adopting CA and made them perceive conventional methods as the option to use.

5.3 Recommendations for Practice

The findings and conclusions from this study lead to several recommendations for practice for the Malawi government and Extension workers in Balaka District.

Implementation of these recommendations should lead to increased adoption of CA by women farmers in the District.

Government Extension workers need to visit when women farmers are most receptive to messages about CA. The results of this study show that visits have the most impact during the growing season (December-February) and After Harvest (June-August). Additionally, three visits seems to be the optimal number of visits to influence adoption of CA. This is supported by Oladele and Adekoya (2006) who found that visits by extension agents influences adoption of a technology.

It is recommended that the Malawi government should recruit, train, and place more Extension workers to assist women farmers to enhance adoption of new agricultural technologies. This would help alleviate the low contact rate women farmers have with

government Extension workers noted by Peterman et al. (2011). This recommendation is supported by Williams, Richter, and Williams (2008) who stated access to extension workers is essential to adoption. If necessary for a better ratio of farmers to Extension workers, groups can be formed that have a mixture of male and female farmers to ensure adequate access to Extension services.

As suggested by the farmers themselves, the package for inputs meant for CA should be subsidized to give a chance for all farmers to adopt. Additionally, as loan facilities are very far from the farmers causing most to fail to go and get a loan, the government of Malawi should help communities to have access to these facilities.

5.4 Recommendations for Further Research

This study provided an insight into the socio-economic factors affecting adoption of conservation agriculture in Balaka District, Malawi. Just as in all other studies, more questions were raised through this study, which therefore leads to implications for further research. There is a need to conduct a similar study on a wider scale with a larger population of participants. Additionally, as this study looked only at women farmers, there is need for a comparative study that combines both gender categories (males and females). There is a need for a study that focuses on the policy makers and how they view adoption of CA, as policy makers were not a part of this study.

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APPENDICES

Appendix A: Survey Instrument

Date of Interview: ----- **Interviewer:** ----- **District:** -----

----- **EPA:** ----- **Village:** ----- **Respondent ID:** -----

Questionnaire

Socio-economic factors associated with the adoption of Conservation Agriculture (CA) among women farmers in Balaka District, Malawi

This questionnaire is designed to solicit your responses on the socio-economic factors that are associated with adoption of CA among women farmers. Your responses will be used for academic purposes only and are highly appreciated. Note that your responses will be confidential. You can be in the study if you want to. If you want to be in the study, you will be asked questions that may take about 45 minutes to answer. The interview will be recorded to assist me in remembering your answers. You will not be identified and after I have finished writing down your answers the recording will be deleted.

By participating in this research there is no more risk than everyday activities. Since you are not identified in my notes or recordings, the data received will not be connected or linked to you. This will help to ensure your anonymity. Any new or important information that is presented during this research that may affect your willingness to continue in this research will be provided to you within reasonable amount of time.

If you decide to be in this study, some good things might happen to you. By participating in this research, there are no direct benefits to you. However, the results of this research may help to add general information to the existing body of knowledge about

conservation agriculture, which may help improve land and production. But we don't know for sure that these things will happen.

When we are done with the study, we will write a report about what we found out. We won't use your name in the report.

You don't have to be in this study. You can say "no" and nothing bad will happen. If you say "yes" now, but you want to stop later, that's okay too.

Grid of questions

Question Number	RQ1	RQ2	RQ3
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Respondent's characteristics

1. Age of the respondent

- a) 18 - 19 years
- b) 20-29 years
- c) 30-39 years
- d) 40-49 years
- e) Above 50 years

2. How many people live in the household?

- a) 1-3 people
- b) 4-6 people
- c) 7-9 people
- d) Other (specify)

3. What is your level of education?

- a) Post - secondary
- b) Malawi School Certificate of Examinations (MSCE)
- c) Junior Certificate of Education (JCE)
- d) Primary Education
- e) None
- f) Other (specify)

Background of socio-economic factors**1. What is the size of your farm? -----hectares**

- a) Less than 1
- b) 1 to 3
- c) Above 3

2. How do you access agricultural information? -----

Source of information	Yes (1)	No (2)
1) Radio		
2) Newspaper		
3) Field days		
4) Information Education and Communication Materials		
5) Other women farmers		
6) Neighbors		
7) Farmer groups		
8) Government Extension workers		
9) NGOs		
10) Mobile Vans		

3. How many extension contacts do you have between the following?

Period	None	Less than three times	Three times	More than three times
Dec-Feb				
Mar-May				
June-August				
Sept-Nov				

a) If more than three times, why? -----

b) If none why? -----

4. How many NGO contacts do you have between the following?

Period	None	Less than three times	Three times	More than three times
Dec-Feb				
Mar-May				
June-August				
Sept-Nov				

a) If more than three times, why? -----

b) If none, why? -----

5. Do you belong to any farmer group/s?

a) Yes (If yes, what are the groups and what is their purpose?)

b) No

6. Do you have any other sources of income apart from the farm?

a) Yes

b) No

7. If yes what are they?(This will help in finding if other sources of income contribute to the farmers capability in adopting CA, farmers will be able to mention these other sources).

a) Business (name them)-----

b) Piece work (*ganyu*) (explain) -----

c) From relatives (explain) -----

d) Other (specify)

8. Do you ever borrow finances from the bank for crop production?

a) Yes (if yes, skip question 10)

b) No

9. If no, why?

- a) I don't have a collateral
- b) I am not eligible
- c) There are no facilities available
- d) Other

10. If yes, what do you use the money for?

- a) For farm investment (labor, inputs, etc.) Anything for CA?
- b) For my business
- c) Other (specify)

11. How many household members work on the farm?

- a) 1-3 people
- b) 4-6 people
- c) 7-9 people
- d) Other (specify)

12. How many household members work off farm? -----

- a) None
- b) One
- c) Two
- d) Three or more

13. Do you ever hire laborers to work on your farm?

- a) Yes (explain what it is for and their gender, age)
- b) No

Knowledge of CA and Adoption

14. Have you ever heard of conservation agriculture (CA)? (Enumerator prompts by defining CA.)

- a) Yes
- b) No

15. Where did you hear about CA?

- a) At a farmer group
- b) From the village meeting
- c) At a friend's house
- d) When I visited another village
- e) From a field day?
- f) From the extension worker
- g) Radio
- h) Other (specify)?

16. Have you ever attended any training in CA?

- a) Yes
- b) No

17. If yes, what was the training about?

- a) On Pit/basin planting,
- b) On maize- legume intercropping
- c) On usage of herbicides
- d) Mulching
- e) Pit planting and mulching
- f) All of the above

18. Have you ever adopted any method under CA? (basin/pit planting, zero tillage/mulching, maize/legume intercropping)

- a) Yes
- b) No (If no, why?)

19. Which system of CA did you adopt? (If no in all options, then skip to question 23)

CA method	Yes (1)	No (2)
Basin/pit planting		
Intercropping		
Mulching		
Crop rotation		

20. If yes, for how long have you been using the technology in your field?

- a) Less than a year
- b) 1 year
- c) 2 years
- d) 3 years
- e) More than 3 years

21. What is your current status on adoption of CA?

- a) Still using CA all over my land
- b) Stopped for a while
- c) Used it on a portion of my land
- d) Other (specify)

22. If discontinued use, why?

- a) Because I did not have money for herbicides
- b) Because it is too involving
- c) Because I did not have enough labor for basin making
- d) I did not know how to use it properly
- e) Other (explain)

23. What is your view on the requirements of practicing CA as compared to conventional agriculture in terms of time management, costs, knowledge, labor and land?

View	Less (1)	Slightly less (2)	Equal (3)	Slightly more (4)	More (5)	No Idea (6)
Time Management						
Costs						
Knowledge						
Labor						
Land						
Other (Specify)						

Questions for the informal interviews

- ✓ What are your general views concerning conservation agriculture?
- ✓ How did you learn about conservation agriculture?
- ✓ What factors do you think influence adoption of conservation agriculture in women farmers?
- ✓ What do you think are the constraints / barriers to adoption of conservation agriculture in women farmers?
- ✓ What do you think should be done in order to increase the number of CA adopters?

Appendix B: IRB Exemption



HUMAN RESEARCH PROTECTION PROGRAM
INSTITUTIONAL REVIEW BOARDS

To: BRIAN TALBERT
AGAD 224

From: JEANNIE DICLEMENTI, Chair
Social Science IRB

Date: 06/28/2013

Committee Action: Exemption Granted

IRB Action Date: 06/27/2013

IRB Protocol #: 1306013715

Study Title: Socio-economic factors associated with adoption of conservation agriculture among women farmers in Balaka District, Malawi

The Institutional Review Board (IRB) has reviewed the above-referenced study application and has determined that it meets the criteria for exemption under 45 CFR 46.101(b)(2).

If you wish to make changes to this study, please refer to our guidance "**Minor Changes Not Requiring Review**" located on our website at <http://www.irb.purdue.edu/policies.php>. For changes requiring IRB review, please submit an **Amendment to Approved Study form** or **Personnel Amendment to Study form**, whichever is applicable, located on the forms page of our website www.irb.purdue.edu/forms.php. Please contact our office if you have any questions.

Below is a list of best practices that we request you use when conducting your research. The list contains both general items as well as those specific to the different exemption categories.

General

- To recruit from Purdue University classrooms, the instructor and all others associated with conduct of the course (e.g., teaching assistants) must not be present during announcement of the research opportunity or any recruitment activity. This may be accomplished by announcing, in advance, that class will either start later than usual or end earlier than usual so this activity may occur. It should be emphasized that attendance at the announcement and recruitment are voluntary and the student's attendance and enrollment decision will not be shared with those administering the course.
- If students earn extra credit towards their course grade through participation in a research project conducted by someone other than the course instructor(s), such as in the example above, the students participation should only be shared with the course instructor(s) at the end of the semester. Additionally, instructors who allow extra credit to be earned through participation in research must also provide an opportunity for students to earn comparable extra credit through a non-research activity requiring an amount of time and effort comparable to the research option.
- When conducting human subjects research at a non-Purdue college/university, investigators are urged to contact that institution's IRB to determine requirements for conducting research at that institution.
- When human subjects research will be conducted in schools or places of business, investigators must obtain written permission from an appropriate authority within the organization. If the written permission was not

Appendix C: Codebook

Codebook for the survey instrument

Socio-economic factors associated with adoption of Conservation Agriculture (CA)
among women farmers in Malawi

Respondent's characteristics

1. Age of the respondent (**Age**)

- ✓ 18 - 19 years (**1**)
- ✓ 20-29 years (**2**)
- ✓ 30-39 years (**3**)
- ✓ 40-49 years (**4**)
- ✓ Above 50 years (**5**)

2. How many people live in the household? (**Members**)

- ✓ 1-3 people (**1**)
- ✓ 4-6 people (**2**)
- ✓ 7-9 people (**3**)
- ✓ Other (specify) (**4**)

3. What is your level of education? (**Education level**)

- ✓ Post – secondary (**1**)
- ✓ Malawi School Certificate of Examinations (MSCE) (**2**)
- ✓ Junior Certificate of Education (JCE) (**3**)
- ✓ Primary Education (**4**)
- ✓ None (**5**)
- ✓ Other (specify) (**6**)

Background of socio-economic factors

1 What is the size of your farm? -----hectares (**Farm size**)

✓ Less than 1 (**1**)

✓ 1 to 3 (**2**)

✓ Above 3 (**3**)

2. How do you access agricultural information? ----- (**Information source**)

Source of information	Yes (1)	No (2)
Radio (IS1)		
Newspaper (IS2)		
Field days (IS3)		
Information Education and Communication Materials (IS4)		
Other women farmers (IS5)		
Neighbors (IS6)		
Farmer groups (IS7)		
Government Extension workers (IS8)		
NGOs (IS9)		
Mobile Vans (IS10)		

3. How many extension contacts do you have between the following? (**Extension visit**)

Period	None (1)	Less than three times (2)	Three times (3)	More than three times (4)
Dec-Feb (EV1)				
Mar-May (EV2)				
June-August (EV3)				
Sept-Nov (EV4)				

a) If more than three times, why? -----

b) If none why? -----

4. How many NGO contacts do you have between the following? (**NGO visit**)

Period	None (1)	Less than three times (2)	Three times (3)	More than three times (4)
Dec-Feb (NGOV1)				
Mar-May (NGOV2)				
June-August (NGOV3)				
Sept-Nov (NGOV4)				

a. If more than three times, why? -----

b. If none, why? -----

5. Do you belong to any farmer group/s? (**Membership**)

✓ Yes (1) (If yes, what are the groups and what is their purpose?)

✓ No (2)

6. Do you have any other sources of income apart from the farm? (**Income source**)

✓ Yes (1)

✓ No (2)

7. If yes what are they?(This will help in finding if other sources of income contribute to the farmers capability in adopting CA, farmers will be able to mention these other sources). **(Name of source)**

✓ Business (name them) ----- (1)

✓ Piece work (*ganyu*) (explain) ----- (2)

✓ From relatives (explain) ----- (3)

✓ Other (specify) (4)

8. Do you ever borrow finances from the bank for crop production? **(Loan access)**

✓ Yes (1) (if yes, skip question 10)

✓ No (2)

9. If no, why? **(Not borrowing reason)**

✓ I don't have a collateral (1)

✓ I am not eligible (2)

✓ Loan facilities are not available (3)

✓ Other (4)

10. If yes, what do you use the money for? **(Loan usage)**

✓ For farm investment (labor, inputs, etc.) Anything for CA? (1)

✓ For my business (2)

✓ Other (specify) (3)

11. How many household members work on the farm? **(Farm labor)**

✓ One to three people (1)

✓ Four to six people (2)

✓ Seven to nine people (3)

✓ Other (specify) (4)

12. How many household members work off farm? ----- (**Off-farm members**)

✓ None (1)

✓ 1 person (2)

✓ people (3)

✓ or more (4)

13. Do you ever hire laborers to work on your farm? (**Hiring labor**)

✓ Yes (1) (explain what it is for and their gender, age)

✓ No (2)

Knowledge of CA and adoption

14. Have you ever heard of conservation agriculture (CA)? (Enumerator prompts by defining CA. (**CA knowledge**))

✓ Yes (1)

✓ No (2)

15. Where did you hear about CA? (**CA information source**)

✓ At a farmer group (1)

✓ From the village meeting (2)

✓ At a friend's house (3)

✓ When I visited another village (4)

✓ From a field day? (5)

✓ From the extension worker (6)

✓ From the radio (7)

✓ Other (specify)? (8)

16. Have you ever attended any training in CA? (**Training**)

✓ Yes (1)

✓ No (2)

17. If yes, what was the training about? (**Name training**)

✓ On Pit/basin planting (1)

✓ On maize- legume intercropping (2)

✓ On usage of herbicides and zero tillage (3)

✓ Mulching (4)

✓ Pit planting and mulching (5)

✓ All of the above (6)

18. Have you ever adopted any method under CA? (basin/pit planting, zero tillage/mulching, maize/legume intercropping) (**CAadoption**)

✓ Yes (1)

✓ No (If no, why?) (2)

19. Which system of CA did you adopt? (If no in all options, then skip to question

23) (**Method adopted**)

CA method (MA1)	Yes (1)	No (2)
Basin/pit planting (MA2)		
Intercropping (MA3)		
Mulching (MA4)		
Herbicides (MA5)		
Crop rotation (MA6)		

20. If yes, for how long have you been using the technology in your field? (**Duration adoption**)

- ✓ Less than a year (1)
- ✓ 1 year (2)
- ✓ years (3)
- ✓ years (4)
- ✓ More than 3 years (5)

21. What is your current status on adoption of CA? (**Status**)

- ✓ Still using CA all over my land (1)
- ✓ Stopped for a while (2)
- ✓ Used it on a portion of my land (3)
- ✓ Other (specify) (4)

22. If discontinued use, why? (**Discontinued**)

- ✓ Because I did not have money for herbicides (1)
- ✓ Because it is too involving (2)
- ✓ Because I did not have enough labor for basin making (3)
- ✓ I did not know how to use it properly (4)
- ✓ Other (explain) (5)

23. What is your view on the requirements of practicing CA as compared to conventional agriculture in terms of time management, costs, knowledge, labor and land? (**View of CA**)

View	Less (1)	Slightly less (2)	Equal (3)	Slightly more (4)	More (5)	No idea (6)
Time Requirement (VCA1)						
Costs incurred (VCA2)						
Knowledge Requirement (VCA2)						
Labor Demand (VCA3)						
Land Requirement (VCA4)						
Other (Specify) (VCA5)						

Questions for the informal interviews

- What are your general views concerning conservation agriculture?
- How did you learn about conservation agriculture?
- What factors do you think influence adoption of conservation agriculture in women farmers?
- What do you think are the constraints / barriers to adoption of conservation agriculture in women farmers?
- What do you think should be done in order to increase the number of CA adopters?

Appendix D: Researcher Identity Memo

I grew up with my grandparents in a rural area in the Northern part of Malawi where we were full-time farmers. Farming was our day-to-day activity after my grandfather retired from his pastoral job. I became so interested with the farmers that I became interested in working with them. Many women farmers around our community would leave their farms and come to work on our farm in exchange for food or money to buy food. Most of these women were from female-headed households who were widowed, separated or whose husbands had migrated to the city. Many migrated to Johannesburg (a.k.a. Jo'burg) in South Africa to work in the mining industry, but using the excuse of “life is so hard in Jo'burg” neglected their families by not sending money to help with the farm, food, and other expenses. These women, filled with the love for their children, would come to our farm for piecework in search of food and income for their basic needs. In so doing, their fields would suffer because the time was the same (critical period) for crop management. In delaying to manage the weeds in their farms, they experienced low yields because the weeds in their fields competed with their corn for nutrients. This resulted in a vicious cycle of inadequate harvests (i.e. every year, there was low food production in their homes and every year they would be at our doorstep looking for a piecework). Inadequate food production was their continual problem, which I observed for a long time.

When I grew up and finished my secondary school, I thought of joining the University of Agriculture and study ways of helping farmers to increase their food production at household, community and national levels. For four years, I studied agriculture with an emphasis in agricultural extension and rural development. When I

graduated in 2008, I started working as a high school teacher (teaching Agriculture), but my mind was still on the women farmers I encountered during my childhood days.

In Malawi, most farmers are women and much of agricultural work is done by women but their productivity is low because they follow conventional practices with only a few adopting modern agricultural technologies. Additionally, in male-headed households, men like to take control of the crops after harvesting and income after selling. Women had little access to the income. So, the role of women in agriculture was not fully recognized. Women were burdened with multiple roles (reproduction, production, and caretaking) while men called themselves heads of the household, acting like bosses, and could not help. The men also made decisions on farm inputs and owned the land, while the women just worked on them and every decision about the land and inputs required the husband or a male family member's approval.

The Food and Agriculture Organization through the Malawi Ministry of Agriculture, in the Department of Agricultural Extension decided to work on gender mainstreaming in agricultural development by training policy makers, other NGOs implementing agricultural work, and extension workers. The training was on how to train farmers to recognize the gender gap in agriculture in terms of roles, access and control of resources, as well as equal participation between men and women farmers in agricultural programs, and adoption of improved agricultural technologies by women farmers. I happened to be one of the officers employed for this task in 2009 and since then, I was part of the team advocating for inclusion of women in various agricultural programs/projects as well as considering the factors that impact their participation. I am still an advocate for gender equality in agriculture under the Department of Agricultural

Extension in Malawi. Agricultural technologies are brought to the farmers with the aim of increasing their food production and improving food security status at household and community levels, which in the end leads to national food security. Most technologies brought to the farmers are emphasizing reducing the amount of labor required of women farmers who have multiple roles to play. The technologies are also to increase yield on small pieces of land to ensure food security at household, community and national levels. However, the decision to adopt a technology lies with the female farmer who uses the land but is limited due to lack of full access to land and inputs because the decision on which inputs to buy lies with the husbands.

Since Conservation Agriculture (CA) was introduced to the farmers, there is still little participation/adoption by women farmers. Yet if we consider the benefits, women farmers should adopt CA. This technology can increase production while at the same time lead to reduced labor demands (except pit planting) especially during land preparation and weeding, as conservation agriculture does not need these. CA involves minimum soil disturbance during the planting time. Since there is little labor demand, it could reduce the workload that women are facing at home and give them more time to concentrate on other income generating activities that might be sources of income for the household. In trying to understand why there is low adoption of the technology by the women farmers, I had to conduct this study to find factors influencing these women farmers to adopt the technology. With this new knowledge, technology implementers can include the factors that influence women's adoption of CA. Although the Malawi government is funding the implementation process through the Ministry of Agriculture, the effectiveness has yet to be seen because there is need to avoid gender bias by having

equal participation of men and women in any agricultural technology. Most studies on adoption of CA have been conducted for farmers in general; however, a few have focused on women farmers only and adoption of agricultural technologies. More needs to be done that recognizes women as playing a major role in agriculture and that can facilitate an increase in adoption rates of technologies such as CA.

Because of my similar life experiences and my professional experiences in working with female farmers, I understand what these women are going through. When I was doing my job, my assumptions were that we were doing a great job and that all these technologies that are trickling down to the farmers are gender sensitive. However, in looking at the literature, I have realized that I was wrong and I still needed to conduct a study and find out what went wrong. With my farming background, I was able to approach the farmers for my research study. I also believe I have a way of having a conversation with people that makes them feel at ease and tell me how they feel. This was a strength for capturing information for my study. By the end of it all, my study results will help the government, policy makers and implementers to be better able to provide technologies that are gender sensitive to the farmers.