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CREDIT ACCESS, CROP OUTPUT AND WELFARE OF WOMEN FARMERS IN THE

NORTHER REGION OF GHANA

BY

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DECLARATION

Student

I hereby declare that this thesis is the result of my original work and that no part of it has been presented for another degree at this university or elsewhere.

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We hereby declare that the preparation and presentation of the thesis was duly supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies.

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ABSTRACT

Access to credit enhances productivity and quality standard of living by breaking the vicious cycle of poverty of smallholder farmers, especially women farmers. It is usually considered as an essential input to increasing agricultural productivity. This study examined the effect of credit access on welfare through crop output of women farmers in the Northern Region of Ghana. Based on this, semi-structured questionnaire was administered to 300 sampled women farmers selected through a multi-stage random sampling from two selected districts in the Northern Region. A multivariate probit model was used to examine the effect of the determinants of farmers' choice of sources of credit. The Endogenous Switching Regression (ESR) model was used to estimate the impact of credit access on women farmers' output controlling for all possible biases. The impact of credit on welfare through output was examined using CMP model. Credit access, welfare and output were estimated individually and also within a Conditional Mixed Process (CMP) system for choice of appropriate estimation due to endogeneity. Results of the CMP estimation showed that age, household size, extension access and member of FBO significantly influence farmers' choice of source of credit. Results further showed that credit access, expenditure on inputs, years of farming, land size and member of FBO significantly impact on crop output. Also, the results revealed that crop output and off-farm income significantly influence welfare of women farmers. A pairwise correlation of the sources of credit revealed that VSLA and Susu sources are complementary indicating that farmers who accessed credit from VSLA also accessed credit from Susu. However, the correlation between Family and Friends and VSLA the two sources of credit are substitutes. This implies that farmers who accessed credit from family and friends did source credit from VSLA and the vice versa. Based on this, government and the commercial banks should provide credit facilities that take into consideration the needs of women farmers in terms of collateral demand for easy access to capital. This will enhance easy purchase of input to enhance output. Also, government and other stakeholders should put emphasis on the various forms of credit to enhance easy access and usage. This will reduce credit diversion and the default rates in the credit management.

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DEDICATION

I dedicate this work to the Almighty Allaah, to my parents Alhaji Abdallah Musah and Hajia Zenabu Adam. Special dedication to my husband, Mr. Abdul-Latif Bavug and my beautiful daughters, Ma-isha Abdul-Latif Bavug, Aqeelah Abdul-Latif Bavug and Nada Abdul-Latif Bavug whose support and encouragement made this dream a success.

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LIST OF ACRONYMS

AGRA	Alliance for a Green Revolution in Africa
F&F	Family and Friends
FAO	Food and Agriculture Organisation
GDP	Gross Domestic Product
GSS	Ghana Statistical Service
IFAD	International Fund for Agricultural Development
IISD	International Institute for Sustainable Development
IITA	International Institute of Tropical Agriculture
MoFA	Ministry of Food and Agriculture
ROSCA	Rotating Savings and Credit Association
SSA	Sub-Saharan Africa
UN	United Nations
VSLA	Village Savings and Loans Association
WB	World Bank
WBDR	World Bank Development Report

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CHAPTER ONE

INTRODUCTION

1.1 Background to the study

The main driver of most economies in Africa especially Ghana, is the agricultural sector. The agricultural sector remains a major driving force in the development of the Ghanaian economy, despite being overtaken by the services sector in recent times (GSS, 2018). Agriculture contributes more in terms of its share of Gross Domestic Product (GDP) and the principal foundation of foreign exchange earnings (Alliance for a Green Revolution in Africa (AGRA, 2013). In sub -Saharan Africa, majority of the people depends on agriculture as a source of livelihood, especially among rural poor and rural dwellers. Relative to Ghana, agriculture has given way to the service sector in terms of its contribution to the GDP and contributes about 26.1% (MoFA, 2016) The current climate change effect has exposed smallholder farmers to low yield and productivity. The most affected are women with low access to factors of production. To women who have access to the factors of production, cost of these factors are beyond the reach of women due to lack of access to credit. Women constitute about 95 percent of those engaged in agro processing and 85 percent of those in food distribution (Women in small holder Agriculture in Ghana 2014). Women are central to the economies of Sub- Saharan Africa consisting of about 60 percent of the informal sector, providing roughly 70 percent of the total agriculture labour as well as being principal food producers (Blackden and Bhanu, 1998).

The Ghanaian agriculture sector is principally on smallholder basis. About 90 percent of farm possessions are less than 2 hectares in size (Seini and Nyanteng, 2005, MoFA,

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2016). The farming system is traditional with the use of hoe and cutlass as main tools (MoFA, 2010). The conventional role of agriculture includes the delivery of food security, the supply of raw materials for industrial use, creation of employment, and generation of foreign exchange earnings. The sector serves a vital role in the improvement of the rural economy as well as general economic development. This critical role in the Ghanaian economy calls for increased investment in the sector.

According to International Fund for Agricultural Development (2011), at least 70 percent of the poor dwells in the rural areas of developing countries and the proportion of women is very significant (Ravallion, Chen, & Sangraula, 2007, World Bank, 2014a & b). Majority of the income of the rural dwellers hinges on agriculture with women accounting for above 40 percent of the total labour force. Women in rural areas cultivate basically to meet household needs and sell the surplus to the market. In some cultures, the division of labour is strict. Women are required to handle household chores while men bring in the financial resources for household needs. Sanginga and Bervinson (2015), noted that crops that are mostly cultivated by women in SSA include Oilseeds and legumes (cowpeas, soybean and groundnuts). They indicated that these crops are very pertinent in sub-Saharan Africa (SSA) as they offer a variety of social, economic, and environmental benefits. For example, these crops are cheaper sources of proteins as well as a source of income. Notwithstanding the critical roles played by women in the cultivation of these oilseeds and legumes, empirical evidence points out that there is a gap between men and women concerning farm yield in Africa. This emanates from the gender differences that continue to exist in respect of access to productive resources such

as land, livestock, labour, extension, financial services, and technology (Muriithi et al., 2018).

Gender inequality is an important matter in Ghana in particular, and SSA in general. This is as a result of norms and traditions that do not allow men and women to have equal access to production resources. Manda et al. (2014) indicated that Cultural rule and customs hamper women's capacity to take over farmlands and as a result, add to widening gender gaps in the quality and size of farmland. But it is known that reducing gender inequality is a step in the right way to adding to agricultural growth and the achievement of food and dietary security. However, for productivity to increase in the agriculture sector in most countries in SSA, not only do we need equality in access to production resources, but also there is the need to consider access to finance as a booster of productivity (Sekyi, 2017).

Also, according to the International Institute for Sustainable Development (IISD, 2015), for a country to move from subsistence to commercial agricultural production, there is the need to pay attention to finance which will boost growth in the sector. Hussain and Thapa (2015) also affirm that one of the significant challenges facing smallholder farmers especially those in developing countries in their day-to-day farming activities is access to credit. However, in developing countries where majority depend on agriculture, financing for investment is scarce (International Finance Corporation [IFC], 2013). In Africa, commercial lending to agriculture sector is less than 1 percent (IFC, 2013).

However, one of the main channels of reaching a drastic decline in poverty and improving farmers' welfare is to increase agriculture productivity through technology adoption, and this is tied to financing. This will, at the micro level, results in an increase

in farm earnings, food security, poverty reduction, and enhanced rural household well-being, even though on the aggregate will lead to inclusive industrial development and economic growth (Awotide et al, 2015). Growth in agricultural output, according to Kuznet (1964) can provide and maintain business progress in many dimensions. First, it lets the agrarian economy to sector to issue workforce to the industrial sector while meeting food needs. Second, it also increases agricultural sector revenue and creates rural purchasing power needed to purchase industrial goods. Finally, it enables the agricultural sector to supply food to industrial workers at affordable prices to the profitability of the industries. It is evident that there is a direct positive association between credit access and agricultural output, and one of the solutions to agricultural financing is easy access to credit (Obisesan & Akinlade 2013). Making credit available to rural households has been noted as an essential instrument that can alleviate poverty among poor rural families. Sekyi (2017) indicated that improving access to financial services is a crucial step to reducing poverty and improving development outcomes by enabling the rural poor to smoothing their consumption and cope with risk. Credit access is necessary for increasing the ability of households to cater for expenses such as the purchase and use of improved agricultural inputs and the achievement of food security (IFPRI, 2002; Sekyi, 2017). Moreover, (Anyiro and Oriaku, 2011) posited that rural household access to credit has the prospect of influencing uptake and adoption of improved agricultural technologies that may improve the earnings of smallholder farmers and in poverty reduction among them. Reyes et al (2012) also reported that rural development and farm productivity, in particular, can be influenced by many factors of which access to credit is no exception.

There are two primary sources of credit in Ghana from which farmers can borrow, that is the formal and the informal sources. The formal sources of credit comprise of banks, and the registered financial institutions and the informal sources include self-help groups such as "susu groups", Rotating Savings and Credit Association (ROSCA), Village Savings and Loans Association (VSLA) and other unstructured agents like money lenders, family and friends, among others. Despite these sources of credit, majority of farmers in Ghana still inadequate access to credit (Owusu and Antwi, 2010) and this is due to the constraints which either limits the farmer's ability to obtain the loan or the adequacy of the loan. For instance, formal sources often require collateral in the form of land and other variables which majority of farmers lack (Owusu and Antwi, 2010).

Deficiency in accessing credit can both be a demand and supply function. Being a supply function, financial institutions may find providing credit to rural smallholders as very risky and expensive, hence restricting the amount given or coming out with conditions that is too challenging like collateral demand. On deficiency of accessing credit as a demand function, farmers may lack satisfactory collateral, and even in situations where credit is easily reachable, farmers sometimes find it very unsafe to go in for it (Boucher *et al.*, 2008).

The financial institutions (e.g., savings and loans, microfinance) though very crucial in the agricultural sector, often give small amounts with high-interest rate and short duration for repayment. However, accessing credit from the informal sector by women farmers is generally difficult as compared to men due to lack of collateral and as such, women farmers usually rely on credit from other informal sources such as VSLA, susu, among others.

1.2 Problem Statement

Women are key players in food chain beginning from production, marketing and intra household delivery of food (Agu, 2013). They also play a vital part in post-harvest activities such as shelling of grains, storage, processing and marketing. However, despite the role they perform in agriculture, women are faced with numerous challenges more than their male counterpart with regards land acquisition, access to agriculture extension service as well as credit which hinder their ability to increase productivity as well as income (Agu, 2013). Most deprived families including women in developing countries lack adequate access to formal financial services including credit, savings and insurance (Bauchet et al., 2011) This inadequate access to formal credit makes them continuously dependent on informal sources of farm credit (self-help groups, money lenders and associations) who can provide them with credit on short notice with no restrictions and collateral demand. The inadequate access to credit limits women's ability to access capital which has a greater impact on farm output and general welfare. Moreover, the nature of land tenure arrangement makes banks neglect women since they do not own land to use as security. This is in line with a study conducted by IFAD (1998) in the Upper East region which noted that women limited access to land affects the type of crop they grow. For instance, women in Ghana and the North, in particular, are mostly engaged in the cultivation of leguminous crops such as groundnuts, soybeans and cowpea (Ghosh et al., 2000). According to Ahmed et al. (2012), addressing these and other issues facing women farmers could lead to a surge in food production and improvement in household food security. This is not far from a report by FAO (2011) that if women have same access as men to vital productive resources, they could increase their farm yield by

20-30%, which could increase agriculture output by four percent and, a subsequent reduction in hunger by 100-150 million people in developing countries.

According to World Bank (2004), poverty in rural settings of Ghana still remains a systematic issue especially in the northern part of the country due to poor access to basic infrastructure, quality education, and health as well as production credit. It is noted that six (6) out of ten (10) of whom are poor, are mostly women. Women suffer more not only from deficiency in accessing financial facilities but also productive resources (Fletschner & Carter, 2008).

Moreover, GSS (2014) noted that about 93% of households are engaged in agriculture in rural Savanna. Unfortunately, the seasonal nature of agriculture in the savannah areas has led to more considerable financial suffering and poverty among the rural folks. Poverty in rural Ghana remains a systematic issue, especially in the northern sector due to inadequate access to necessary infrastructure, quality of education, health as well as production credit. While Ghana's overall poverty rate had declined from 51% in 1992 to 24.2% in 2013, the rural enclaves have experienced only a marginal decline (GSS, 2013). According to Sekyi (2017), though there is a general decline in the rate poverty in Ghana, the three northern regions experienced insignificant decrease with the rate being more than double the national average. Six out of ten of the world's poor are women (Women Thrive, 2014). Though the situation of poverty concerning women is a global phenomenon, its sizes, magnitudes, and effects in the socio-cultural setting of the women in Northern Ghana is very worrying (Ziem and Gyebi, 2011). Considering such comparatively high levels of poverty in the north, the role of credit access and participation among women farmers cannot be underestimated. However, women's

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simultaneous access to the various sources of credit and the factors influencing women's decision to access credit from different sources have not been adequately explored. Moreover, whether access to credit does have an impact on farm productivity and translate into welfare gains has also not be sufficiently estimated. This study adds up to the body of knowledge in two unique ways: (1) it models the joint decision of women to access credit from diverse sources and (2) the impact of credit access on productivity, and its subsequent effects on welfare. The study, therefore, seeks to address the following research questions:

1. What are the determinants of sources of credit accessed by women farmers in the Northern Region?

2. What is the impact of credit access on crop output of women farmers in the Northern Region?

3. What is the effect of credit on welfare through crop output of women farmers in the Northern Region?

1.3 Research Objectives

1. To identify the determinants of sources of credit accessed by women farmers in the Northern Region.

2. To assess the impact of credit access on the output of women farmers in the Northern Region.

3. To analyze the effect of credit on crop output and welfare of women farmers in the Northern Region.

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1.5 Relevance of the study

Women constitute the poor in developing countries and often have difficulties accessing credit, and this has a negative repercussion on agricultural productivity, health, food security, and to a large extent their welfare. However, poverty reduction and its related issues have been the priority of the Ghanaian government over the years. This study will provide empirical evidence on the determinants of access to credit by women farmers and its impact on welfare, which will serve as a guide to designing and implementing gender-sensitive programmes. This will provide a guide for credit access and usage of credit by women farmers in the Northern region.

Findings of the study will help development policy makers understand the plight of women farmers in terms of access to credit and the conditions governing access to credit. It is expected that women access to credit will determine their farm yield, and subsequently boost their welfare. This study will help in assessing the various sources of credit accessed by women farmers in the northern region. When this is identified, development partners or donor agencies promoting women in agriculture can focus much attention on the various sources mostly accessed by women to increase their chances of assessing credit. In addition, this research will also help unravel the factors that influence women credit access. When the role of access to credit is realized, government can help facilitate and make sure that there is easy access to credit to encourage more women to involve themselves in the agricultural sector for improved livelihoods.

The study will also provide basis for further research on credit access, agricultural productivity, and welfare of women.

1.6 Organization of the study

This study has five Chapters. Chapter one of this study starts with an introduction, statement of the problem, research questions, and objectives, and significance of the study. Chapter two consist of the literature review on various topics relating to credit participation by female farmers in northern Ghana. In chapter three, we explain the study area, data collection instruments, such as questionnaires and interviews, as well as data analytical methods. Chapter four compose of results and discussion. Chapter five provides a summary of the findings, conclusion, and policy implications based on the findings of the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This section reviewed both theoretical and empirical literature relevant to the study. The chapter consist of nine sections. Section 2.1 describes the concept of credit, while section 2.2 outlines the types of credit. Section 2.3 discusses the sources of credit, and the actors in the informal sector in Ghana. Section 2.4 discusses the determinants of access to credit. In section 2.5, the study discusses women participation in agriculture, while the barriers to women participation in agriculture is discussed in section 2.6. The last three sections discuss determinants of access to credit, section 2.8 discusses credit access and agricultural productivity and the last section which is section 2.9 discusses credit access and welfare.

2.1 Concept of Credit

The term credit has been defined by several authors. Acheampong (1986) defines credit as temporary transfer of capital resource from an individual or institution to another person or institution for a specific period of time, purpose and at an agreed interest charge. Bannock and Manser (1989) viewed credit as granting the use of goods and services without immediate payment. Credit is an important mechanism for providing food security in growing and diversifying rural communities in many low income countries (Nsiah-Gyabaah and Edusah, 1985). For instance, Nwaru et al (2011) defined agricultural credit as the present and temporary transfer of purchasing power from a person who owns it to a person who wants it, allowing the later the opportunity to

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command the other person's capital for agricultural purpose but with confidence in his/her willingness and ability to repay at a future date with or without interest. Credit has been recognized as crucial for both consumption and investment perspectives (Okurut et al*.,* 2004). Credit is any form of deferred repayment. Credit is the trust which allows one party to provide resources to another party where the second party does not reimburse the first party immediately but instead arranges to repay or return those resources at a later date (Finlay, 2009; Ingham, 2004).

Generally, credit could denote cash or non-cash items used to purchase goods and services with assurance of paying at a forthcoming date. Credit in the form of cash is seen as credit farmers access from moneylenders or from recognized financial institutions while non-cash credit is credit in the form of inputs normally supplied by either individual entrepreneurs or businessmen among others, for which payments are made after harvesting (Kuwornu et al, 2012). In the setting of the research credit is explained as the provision of farm input, services and cash and paying at a later date.

2.1.1 Types of credit

There are two types of credit- consumption and production credit (Santos, 2011). Consumption credit is granted for the purpose of acquiring consumable goods and services whiles production credit is given for acquisition of factors of production (Santos, 2011). This could be in the form of cash credit, inventory or input credit.

This is granted for the purpose of acquiring consumable goods and services by the application of which no further financial returns can be generated to enable the borrower pay off his debt. Consumption credit provides security for enterprise funds to be used in productive activities. Example of such goods are food and meat items, clothing, funeral

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expenses, school fees, emergencies such as sudden needs to travel or accidents and marriage expenses. Consumption credits are usually accessed as cash credit or inventory credit. Therefore lenders should understand all the loan needs of borrowers so that farm economic plans can be complete and household consumption plans consistent with them (Raeburn 1984). .

This is the credit advanced specifically for acquisition of factors of production, the application of which greater financial returns are generated from the enterprise to which the factors are applied. Examples are farm inputs, such as fertilizers, insecticides and improved seeds; labour, land and management (Owusu-Acheampong, 1986). Production credit can be served to client as input credit, cash credit or inventory credit.

Generally, credit could denote cash or non-cash items used to purchase goods and services with a promise to pay at a future date. Credit in the form of cash is seen as credit farmer's access from moneylenders or from recognized financial institutions while non-cash credit is credit in the form of inputs normally supplied by either individual entrepreneurs or businessmen among others, for which payments are made after harvesting (Kuwornu et al, 2012).

In the context of the study credit is defined as the provision of farm input, services and cash and paying at a later date.

2.1.2 Factors influencing credit usage

The underlying assumption on the provision of credit to smallholder farmer is that farmers will put the credit accessed to economically viable and feasible use and ultimately result in increased productivity and subsequent improvement in standard of

living. In spite of the assumption above, credit advanced can be used for various purposes. In addition to use for productive purpose, credit can also be used to service family expenses, refinance old debts as well as for home repairs. The proportion of credit used in productive activities can be affected by the time of delivery of credit. Since most agricultural activities are seasonal, the untimely or late delivery of credit may predispose the farmer to use it on other activities from what it was originally intended for including consumption. The level of knowledge or skill of the farmer in the enterprise for which credit was advanced may also influence his ability to use the loan for productive purposes (Ledgerwood, 1999).

The use of credit for production activities is expected to lead to increased productivity. While consumptive use of credit may not directly lead to improved productivity, it may indirectly influence productivity since it frees up household's productivity inputs and enterprise revenue which can be put back into the business (Ledgerwood, 1999).

2.2 Sources of Credit for Farmers

Women farmers access credit from different sources for farm activities in order to realize improvement in their lives. Littlefield, Morduch and Hashemi (2003) explained that credit is expected to enable the poor increase their household incomes, build assets and also reduce their vulnerability to crisis. This in turn will enable the poor invest in education, health and meet a variety of other financial investments. The financial system in Ghana falls into 3 main categories: informal, semiformal and formal financial institutions.

2.2.1 Formal Financial Establishments

The formal financial establishments comprise of mainly the banks. This financial sector has undergone various legislative transformations in terms of policies and numbers since 1897 when the British Bank of West Africa was established (Bawumia, 2010). The need for these transformations arose as a result of changing economic environment and financial needs of citizens of the country. For instance, as part of government's desire to use the banking system to drive development, a number of development banks such as the National Investment Bank (NIB) and the Agricultural Development Bank were established in 1963 and 1965 respectively (Bawumia, 2010).The aim of the National Investment Bank was to assist in the development of the industrial sector while the Agricultural Development Bank was to assist in the development of the agricultural sector. Aside the development banks, other forms of banks in the formal financial sector include Commercial banks, Merchant banks, and Rural and Community banks. They are incorporated under the Company code 1963 (Act 179) which gives them legal identities as limited liability Companies and they are licensed by the Bank of Ghana (BOG) (Steel and Andah, 2002).

These formal financial institutions are not popular in most rural communities because of certain features like cumbersome saving and lending procedures, lack of conventional collateral for low income clients, general banking regulations which discriminate against low income savers and low interest rates for savings (Miracle and Cohen, 1980). The share of smallholder credit in Commercial banks is on the decline. Credit from formal sources often involves delays and completion of many formalities too complicated for the

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unsophisticated small scale and often illiterate entrepreneurs (Nsiah-Gyabaah & Edusah, 1995).

2.2.2 Semi-Formal Financial Institutions

The semi- formal financial systems are formally registered but are not licensed by the Bank of Ghana (Steel & Andah, 2002). They include Savings and Loans Companies, Non-Governmental Organizations (NGOs), Government Credit Schemes and the Credit Unions (CUs) (Osei-Assibey, 2011).

Savings and loans companies (SLCs) emerged in the late 1980s as providers of target group oriented financial services. They operate under the Financial Institution (Non-Banking) law 1993 (PNDCL 328) (ISSER, 2011). Between 1990 and 1993, BOG issued regulations aimed at enhancing the screening and monitoring of SLCs. The activities of SLCs are however limited in the Northern region of Ghana. For instance, in a study conducted by Peprah and Muruka, (2010), only 5.9% out of a total number of 17 SLC was located in the Northern region in Ghana.

NGOs are incorporated as companies limited by guarantee (not for profit) under the Companies Code. Their poverty focus leads them to relatively deep penetration to poor clients using microfinance methodologies, though mostly on a limited scale. They are not licensed to take deposits from the public and hence have to use external (usually donor) funds for micro credit (Osei-Assibey, 2011).

Credit Unions (CUs) were first introduced in Ghana by Roman Catholic fathers working in the Northern part of the country in 1955 (Aryeetey and Gockel, 1991). Specifically it was established at Jirapa in the Northern Region (now Upper West) (Quanoo,

1997).These Credit Unions are cooperative frugality societies set up in both rural and uban areas and places where people work (Andah, 2005). The key reason for the establishment of the Credit Unions was to encourage savings among members (farmers, traders, and industrial workers) for productive ventures to better their socio-economic being (Egyir, 2010). A credit union normally provides intermediation (savings and loans facilities) solely to its members, even though some are considering providing financial facilities more extensively in their communities (Andah, 2005).

CUs were brought under legislation in 1968 and the Credit Union Association (CUA) was formed as an apex body, with 254 CUs (64 of them rural) with some 60,000 members (Quainoo, 1997). CUs are reported to be performing weakly financially due in large part to their organization as cooperative societies with a welfare focus, and in particular to their policy of low interest rates on loans. Individual members make predetermined periodic deposits into their accounts and may borrow up to two times their savings balance. Most CUs require borrowers to provide security, in addition to being in good standing with their deposits (Steel and Andah, 2003). Ideally, this can be in the form of a guarantee from another member of the credit union who has adequate uncommitted savings balance (Steel and Andah, 2003). Despite the fact that CUs were first established in Northern Ghana their operations are limited in this area.

2.2.3 The informal financial institutions

The informal financial sector includes financial actors such as susu collectors, ROSCAS, money lenders, families and friends, self-help groups among others (Aryeetey, 1998; Owusu-Antwi and Antwi, 2010). It is this large variety of actors that causes difficulties in characterizing the nature and structure of demand for financial services in the informal

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sector (Aryeetey and Gockel, 1991). These informal institutions were usually set up by village workers with the aim of achieving the needs of its members. This helps support members in times of unemployment and financial assistance in the case of emergency.

2.2.4 Actors in the informal financial sector in Ghana

2.2.4.1 Moneylenders

Moneylenders are one of the key actors in the informal financial segment. They are known to be important commercial lenders, often lending from excess earnings from farming or dealings. Credit from this source is however noted to be costly and therefore, often serves as a last option. However, old clients who have demonstrated trust worthiness are charged a lesser interest rate than those who are now coming into the market (Owusu and Antwi, 2010). Loans from moneylenders typically average 3 months and rarely are made for more than 6 months though some borrowers may take longer time to repay (Steel and Andah, 2003). The moneylenders in Ghana are reported to advance loans at interest rates higher than the banks but without collateral, and disburse loans very quickly if the client is known (Jones et al., 2000). The amount lent out by money lenders to clients may first depend on the relationship between the lender and the client, the capacity of the borrower to repay and on the lending capacity of the lender (Aryeetey and Gockel, 1991).

2.2.4.2 Susu Collectors

The susu system is a traditional savings collection method which came from Nigeria and made known in Ghana in the beginning of the twentieth century. Susu collectors are informal finance providers who supply households with short-term and flexible financial products. Susu collectors are not subject to rules and hence, saving with them can be

quite unsafe (Owusi-Antwi and Antwi, 2010). A participant who engages in susu collection system has to save with a susu collector for a number of months in order to demonstrate his trustworthiness, as well as his money flow, before being permitted to borrow. Based on the style of procedure, the susu collector has to visit his or her clients every day to collect a fixed amount of money conditional on the client's money flow for a period of 31 days. The day-to-day contributions of a client are documented in a savings account. The total amount of the contribution is paid in whole while the susu collector retains one day's contribution as a payment for his services (Owusi-Antwi and Antwi, 2010).

2.2.4.3 Relatives and Friends

Relatives and friends, landlords and traders also play very significant role as providers of credit in the informal financial sector in Ghana (Ekumah and Essel, 2001; Owusu-Antwi and Antwi, 2010). Relatives and friends are known to be the most common providers of credit in the informal sector and usually charge near-zero interest rates (Aryeetey, 1992).This credit source is small, however, and the over-all credit from these non-institutional sources is not enough to implement rural development programs (Owusu-Antwi and Antwi, 2010).

2.3 Determinants of access to credit

Access to credit is an essential element for policies aimed at changing rural economies, especially for a mainly subsistent agricultural economy like Ghana. Though quite a number of formal financial institutions have penetrated the rural areas in the country, access to credit among many agricultural households remains inadequate. Several factors affect a person's access and participation in the various sources of credit. Among them

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used in the study include; age, head of household, number of dependents, marital status, household size, land size, expenditure on input and distance

It has been indicated that as the age of women increase they cannot partake in microfinance programs very well (Diagne, 1999). There is a negative relationship between age and the likelihood of participation in credit programme from formal and semi-formal institutions. This means that as an individual is growing up or ageing, the tendency to borrow from formal and semi-formal institutions decreases. This can be due to the fact that the ability to repay the loan might decrease because the individual might be too weak to work to generate the needed income to pay back the credit (Togba, 2009). A study by Mpuga in 2008 disclosed that the age of a person is positively related to the choice of applying for credit and the amount of credit applied for. The young and active individuals with determination to make higher incomes and increase investment or engaged in different activities are expected to be more active in terms of saving so as to accumulate enough capital. The older are likely to rely more on their past savings and accrued wealth for consumption. He further stated that the young may tend to save and/or borrow more for various activities while the old may be less inclined to save or borrow. Those at the medium age have positive and significant demand while the old are less inclined to demand for credit. Contrary to Mpuga's findings, a study by Tang et al. (2010) proved that old farmers are more likely to borrow than younger farmers. This is because older farmers have more social network or social capital and, thus, have more access to credit market. The study by Nwaru in Nigeria, 2011 contradicts this result and proved that age of the individual does not affect their credit demand.

In a study conducted by Diagne (1999), landholding size was found to have a positive but statistically significant effect only on access to informal credit. The portion of cultivable land in total household land had a positive effect on access to formal credit. This positive effect was ascribed to the fact that seasonal agricultural loans come as input packages equivalent to farmers' acreage. On the other hand, the marginal effects of the share of the value of land in the total value of household assets was negative and statistically significant for both access to formal and informal credits

The role of households' size can be seen indirectly. The larger the household the greater is its expenditure. The direction of relationship between this and participation in credit programme may however be uncertain (Togba, 2009). In a study by Bendig et al. (2009) using a comprehensive survey in Ghana to identify the possible drives that affect the different types of households'demand for financial services, results from a multivariate probit regression method showed a positive influence of household size on demanding microcredit as larger households are more exposed to shock (e.g. illness) from higher number of household members. A study by Tang and others in 2010 also revealed that, household size negatively affected the demand for credit. This was attributed to the fact that larger households assumed to contain more children and elderly people and not households with more economically active adults, are likely to consume a large share of their income and have less collateral.

Chen and Chivakul (2008) explain that individuals with larger household size are more likely to have a higher dependency ratio which will increase their credit needs making them more likely to demand credit than individuals with smaller household size.

Education can impact participation in microfinance credit programme. Formal and semi-formal sources involve more papers to fill. It is assumed that the likelihood of a person who has not been to school to take loan from formal and semi-formal is low and are most of the time ignored by these institutions. It is again assumed that households with a good educational level are more likely to choose more formal or semi-formal financing practices than less educated ones (Togba, 2009). Tang et al. (2010) indicated education as one of the most important variables that affect households demand for credit. Their findings indicated that additional year of education by the household head would increase the likelihood of borrowing by another 2.5 percent. According to their study, whereas education increased households' chance of borrowing from formal credit markets, it decreased or did not have impact on informal credit demand at all. Chen and Chivakul (2008) also debate that, education, at primary and secondary levels may affect demand positively, but at four-year university level, education has negative but insignificant effect. This could imply that highly educated individuals already enjoy high income and wealth and have little need to borrow.

 Bendig (2009) established that a better-educated household heads are likely to use credit from formal financial services. Heffernan and Pollard (1983), highlight the association between education and demand for credit. According to them, the more educated farmers are the more their ability to understand the importance of modern technologies and improved seed varieties. This will result in more educated farmers demanding more credit to enable them purchase modern farm equipment and improve seed varieties.

Group affiliation is a vital tool for screening loan applications and for ensuring that contracts can be enforced (Aryeetey, 2005). The group based microcredit program allows

borrowers who cannot provide collateral, to form their own group where members are mutually accountable for each other's repayments though loans are given to individuals. Since MFI's decide not to take any lawful action against defaulters, the only tool they have against loan defaulters is joint liability, where if any member is unable to repay, other group members cannot borrow unless they assist in repaying defaulters liability (Al-Mamun et al., 2011). Ghatak (1999) mentioned that group lending programme provide a chance for the MFI's to differentiate good borrowers from the risky ones. This joint liability feature of group based microcredit programme attracts the attention of development communities. The group's ability to improve repayment performance allows MFI's to achieve institutional financial sufficiency (IFS) and reaching large numbers of poor and hardcore poor households, thus, generating positive socio-economic impacts (Zhang & Xu, 2008). It is therefore easier for women to access microcredit when they are in groups than as individuals.

Income is an important variable observed by the lenders. Depending on the flow of revenue, households can get credit or not. Although the collateral (physical assets) is not required for some microfinance credit programme, income is considered as wealth for the households. This household wealth includes the endowment such as land, housing, etc. The likelihood of participating or demanding credit is directly linked to wealth. But this is not always the case as microfinance aims at targeting the poor (Togba, 2009).

Other variables identified to have likely influence on the demand for credit which need to be considered include farmers' engagement in other economic activities in addition to farming and total value of assets. For instance, Heffernan and Pollard (1983) argue that farmers who have a reliable stream of income from off farm employment may be under

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less pressure to increase farm production hence are less likely to demand credit for farming. Furthermore, he added that income from off-farm employment increases the farm household's internal liquidity providing more capital with which to undertake farm level activities or innovations which will negatively influence the probability of demanding credit by farmers.

Awunyo-Vitor and Abankwah (2012) found that engagement in other economic activities in addition to farming exhibit positive and significant relationship with demand for informal credit. They explain their result to mean that farmers who engage in other economic activities are aware that if they are not able to pay with income from farming they can rely on income from other economic activities to repay the loan which increase their probability of demanding informal credit.

In one study conducted in Malawi, total value of assets was found to have no significant effect on access to both formal and informal credits. The composition of household assets was much more important in determining household access to formal credit than the overall value of the assets (Diagne, 1999).

Mohieldin & Wright (2000) in a study of formal and informal credit markets in Egypt found that the ownership of assets significantly influence the demand for informal credit. They explained that the result was reasonable as assets may serve as security for securing credit. In divergence, studies by Elhiriaki and Ahmed (1998) and Burslund and Tarp (2008) found value of assets to have a significant and negative influence on the demand for informal credit. They contend that larger assets can easily be converted into cash when the need for credit arises as a result, a lesser chance of demanding credit from the informal sector. Awunyo-Vitor and Abankwah (2012) however found no significant

relationship between value of assets and demand for informal credit. They explained that informal credit delivery is largely based on social reputation and relationship and not on asset as collateral.

2.4 Measurement and determinants of access to credit

In literature, there are presently two methodologies for measuring household access to credit and credit constraints. The first method infers the presence of credit constraints from violations of the assumptions of the life-cycle/permanent-income hypothesis. More precisely, the method uses household consumption and income data to look for a significant dependence (or "excess sensitivity") of consumption on transitory income. Empirical evidence of significant dependence is taken as an indication of borrowing or liquidity constraint (see, for example, Besley, 1995). The second method classifies household as credit constrained or not by using information on households 'participation and experiences in the credit market. The classification is then used in reduced form regression equations to analyze the determinants of a household being credit constrained (see Cox & Jappelli 1990; Feder et al., 1990; Zeller 1994; Barham and Boucher 1994). The shortcomings of these two approaches are reviewed in Zeller et al. (1996:1997) and Diagne et al (1997). The next section develops a methodology based on the *credit limit* concept, which allows a more satisfactory analysis of the determinants of the extent of a household's access to credit and its demand for formal and informal credits.

2.4.1 Analyzing credit with the credit limit variable

Lenders are generally constrained by factors outside their control on the maximum amount they can possibly lend to any potential borrower. This makes the borrower face a limit on the overall amount she/he can borrow from any given source of credit regardless

of the creditworthiness, the interest rate, or collateral she/he is willing to put up to back the loan. Furthermore, due to the possibility of default and lack of effective contract enforcement mechanisms, lenders have the incentive to further restrict the supply of credit, even if they have more than enough to meet a given demand and the borrower is willing to pay a high enough interest rate (Avery, 1981; Stiglitz and Weiss, 1981). Therefore, from the borrowers' view, the relevant limit on supply is not the maximum amount the lender is *able* to lend, but rather the maximum the lender is *willing* to lend.

2.4.2 Access to credit and participation in credit programmes

Access to credit is often confused with participation in credit programmes. Indeed, in many credit studies, the two concepts are often used interchangeably. However the crucial difference between the two concepts lies in the fact that participation in a credit programme is something that households choose to do freely, while access to a credit programme entails constraints placed on households (for example availability and eligibility criteria of credit programmes). In other words, participation is more of a demand-side issue related to the potential borrower's choice of the optimal loan size while access is more of a supply-side issue related to the potential lender's choice of the maximum credit limit. The *lack of access to credit* for a given source of credit can be defined as when the maximum credit limit for that source of credit is zero. That is, one *has access* to a certain type of credit when the maximum credit limit for that credit type is strictly positive; and one *improves* someone's access to that type of credit by increasing access for that credit.

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2.5 Agriculture in Ghana

Agriculture since post-independence has been the mainstay of Ghana's economy (McKay and Aryeetey, 2004). Even though the performance of the agricultural sector has been on the decline lately, it still remains the sector which employs about half of the labour force and it is the largest foreign exchange earner (MoFA, 2010a). In Ghana, agriculture is predominately on small holder basis. Approximately 90% of land holding falls below 2 hectare though there exist bigger lands and plantation. Farming system is traditional with hoe and cutlass as main tools (MoFA, 2010). The agricultural sector consists of five key sub sectors, the food crops, livestock, fisheries, cocoa and forestry. The main food crops grown in the country include cassava, millet, plantains, maize, rice, yams peanuts, and sorghum. Ghana's main export commodities are cocoa and cocoa products, timber and wood products, fish and fish products, shea nuts and coffee. Other industrial crops include cotton, oil palm, rubber, coconut and sugarcane. The country is however divided into six distinct agro ecological or vegetational zones namely; high rainforest, semi deciduous forest, forest savannah, guinea, sudan and coastal savannah. There are a number of challenges to the development of agricultural production in Ghana. These include land ownership (which is mainly communally owned by families), inadequate credit facilities, factor market constraints, post-harvest losses, poor storage facilities, poor agriculture practices, poor returns on productivity-related costs and irrigation facilities.

2.5.1 Women participation in agriculture

Women in all parts of the world play vital roles in agriculture production. More than half of the world's women are involved in food production. According to IFAD (2007), global food security is dependent on the works of rural women as they are the key producers of

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food crops globally. Worldwide, women produce over 50 percent of all food (FAO, 2012a) and 80-90 percent in Sub-Saharan Africa (UNDP, 2013). African women are an integral part of the agriculture sector. They represent up to 52% of the total population in the sector and are responsible for approximately 50% of the agricultural labour on farms in Sub-Saharan Africa (SSA). Reports show that in some African countries women spend approximately 60% of their time on agricultural activities (ILO, 2010). More than 60% of working employed women in SSA work in agriculture (FAO 2014)

The international development community has recognized that agriculture is an engine of growth and poverty reduction in countries where it is the main occupation of the poor (World Bank, 2007). However, the agricultural sector in most developing countries is underperforming, partly because women, who represent a crucial resource in agriculture and the rural economy through their roles as farmers, labourers and entrepreneurs, almost everywhere face more severe constraints than men in access to productive resources. 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 that women make and take steps to alleviate these constraints.

Women in developing countries make essential contributions to the agricultural and rural economies as their roles vary considerably between and within regions. However, these roles are changing rapidly in many parts of the world, where economic and social forces are transforming the agricultural sector. Rural women often manage complex households and pursue multiple livelihood strategies. Their activities typically include producing agricultural crops, processing and preparing food, caring for family members and

maintaining their homes, collecting fuel and water, tending animals, working for wages in agricultural or other rural enterprises as well as engaging in trade and marketing. But many of these activities are not defined as "economically active employment" in national accounts but they are essential to the well-being of rural households.

According to FAOSTAT (2010), women comprise just over 40 percent of the agricultural labour force in the developing world, a figure that has risen slightly since 1980 and ranges from about 20 percent in the Americas to almost 50 percent in Africa. Although women's roles and involvement in economic activity in the traditional sense has to a great degree been well-defined and constrained along biological and cultural lines, their role in the Ghanaian economy have not been restricted to the home alone but has cut across all sectors of the economy with its effect touched more in the agricultural sector and services (wholesale and retail sub-sector) sectors. Women's involement in agriculture has contributed to household incomes and the education and health of their children.

Rural development in Africa cannot be imagined without the active participation of women. Women are, of course form an integral part of farming household. Etenesh (2005) asserts that women are involved in over half of the farm activities in many developing countries, bear most of responsibilities for household food security and contribute to household wellbeing through their income generating activities. However, in order to improve the capacity of African countries to meet their food demand, women's roles have to be recognized and they should be given equitable access to and control over the land, credit facilities, extension services and improved tools as well as membership in cooperatives and other rural benefits (Win rock, 2001).

Also, it is impossible to think of development while neglecting the women work force, as women represent the major force for rural changes, largely as an un-tapped resource that could boost rural development and lead to higher growth rates and increased food production (Nigist, 2004). Sub-Saharan women play a central role not just in agricultural activities but in domestic activities. Women are the primary caregivers and are concerned with providing the necessities for their children's' health and wellbeing in their households (Duffo, 2003). Although these activities play a vital role in the development of the future generation, many of these domestic activities are unpaid activities (Doss et al, 2011). In Ghana, women perform more activities than men not only in their home but also in the field. In the household, women are responsible for preparing food, caring for their children and gathering firewood and water, and in the field women perform most of the cropping activities and help in raising the livestock (Saito et al., 1994).

2.5.2 Barriers to women participation in Agriculture

The importance of women in agricultural development cannot be over-emphasized. Yet, with all the considerable contribution they make they are thoroughly downgraded and their efforts under-valued in conventional agricultural and economic analyses (Jiggins *et al*., 2000). Women usually lack access to credit, land and education, which make their advancement in economic development relatively difficult.

Land occupies a paramount place among the resources available for human survival. The existence of humans is largely dependent on land as it constitutes the platform for which human activity and development occurs (Hussein & McKay, 2003). The dynamics surrounding land is vital to sustainable growth, good governance and the well-being of individuals in society (Edewor, 2014). Such forces also determine the economic

opportunities available and accessible by both the poor and the rich in society (Deininger, 2003). Majority of the world's food are produced by women yet they lack control over land even though it is clear that the pattern by which land is allocated and regulated have an important place in determining how resources can be utilized (Ratcliffe, 1976). Okojie (1998) makes it clear that in spite of symbolic association between women and the land, as well as the popular cultural perception of earth as mother, women own only 1 per cent of the world's land. Over the years, research has shown that the female gender suffers denial of access and ownership of land by the male counterpart globally, especially in Africa (FAO, 2002; UNFPA, 2004; Iruonagbe, 2010e).

Despite women's high dependence on land for the farming activities they do not have right to own land. They can only have access to land through their fathers or through a portion allotted to them by their husbands (Doss, 1999; Edewor, 2014; Fakoya et al., 2005).

Research has shown that credit facilities empower women in taking a greater role in household decision making, having greater social networks, having greater access to financial and economic resources, more bargaining power vis-à-vis their husbands and having greater freedom of mobility (Swain & Wallentin, 2008). However, women continue to experience difficulties in their effort to access such credit facilities. This is particularly the case for rural women who are illiterate and mainly dependent on their husbands for agricultural inputs.

In order to address the challenges in accessing credit by women, microfinance institutions have been established to provide easy avenues for poor persons to access credit. However, the bureaucratic characteristics embedded in these institutions, high illiteracy

level of the women, and cultural factors such as lack of autonomy, decision-making power, and participation in household and societal decision-making have defeated its purpose in the lives of rural women (Okojie et al., 2009). In most cases, collateral is often required from these women usually in the form of physical assets which they lack access to and as such, denies them access to such credit facilities. Such demand for collateral is stimulated by the perceived short life cycle of women-run businesses, which do not often exceed a period of four years (Mutalima, 2008). This in turn decreases their ability to produce sufficient quantity of food for consumption and sale. On the other hand, where such collateral are provided through their husbands, the consequence is that their husbands in turn make the decision on how the fund is to be used. This further ties the woman to the apron of her husband which eventually makes this fund to have no meaningful impact on her agricultural production and make loan repayment difficult (Murray & Boros, 2002).

Furthermore, where such funds can be obtained in a group, such as Cooperatives Societies or Self Help Group (SHG), these women are often denied attendance to those meetings by their husbands as they are perceived to be attending meetings where the overthrow of the man as the head of the family is to be discussed (Ozoya, 2016). Nonetheless, such groups have been found to be the most profitable avenues through which the women's lives can be improved by microfinance institutions. In a study conducted in India on the effect of microfinance institutions on women's empowerment, it was discovered that there was significant empowerment of the SHG members, whereas no significant change was observed on average on the lives of those not belonging to any group (Swain & Wallentin, 2008).

There are often two types of technologies, namely; local and modern. Local technologies are often of small-scale size, simple operations, cheap and made of indigenous materials. Modern technology, on the other hand, is often of large-scale, expensive, profit-oriented and of complex operations (Bob, 2004). According to Bob (2004), various expressions are often used to describe technology which is developed and utilized at the local level. Such terms include indigenous, alternative, appropriate, adoptive, self-reliant, intermediate, and people's technology. Most peoples who use indigenous technology often belong to the groups that are traditionally marginalized; have low profile; and low social status. These include women, the landless and the rural poor.

Women farmers need both local and modern technologies to achieve enhanced food productivity. According to International Institute for tropical Agriculture (IITA, 2005), several machines are made available by the Institute through the Integrated Cassava Project (ICP). This is expected to be of immense assistance to rural women farmers in Edo State because cassava is their major farm crop but literature has shown that these are absent among rural women farmers in the State (Ozoya, 2008)

Storage facilities have posed several challenges to rural women as they have to depend on crude methods to store their farm produce from perishing. This makes availability of food after the harvesting season scarce and sufficient income is often not generated as the produce cannot last long enough to be available for those who will demand for them beyond the harvest season.

The need to occupy ourselves in the twenty-first century with rational, equitable and sustainable application of the natural resources that promote worldwide food supply, such as labour, land, clean water, oil and other agricultural inputs, is fast becoming widespread

as the consequences are biting hard on both rural and urban dwellers. It is now clearly acceptable that neglect in this regard will engender starvation (Hodges, Buzby & Bennett, 2011). World population is expected to reach 9.1 billion by 2050 which requires a 70 per cent increase in food production (FAO, 2011).

Consequent upon the use of poor storage facilities, use of poor storage techniques and poor processing techniques, post-harvest food losses are high in Nigeria. It is clear, therefore, that great post-harvest loss is one of the main avenues of food waste, thereby reducing food security. Unawareness of people on how to preserve food security is a common problem. As such, the need to empower rural women with modern storage and processing facilities can be understood within the context of the massive waste that occurs after harvest and the impoverishment that women experience consequently.

Agricultural extension services are known to be important in serving as a cost-effective method of boosting the productivity and income of farmers (Adesiji, Kehinde & Omotesho, 2013; Galie, 2013). In most African Countries, agricultural extension services, which are essential to economic development programs, are non-existent, weak or unsatisfactory (Agu, 2013). Unfortunately, even when extension services are existing, the content and method of service delivery are often unresponsive to the needs of female farmers (Hilda, 2000, as cited in Agu, 2013). It was observed that new technologies are usually introduced to help men, with the basic assumption that women carry out only menial tasks such as weeding, thinning, and transplanting, and that the traditional tools they use, like hoes, are sufficient to enable them to step up and sustain productivity (Collier & Dercon, 2014; Ogato, Boon, & Subramani, 2009). This also has affected the

women in farming, as it becomes difficult for them to access the extension services that they might need to increase their yields, and make their work easier.

It has been noted that extension services enable farmers to adopt current innovations, boost food production sometimes as high as 13–500%, and protect the environment. However, efforts at obtaining data on the effects of extension trainings pose a great challenge due to the divergence on farmers' access to extension services across various communities (FAO, 1993). Though women play a central role in agriculture across Africa, including Ghana, most of them are often bypassed in agricultural extension trainings (Rousan, 2005). Adesiji *et al.* (2013) attribute the prevailing negligence of women farmers by extension agents to women's "limited control over assets and decisions and systemic biases that are evident in agricultural institution throughout Africa and much of the world". A major asset over which women lack control and ownership is land.

IFAD (2007) notes that a substantial share of the income of the rural poor comes from farming, the report therefore recommended that democratizing access to and control over land and water resources is crucial for empowering women.

In Ghana particularly, studies show that women face challenges in accessing agricultural extension services. In a recent study conducted by (Ayamga et al., 2015) majority of women interviewed reported that they were not treated equally with their male counterparts when it comes to accessing extension services, including training on effective use of new technologies for better yields.

According to Agu (2013), women farmers in Africa are often portrayed as an exploitable instrument and as such weak and naive. Traditions, culture and religion have also reduced women as second class citizens of which Ghana is no exception. Women lack of participation in decision making and policy formulation has hindered development in the agricultural sector resulting in decision makers overlooking most of the key issues touching women (Agu, 2013; Doss, 2014). As such, women now organize themselves into groups and movements to press for their cause at all levels.

Security of land tenure is often assumed to empower the rural poor, improve their livelihoods as well as increase their food supplies, raise rural employment and foster more sustainable agricultural practices (Ayamga et al., 2015). They further maintain secured land rights are have significant positive influence on the alleviation of poverty, as it gives the owners greater control over their labour and hence invest in the land and crops, greater access to extension services and more negotiating power.

The pursuit for food security has often left the poor with little option but to use their inadequate resources extensively. They are often obliged to adopt survival strategies with short-time horizons due to factors such as their insecure land tenure rights, their limited access to financial services, their lack of access to information and lack of access to agricultural inputs (Ayamga, 2015). Secure resource rights although cannot guarantee sustainable land management, it can however serve as a powerful incentive. Farmers with long-term access to land have a greater tendency to sustain the land and develop ways of preserving and regenerating it (Quisumbing et al., 2014, as cited by Brückner, 2012).

In sub-Saharan Africa, women market their produce largely in local markets. Mehra & Rojas (2008) state that for female farmers to engage in marketing successfully, they

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should have the capacity to participate knowledgeably and effectively. One of the challenges that rural women farmers face is to negotiate terms and prices with powerful buyers (Mehra & Rojas, 2008). Rural women farmers in Ghana usually lack access to markets due to lack of dependable transport in those areas. A large portion of their income paid for transport. Female farmers prefer selling their produce at informal markets because they house all the different grades of the vegetables that the women produced. However, they are confronted with enormous competition from other farmers at the informal market and their prices sometimes are often lower than expected which further reduced their farm income.

2.6 Empirical Discussions on Access to Credit

Lack of credit is one of the primary hindrance among several other factors affecting productivity and income of many rural households. Most of the household due to inadequate institutional finance, are forced to seek final services through the informal channels (Sisay, 2008).

Duy et al. (2012), investigated the factors affecting rural individual and group based household access to formal credit in Mekong Delta, Vietnam owing to the fact that poverty levels remain significant in rural MD. It is assumed that credit access is the vehicle for poverty alleviation and therefore the need to assess how households borrow. They applied the Heckman two-step model to determine the farm household' access to formal credit in Mekong Delta, Vietnam. The study revealed that family size, household capital endowment, marital status, distance to market center and location as significant factors determining access to formal credit.

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In a study by Adeola (2008) in examining the borrowing behavior of respondents in Oyo State, the logit model was used to estimate the effect of the determinants of credit constraints and results showed that transitory income, predicted interest rate and educational level significantly influence borrowing behavior. Also it was revealed that 41% of the respondents had no access to formal credit while the remaining 59% had.

In addition, output from the study by Isaga (2018) on factors affecting access to bank credit by smallholder farmers in Mvomero District of Morogoro, Tanzania, also applied a logit regression model findings revealed that the value of assets invested in farm activity, education and gender are significant factors affecting smallholder farmers' access to bank credit. The study there recommended the establishment of state-own banks that will exclusively provide financial service to agriculturalist by establishing guarantee schemes and the development of new financial products to cater for the needs of smallholder farmers.

Omonona et al. (2010) used the probit model and a stochastic frontier analysis to examine the factors influencing credit constraints and production efficiency of farm household in Oyo State, Nigeria. The results show that 79.2% of the respondents were credit constrained and had a negative effect on production efficiency. Also age, gender, education and dependency ratio of the farmers were the significant variables influencing credit constrained conditions of farmers.

Hananu et al. (2015) used a household survey data from United States Agency for International Development (USAID)'s feed the future initiative on 2,330 sampled farm households and results from the logistic regression model revealed that age, education, group membership and source of credit significantly influence agricultural credit demand.

They recommended that stakeholders be encouraged in the formation of cooperative groups to enable farmers pull resources together or streamline loan application processes.

Ibrahim and Aliero (2012) examined the factors influencing access to formal banking credit in the rural areas of Nigeria. Data was collected from rural areas of Kastina State. The study used the probit modelling approach to analyze the factors that influence farmer's accessibility to formal credit and revealed that level of income, education attainment, collateral and marital status have significant positive influence on farmers access to credit while interest rate and transaction cost have significant negative influence. The study concluded that with the prevailing banking arrangement in Nigeria rural farmers have little or no access to credit from conventional banks.

In addition, Okurut et al. (2005) examined factors that influence credit demand and supply in Uganda by employing the logit model. Using observed household individual characteristics. The household characteristics that influences demand include age, education and household expenditure per adult equivalent. They argued that household composition, migration status and credit demand is higher for males than for females and for credit is less in household with higher dependency ratio. Demand for credit is less in households with sick members and more land assets per adult equivalent. Gender on the other hand does not play a significant role in the demand for credit.

Dzadze et al (2012) results on factors determining access to formal credit in the Abura-Asebu Kwamankese district of central region of Ghana using the logistic regression model revealed extension contact, educational level and saving habit as significant and positive factors influencing farmers` access to formal credit. The study recommended that the Ministry of Food and Agriculture (MoFA) should ensure an increase in the farmer-

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extension agent contact by proving agriculture extension agents on timely basis and ensure logistic support to make periodic visits to farmers in their communities.

Dabone et al (2014) also conducted a study to ascertain the determinants of access to cash crop production in Ghana with emphasis on the cocoa industry. A binary probit model was used to estimate the probability of access to credit by farmers. Results from the regression analysis showed that savings level of farmers, revenue from sales, farm size and years of farming significantly determine farmers' chances of having access to credit from formal and informal sources. It was recommended that extending credit to women will not only accelerate the growth of their micro-farms but has trickle down effects on their entire household as income earned from their farms is mostly used to cater for their household.

Oboh et al (2011) in their study on the determinants of formal agricultural credit allocation to the farm sector by arable crop farmers in Benue State, Nigeria employed the multiple regression model to identify the determinants of credit allocation to farm sector. The study revealed that the rate of credit allocation to the farm sector is significantly influenced by age, education, farm size, loan delay, bank visit and household size.

Iyanda et al. (2014) in their study on social capital and access to credit among cassava farming households in Ogun State, Nigeria, they employed the logistic regression model in analyzing access to credit and the results revealed that increasing value of decision index, age, household size and payback period.

Etonihu et al. (2013), in their study on the determinants of access to agricultural credit among crop farmers in a farming community of Nasarawa State, Nigeria used the

stepwise linear regression model. The study revealed that education, distance to source of credit and types of credit significantly affect farmer's access to agricultural credit and recommends enabling environment to ease farmers access to education and credit facilities.

Nkegbe et al. (2017) employed the conditional mixed process framework to estimate access to farm credit, credit constraint and productivity in Ghana and results from the study revealed that age, literacy, farm non-mechanised equipment and group membership were variables influencing farmer access to credit.

2.7 Credit participation and agricultural productivity

The effect of access to credit on agricultural productivity cannot be overemphasized. Literature has shown that credit has a great influence on agricultural productivity. Credit enables risk-averse smallholder farmers to resolve their cash constraint as well as investment in farm, mainly in enhanced farm equipment and inputs which may possibly increase agricultural production (Fuentes, 1996). This suggests that though access to credit may not have a direct impact on productivity, it could have a positive and significant indirect impact through its positive influence on agricultural technologies adoption, hired labor, increased capital for farm investment, and improved household welfare through better-quality health care and better nutrition.

Also, with credit, the farmer can raise his or her productivity which will warrant greater farm output and increase income. Credit is crucial for agricultural development and is often a vital element of agricultural modernization. It cannot only remove a financial constraint but it could also increase production and income, and may fast-track the

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adoption of technologies (Atieno, 1997). It can improve income by enabling the undertaking of additional income generating activities, and the rural households also can finance more consumption and have surplus finance available for further investments (Rosenzweig, 2001). Also, credit facilities will help farmers purchase modern inputs such as high-yielding varieties of seeds, fertilizers, and install irrigation to increase production (Vicente & Vosti, 1995).

Feder *et al.* (1990) suggested that credit permits farmers to please the cash needs prompted by the production rotation which depict agriculture; land preparation, planting, cultivation, and harvesting are normally done over a timespan of several months in which very little cash revenue is earned, while expenditure on materials, purchased inputs, and consumption need to be made in cash. Thus, access to credit may affect farm productivity because farmers facing compulsory capital constraints would be likely to to use lesser levels of inputs in their production undertakings related to those not constrained (Feder et al., 1989; Petrick, 2004).

In an empirical analysis of factors that affect technology adoption carried out by Feder and Umali (1993) and Cornejo and McBride (2002) highlight access to credit as a crucial determinant of adoption of most agricultural innovations. It is assumed that access to credit promotes the adoption of risky agricultural technologies through the easing of the cash constraint as well as through the boosting of household's risk bearing ability. With an option of borrowing, a household can do away with risk reducing, but inefficient income diversification strategies and concentrate on riskier but efficient investments (Eswaran and Kotwal, 1990).

In a study conducted in Nigeria by Nweke et al. (2002), credit constraint has been identified as a most important factor influencing adoption of modern cassava production techniques such as herbicides, hybrid cassava stake, insecticides, inorganic fertilizer, tractor, appropriate spacing, planting date and tillage practice.

According to Freeman *et al.* (1998), farmers' access to credit is also very vital in the sense that it can aid the levels of input use closer to their potential levels when capital is not a constraint, thus leading to higher levels of output per farm and productivity, given fixed resources such as land. This implies that the marginal contribution of credit brings input levels closer to the optimal levels, thereby increasing output and productivity (Feder *et al*., 1990).

Access to credit is also seen a significant tool for smoothing consumption and encouraging production especially for poor households (e.g. Swain *et al.,* 2008; Conning and Udry, 2005; Armendariz and Morduch, 2005; Zeller *et al.,* 1997). This means that access to credit can considerably increase the capacity of households with no or limited savings to meet their financial needs for agricultural inputs; especially those that are highly necessary for weed, pest, and disease control and productive investments. Furthermore, easy availability and access to credit enables farmers and entrepreneurs to expand by undertaking new investment.

Lawal and Abdulahi (2011) found that the informal financial sector in Kwara district of Nigeria impacted positively on agricultural production with rotating savings having the greatest impact, followed by periodic savings. Jing et al (2010) estimated that agricultural productivity and rural household income in China improved by 31.6% and 23.2%,

respectively, with the removal of credit constraints. They found that access to credit ensured timely and adequate use of inputs for the implementation of all field operations by farmers. Awunyo-Vitor et al (2014), observed in the Brong Ahafo region of Ghana, that there is a positive impact of agricultural credit on maize productivity.

Khandker (2002) argues that Availability of credit can be the leading edge of rural development. Credit can be employed to extend the total area under cultivation and invariably output. Farmers can further acquire farm machinery and equipment that can help increase acreage and also buy and use important inputs such as improved seeds, weedicides, pesticides and fertilizer. Credit provision to the poor makes a lot of difference to the poor by raising their per capita income and consumption as well as household net worth, thereby increasing the probability that the beneficiaries lift themselves out of poverty and provide for their basic needs. The provision of credit to smallholders especially women is not intended only for increasing productivity but also to contribute to their empowerment (Goetz & Gupta, 1996).

Awotide et al. (2015) studied the impact of access to credit on agricultural productivity in Nigeria using the Endogenous Switching Regression Model (ESRM)). The first stage of the ESRM reveals that total livestock unit and farm size are positive and statistically significant in determining the farmers' access to credit. The second stage reveals that total livestock unit and farm size are negative and statistically significant in explaining the variations in cassava productivity among the farmers that have access to credit, while household size, farm size, and access to information assets are negative and statistically significant in explaining the variation in cassava productivity among the farmers without access to credit. It was finally discovered that access to credit has a significant positive

impact on the production of cassava. They recommended that, credit establishments should consider boosting their credit services to rural farming households in order to guarantee that more households benefit from it.

Nkegbe et al. (2018) examined the effects of input credit on smallholder farmers output and income using Masara N'Arziki support project in Northern Ghana. A cross sectional primary data was used to estimate the effect of the project participation on farm output, yield and income using propensity score matching method (PSM).Results from the study revealed that project participation is skewed towards experienced farmers with big-sized household and farms. The effect of the project on outcome however was somewhat not satisfactory in the sense that participation only raised output and yield but not income.

Employing a cross sectional data from 360 selected rice farmers in the south west Nigeria, Salami et al (2019) analyzed the impact of credit demand on productivity of rice farmers. They employed the ESRM. The results showed that household assets, access to service, climate variable, regional variables and transaction cost significantly influence farmer's credit demand decision in the first estimation. Also, in the second estimate, factors such as household assets and access to service significantly explains the variation in rice productivity of participants and non-participants. This implied that facilitating farmer's access to credit will improve rice productivity.

Boucher et al. (2008) assessed the performance of rural credit market in Peru. A model was developed to show that collateral requirement enforced by lenders in response to asymmetric information can lead to not just quantity rationing but also transaction cost rationing and risk rationing which all affect resource allocation and productivity. Insight

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of the model using a panel data set from Northern Peru was tested and estimate of returns to productive endowment for constraint and unconstraint household using Switching Regression Model. Results revealed that consistent with the theory of productivity is independent of endowment for constraint household but is tightly linked to endowment of constraint household. In all, credit constraint lower the rate of agricultural output in the study by 26%.

2.8 Credit Participation and Welfare

Studies have found that microfinance is pertinent to poverty reduction not just for the beneficiaries but has positive spillover effects on the rest of the community (Khandker, 2006). In his study, Khandker (2006) used a panel household survey from Bangladesh and observes that access to microfinance contributes to poverty reduction, especially for female participants, and to the overall poverty reduction at the village level.

Access to credit affects household welfare outcomes through three pathways (Zeller et al., 1997). The first pathway is through the alleviation of the capital constraints on agricultural households: expenditures on agricultural inputs and on food and essential non-food items are incurred during the planting and vegetative growth periods of crops, whereas returns are received only after the crops are harvested several months later. Most farm households show a negative cash flow during the planting season. Therefore, to finance the purchase of essential consumption and production inputs, the farm household must either dip into its savings or obtain credit.

Access to credit can therefore significantly increase the ability of poor households with little or no savings to acquire agricultural inputs. Furthermore, easing potential capital

constraints through the granting of credit reduces the opportunity costs of capital-intensive assets relative to family labour, thus encouraging the adoption of labour-saving, higher-yielding technologies and therefore increasing land and labour productivity, a crucial factor in encouraging development, in particular in many African countries (Christopher 1995; Zeller et al., 1997).

The second pathway through which access to credit affects household welfare is by increasing household's risk-bearing ability and by altering its risk-coping strategy. The third pathway enabling access to credit for consumption smoothing is closely linked to the second, and we therefore discuss them together because they both affect the resilience of households in bearing production and consumption risks.

Credit provision to the poor makes a lot of difference to the poor by raising their per capita income and consumption as well as household net worth, thereby increasing the probability that the beneficiaries lift themselves out of poverty (Khandker, 2002) and provide for their basic needs. Provision of credit to smallholders helps households and individuals to achieve food security and alleviate their poverty (IFPRI, 2002). In Peru, it was observed that households receiving credit were better off than their non-beneficiary counterparts and attributed some of these benefits to the participation of beneficiaries in the Microloan program (Dunn & Arbuckle, 2001). Credit provision to the small farmers allows small farmers some portion of cash necessary to pay for harvest labour. This helps to eliminate the well-established custom of selling the first part of harvest to local intermediaries (middlemen) who purchase at lower than competitive prices in return for cash advances (Morss et al., 1975).

2.8.1 Review of poverty studies

The United Nations Development Report (2000) defines poverty as a pronounced deprivation which encompasses a wide range of issues including hunger, lack of shelter and clothing, lack of access to health care and education and inadequate or lack of access to policy making (UNDP; 1999:2001) Poverty can also be defined as the inability to live up to a particular set standard in a society World Bank, 2016. The standard set by the World Bank demands that a household that is unable to live up to $1.90 per day which is the poverty line threshold, should be classified as poor.

Poverty depends not only on income but also on access to services, hence poverty is also defined as the deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information. As a multidimensional phenomenon, poverty is defined and measured in different ways. This is broadly categorized into absolute or relative poverty measures.

Absolute poverty occurs when people are unable obtain sufficient resources to satisfy their basic needs. Relative poverty on the other hand occurs when people do not enjoy a certain minimum level of living standards as determined by a government. Relative poverty can be associated with comparing one group of people to the other people who are lowly paid or working poor representing the longest groups in poverty line. Sen (2004) established that poverty in an absolute term occurs in the space of capabilities and relative in commodities or characteristics.

2.8.2 Poverty Estimation

The definition of poverty, how it is measured or who constitute 'the poor' are issues that are fiercely contested. The question is whether poverty is largely about material needs or about a broader set of needs that permit well-being. Poverty can be measured in monetary or non-monetary terms but the common measure of Poverty has been the monetary approach where the income consumption expenditure are used as indicator for poverty calculation. This approach poverty measurement operates on the assumption that individuals and households are poor if their income or consumption falls below a certain threshold (poverty line), usually defined as a minimum, socially acceptable level of well-being. According to World Bank, 2007, poverty lines defer across time and societies and hence, each country uses lines which are appropriate to its level of development, societal norm and values. In most cases, two poverty lines are applied to the distribution of standard of living. These are upper and lower poverty lines. In Ghana the current upper poverty line is GHC 1,314 per adult per year while the lower poverty line is GHC 792.05 per adult per year (GSS, 2014). Households above this line are rich while those below but above the lower poverty line are poor and those below the lower poverty line are extremely or very poor.

2.8.3 Poverty Indices

Monetary measure is often used in calculating poverty indices. However, the traditional income poverty indicators are the headcount index and per capita GNP.

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2.8.3.1 The Headcount Poverty Index (HPI)

The headcount index is based on a poverty line that is established by costing a minimum basket of essential goods for basic human survival, using income or consumption expenditure data of households. The incidence of poverty is then calculated as the percentage of the population whose incomes fall below that threshold. The headcount is however expressed as:

$$H = (q/n)$$ (2.1)

Where q = total number of people below the poverty line

n= size of population

The depth and severity of poverty can also be measure with the used of some income indicators using the Foster, Greer and Thorbecke (1984) Index. The poverty gap index measures the degree to which the mean income of the poor differs from the established poverty line (depth of poverty). The Foster Greer Thorbeck **(FGT) index** is expressed as

$$P_a = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^a$$

(2.2)

Where z is poverty line, y is welfare measure (total income/expenditure of household). $z - y_i$ is the proportionate shortfall below the poverty line. a is a parameter which captures the degree of poverty and it ranges between is a and it ranges between 0 and 2, depending on the purpose of the measure. Thus if a =0, and it ranges between 0 and 2, depending on the purpose of the measure. Thus if a =0, P_a decrease to the headcount; if a

=1, P_a captures the depth of poverty and if a =2, P_a measures the severity of poverty decrease to the headcount; if a =1, P_a captures the depth of poverty and if a =2, P_a measures the severity of poverty.

2.8.4 Measurement of Welfare Indicators

Welfare is the level of prosperity and quality living standard of either an individual or a group of persons (Todaro & Smith, 2013). In the field of economics, it is referred to as utility gained through the achievement of material goods and services.

Welfare is noted as a multidimensional variable and mostly measured in terms of real income, real GDP, (how income and expenditure is distributed through society), intangibles (such as the degree of individual's liberty) and literacy. This study however, measured welfare as household per capita expenditure which is limited compared to the broad dimension of welfare as described above. Following the works of Donkoh (2006), the dimension of welfare in this study goes beyond the levels of income to non-income indicators. Thus factors influencing people's standards of living should be an issue of concern in measuring welfare. Grootaert (1997) established that poverty is a function of household endowment (consisting of human and physical capital), where human capital entails members of household and their ability to manage scarce resources (example; age, sex and education). Physical capital on the other hand, includes value of durable assets and land.

In this study the household per capita expenditure approach of estimating welfare was used. In this approach, the relationship between the total per capita expenditure and the explanatory variables is likely to be nonlinear, therefore a log transformation of consumption expenditure is often used, and hence the welfare function takes the form;

$$lnC_i = w_i\gamma + e_{3i} \tag{2.3}$$

Where lnC_i is the natural logarithm of .real per capita consumption expenditure of household i, w_i is a set of household and community characteristics affect consumption expenditure, e_{3i} is a normally distributed random term with mean zero and constant variance.

Welfare is a measure of living standards that define the poverty level of an individual within a specific society, hence using consumption expenditure is more appropriate than income. Aigbokhan (2000) established that the use of income is more problematic as compared to the use of expenditure, since people turn to under report their incomes. Also the use of cash income as sole indicator of a household's income, underestimates the welfare of a household (Oladeebo, 2012). This study will therefore measure households' welfare using total per capita expenditure of the household, which includes consumption expenditure on food, clothing among others.

The GSS poverty lines categorized households into poor, extremely poor and non-poor based on their per capita consumption expenditure on food and non-food items. Welfare is computed as household per capita consumption divided by the Greater Accra (1999) price index augmented by Ghana's equivalence scale. Households with welfare above the upper poverty line (GHC 1,314), are considered rich and those below the upper poverty line but above the lower poverty line (GHC 792.05) are poor while those below the lower poverty line are extremely poor.

2.9 CONCEPTUAL FRAMEWORK

The conceptual framework showing the effects of credit access on output and welfare is presented in figure 2.1 below. It can be seen that credit does not only have effects on output growth but also on the farmers and the community at large. Therefore the conceptual framework developed reflect the outcome of credit access at household level, based on the assumption that increase in output will result in an increase in women farmers' wealth and overall standard of living since the incomes obtained from farming activities will enable the women farmers to meet their expenditure, hence create a possibility of trickledown effect. Credit access has been identified as an essential tool for poverty reduction.

Access to credit enables low income earners especially women who do not have access to formal banking to become economically empowered, increase their role in family decision making and also increase employment levels, increase income, and hence reduce their vulnerability to economic stress.
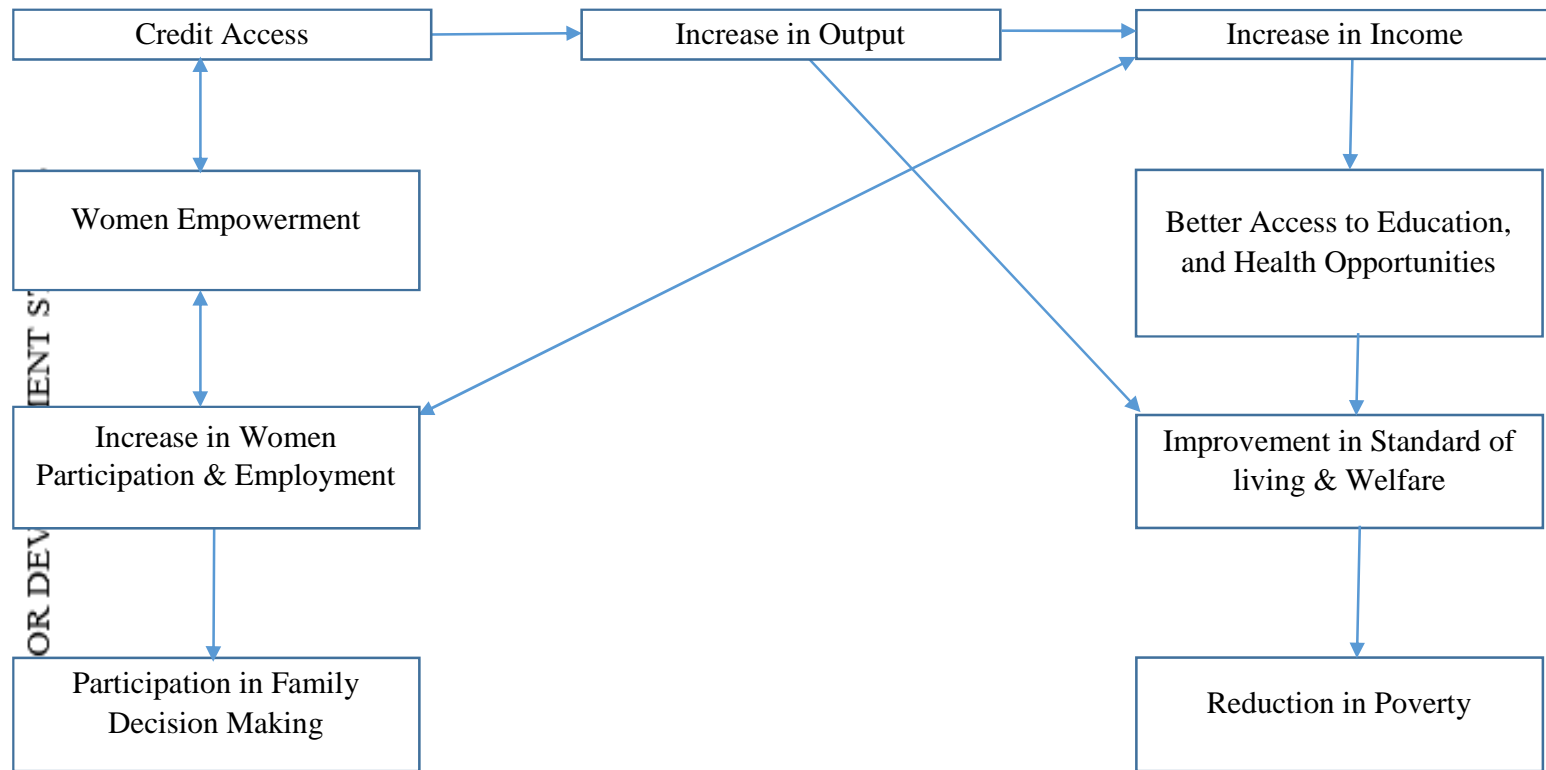
Figure 2. 1: Conceptual Framework of the Study

Source: Author's Construct

In Figure 2.1 above, it can be observed that, access to credit by women farmers support the growth and expansion of their output. The incomes generated from the output will empower them economically to support their families and expand their farms to recruit more farm labour and acquire more physical assets to increase productivity which will further increase income. As the women become economically empowered, their role in decision making at the household level and society will also improve. The women will also be able to contribute towards their household basic needs which will help improve the standard of living of their households and hence contribute to the reduction of poverty.

2.10 Summary of review and gaps identified.

The chapter gave an exposure to the various techniques employed by other researchers in modelling credit access, crop output and welfare of women farmers. It can be observed from the literature that most studies on credit access has not been made to model the three thematic areas, that is, credit access, crop output and welfare in a systematic manner. Few studies link credit access and agricultural productivity (e.g., Awotide *et al.*, 2015) and credit access and production constraints (e.g., Denkyirah *et al.*, 2016). It is important to explore how these three areas interact when they are considered as a system. The study thus attempts to fill this gap in the body of literature by jointly modelling credit access, crop output and welfare, thereby, making a methodological contribution.

Apart from Nkegbe et al (2017) who modelled farm credit, credit constraint and productivity in Ghana using the Conditional Mixed Process (CMP) to control for endogeneity, none of the empirical literature reviewed used this methodology. The

current study therefore follows the work of Nkegbe et al (2017). The need to control for endogeneity is important since exogenous variables are bound to be endogenous.

Also, out of the numerous literature reviewed, none of the studies gave particular focus on women farmers in terms of access to credit to improve their welfare. Women farmers face peculiar problems in relation to credit availability to improve output and subsequently improve their welfare hence the need to study this issue in isolation.

Moreover, it is surprising that out of numerous empirical literatures reviewed, none examined the impact of credit access on crop output and welfare of women farmers in the Savelugu and Karaga districts. This work therefore fills this locational gap in the empirical literature by exploring the impact of credit access on crop output and welfare in the two districts.

Overall, this review, though does not argue to be highly extensive, has highlighted research gaps from which the objectives of the current study emerged. It has shown several methodologies particularly data analytical methods which has informed the choice of the analytical methods for this study. In particular, the present study use of the CMP for the estimation of the combined effect of credit access, crop output and welfare closes a major methodological gap. Furthermore, the review has provided this study with lots of empirical and theoretical studies that will make the discussion of study results a lot easier.

CHAPTER THREE

RESEARCH METHODOLOGY

3. Introduction

This chapter captures a description of the study area in terms of location and size, climate, soil and topography, population, map of the study area, sampling techniques, theoretical framework on access to credit, empirical model specification as well as data analysis.

3.1 Study Area

3.1.1 Location and Size

The Savelugu Municipality with Savelugu being its administrative capital was engraved out of the Western Dagomba District Council in 1988 under the Local Government Act 462, 1993 by Legislative Instrument (LI) 2071. The Savelugu Municipality is located at the northern part of the Northern Region of Ghana. It shares boundaries with West Mamprusi District to the North, Karaga District to the East, Tolon District to the West and Sagnerigu District Assembly to the South. The Municipality has about 149 communities with a lot of the communities concentrated at the southern part. The Municipality also has a total land area of about 1790.70 sq. km.

The Karaga District was carved out of the then Gushegu/Karaga District and officially inaugurated in August, 2004. The municipality is situated in the North-Eastern part of Northern region, roughly between latitudes 93° and 103° North and longitudes 0° and 45° west. The district shares boundaries with four districts in the northern region, west and east Mamprusi to the north, Savelugu to the west and Gushegu to the south and east. The

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district capital which is Karaga is 24km from Gushegu and 94km from Tamale, the Regional capital.

3.1.2 Population Size and Distribution

Report on the Feed the Future Ghana District Profile (2017) indicated that Savelugu Municipal has a total population of 155,293, which comprise of 75,293 males and 80,000females. The average household size of the municipal is 5.8 persons. It lies in the tropical continental climacteric zone. Average precipitation and temperature are similar to the other districts in the Northern Region. The municipal just as other districts of northern is dominated by the young population (age 0 to 17) accounting for about 52% of the population (FFGDP, 2017). The district also accounts for a low adult literacy rate with 85% of the adults having received no education, while only 6% went through primary school and only 8.8% through secondary school FFGDP, 2017).

Karaga district is one of the 22 administrative districts in Northern Region, and classified among the poorest (GSS, 2014). According to the 2010 population and housing census, the district has a total population of 77,706 with 37, 336 males and 40, 370 females. There exist 205 communities in the municipality. The largest household size in the Northern Region (PHC 2000) is in Karaga (11). Since household sizes are greater in rural than in urban areas, the normal household size for the municipality will be 8 persons. More than 70% of the settlement in the municipality has population of fewer than 800. Karaga the district capital is the only settlement with a population of over 10,000. The population of Karaga constitutes about 20.4% of the district population. Only eleven communities have populations of more than 1000 people. All these settlements are found

to the western section of the district along the Karaga-Sung-Pigu and Sung-Tamalgu roads. Below is a map illustrating population of ten largest settlements in the district.

3.1.3 Climate and Vegetation

The Savelugu Municipal and Karaga districts fall within the Guinea Savannah zone. Annual rainfall ranges from 600-1000mm with unimodal distribution. Monthly temperature averages 34˚C and ranges between 16˚C and 42˚C annually. The lower temperatures are experienced from December to late February, in which the North-East Trade winds (Harmattan) greatly influence the districts. The generally high temperatures as well as the low humidity brought about by the dry harmattan winds favor high rates of evapo-transpiration, leading to water deficiencies in the dry season (DMTDP, 2010). The topography of the area is generally undulating with numerous small streams draining it. The district has a number of smaller valleys with larger valleys found towards the periphery where smaller streams merge into larger ones. The climate reflects a typical tropical continental climate experienced in Northern Ghana. There is a rainy season that lasts from May-October peaking in August and September. The rest of the year is virtually dry. The vegetation is a typical guinea savannah type, characterised by tall grasses interspersed with drought resistant trees such as the Shea and dawadawa.

3.1.4 Geology and Soil

The Middle and Upper Voltaian sedimentary formation characterize the geology of the study areas. The middle Voltaian covers the northern part of the district and comprises of sandstone, shale and siltstone. The Upper Voltaian covers the southern part of the district and consists of shale and mudstone. Underground water potential is generally determined by this underlying rock formation, which has varying water potential for underground

water compared to the upper Voltaian formation. Consequently, borehole drilling is expected to have a higher success rate in the northern rather than the southern section (DMTDP, 2010).

Figure 3. 1: Map of the Northern region and its districts

Source: Ghana Statistical Service (GSS), 2020

3.2 Sample Size and Sampling Techniques

A multi-stage sampling technique was used for this study. Multi-stage sampling in this study combined both purposive and simple random sampling techniques. Purposive sampling technique was used to select the two study areas, that is, Savelugu Municipal and Karaga district due to the high level of female farmers in those areas. Five communities were selected through simple random sampling from each district. Out of

the five communities, a total of 30 respondents was selected from each community through a simple random sampling. This means the study covered about 150 respondents in each study area making a total sample size of 300.

The sample size was calculated using the following Cochran's (1977) sample size determination formula:

$$n = \frac{z^2 p(1-p)}{d^2}$$ (3.1)

Where n = the required sample size, z = the confidence level at 95% (standard value of 1.96), p = estimated population percentage under study (90%) and d^2 = margin of error at 3.4% (standard value of 0.034). Since according to the GSS (2010), an estimated average of 90% of households across the two selected districts (Savelugu and Karaga) in the Northern Region are farm households, the population percentage used in this computation is 90%. Therefore, assuming a margin of error of 3.4% and the total estimated population percentage of 90% or 0.90 on farming and credit access, the formula above computed a sample size of 299 farm households. But with reference to Cohen's (1992) arguments of statistical accuracy of high sample size, 300 questionnaires were administered. Statistically, the sample size is large enough to study and generalize about the population.

3.2.1 Sources and Type of Data

The data for this research is obtained from primary sources. The primary data was obtained from women farmers through the administration of semi-structured questionnaire which was designed and administered to solicit detailed information about

Socio-demographic factors such as age, household size, level of education, off-farm income; Farm factors also include farming experience and farm size and in relation to institutional factors, extension access, and member of farmer based organization. The questionnaires were therefore administered in a face to face interview by experienced interviewers with close supervision. In all, 300 questionnaires were administered and duly completed for the data analysis.

3.4 Theoretical Framework

The decision of people to access credit or not depends on the satisfaction one derives from making that decision which falls under the theory of utility maximization. An individual farmer's decision to participate or not in any credit scheme depends on the level of satisfaction the farmer derives from either participating or not.

The theoretical framework adopted for the study is based on the random utility model, as specified by Greene (2003) as detailed below;

Assuming (U_1) and (U_0) are the utilities one drives accessing credit or not respectively, the linear random model for the utility (U_1) derived from one's decision to have credit is expressed as a function of independent or explanatory variables X_i and it is given by:

$$U_1 = X_i \beta_1^* + \mu_1 \qquad (3.2)$$

On the other hand, the utility (U_0) one derives for not accessing credit is given as:

$$U_0 = X_i \beta_0^* + \mu_0 \qquad (3.3)$$

Where X_i is explanatory or independent variables (such as educational level, age, income, marital, religion etc), β_1 and β_0 are parameters for decision to join or not to access credit respectively, μ_1 and μ_0 are error terms for deciding to or not to access credit respectively. According to Gujarati (2006), the error terms in the above equations are assumed to be normally independently and identically distributed. For an individual to make the decision to access credit, the expected utility derived from accessing credit must be greater than the expected utility derived for not accessing credit thus $E(U_1) > E(U_0)$.

The probability of participating in credit is given by:

$$P(U = 1 | X) = P\left[\left(X_i \beta_1^* + \mu_1\right) > \left(X_i \beta_0^* + \mu_0\right)\right] \tag{3.4}$$

$$P(U = 1 | X) = P\left[\left(X_i \beta_1^* + \mu_1\right) - \left(X_i \beta_0^* + \mu_0\right) > 0 | X\right] \tag{3.5}$$

$$P(U = 1 | X) = P\left[X_i\left(\beta_1^* - \beta_0^*\right) + \left(\mu_1 - \mu_0\right) > 0 | X\right] \tag{3.6}$$

$$P(U = 1 | X) = P\left[\left(\beta^* X_i + \mu^*\right) > 0 | X\right] \tag{3.7}$$

$$P(U = 1 | X) = F\left(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots + \beta_n X_n\right) \tag{3.8}$$

Where *P* is a probability function, $\mu^* = \mu_1 - \mu_0$ is a random term, $\beta^* = \beta_1 - \beta_2$ is a vector of unknown parameters and F is the cumulative distribution function of μ^*. The distribution of "*F*" depends on the distribution of the error term, μ^*. Given that the

effect of *X* which is a vector of explanatory variables on the response probabilities (*Y*) can be estimated using a binary probit model as stated below;

$$Y_i = \left(\beta_0 + \beta_1 X_{1i} + ... + \beta_{ni} X_{ni} + \mu_i \right) \tag{3.9}$$

3.5 Model Specification

This section presents the approaches applied for empirical estimation in the study. These are the multivariate model, the endogenous switching regression model and the conditional mixed process.

3.5.1 The Multivariate Probit Model

A farmer's decision to participate in a particular credit source is discrete in nature and calls for a choice model. Univariate logit and probit models are not appropriate and in this case, since they may generate biased estimates because these methods assume the independence of error terms of the different credit sources. Whereas a farmer may participate in different credit sources and the decision to participate in one source could be influenced by the decisions to participate in other sources. Therefore, a multivariate probit model introduced by Ashford and Snowden (1970) is appropriate. This model allows for the interrelationships among various credit sources, that is, the potential correlation among the unobserved disturbances in the participation equation. Ignoring such issues leads to biased and inefficient estimates (Greene, 2003; Wooldridge, 2002).

The multivariate probit model (MVP) is a popular classic model for studying binary responses of multiple entities. In a single-equation statistical model, information on women farmers` participation in a source of credit does not alter the likelihood of her participating in another source of credit. However, the MVP approach simultaneously

models the influence of the set of explanatory variables on each of the different practices, while allowing for the potential correlation between unobserved disturbances, as well as the relationship between the adoptions of different practices (Belderbos et al., 2004). One source of correlation may be complementarities (positive correlation) and substitutabilities (negative correlation) between different practices (Ibid). Failure to capture unobserved factors and interrelationships among adoption decisions regarding different practices will lead to bias and inefficient estimates (Greene, 2008).

The observed outcome of a credit participation can be modeled following random utility formulation. Consider the ith farmer $(i = 1,....., N)$ facing a decision on whether or not to participate in available source of credit s (s = 1,……,N). Let U_0 represent the benefits to the farmer from not participating in any form of credit, and let U_k represent the benefit of participating in the kth source of credit: $(k = V, S, F)$ denoting choice of VSLA (V), Susu (S), and Family and friends (F). The farmer decides to participate in the kth source if $Y_{isk}^* = U_k^* - U_0 > 0$. The net benefit Y_{isk}^* that the farmer derives from the kth source is a latent variable determined by observed household demographic characteristics X_{is}, and unobserved characteristics u_{is}:

$$Y_{isk}^* = X_{is}'\beta_k + \mu_{is} \qquad (k = V, S, F) \qquad (3.10)$$

Using the indicator function, the unobserved preferences in equation (1) translate into observed binary outcome equation for each choice as follows:

$$Y_k = \begin{cases} 1 \, if \, Y_{isk}^* > 0 \\ 0, otherwise \end{cases} \qquad \left(K = V, S, F\right)$$

In the multivariate model, where participation in the various sources of credit is feasible, the error terms jointly follows a multivariate normal distribution (*MVN*) with zero conditional mean and variance normalized to unity (for identification of parameters) where

$\left(\mu_v, \mu_s, \mu_F\right) \sim MVN\left(0, \Omega\right)$ and the symmetric covariance matrix Ω is given by

$$\Omega = \begin{bmatrix} 1 & \rho_{VS} & \rho_{VF} \\ \rho_{SV} & 1 & \rho_{SF} \\ \rho_{FV} & \rho_{FS} & 1 \end{bmatrix}$$

Particular interest are the off-diagonal element in the covariance matrix, which represent the unobserved correlation between the stochastic components of the various sources of credit. On the basis of this assumption, equation (3.12) gives an MVP model that jointly represent the decision to access credit from a particular source. The off- diagonal element allows for correlation across the error terms of several latent equations representing unobserved characteristics that affects the choice of alternative sources of credit.

Empirically, the general model for access to credit for each of the various sources in a system of equations can be specified as:

$$Y_{ik} = \beta_0 + \sum_{i=1}^{m} \beta_{ik} S_{ik} + \sum_{i=1}^{m} \beta_{ik} F_{ik} + \sum_{i=1}^{m} \beta_{ik} I_{ik} + \varepsilon_i \qquad (3.11)$$

$\forall i = 1 \dots m$ regressors

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3.5.2 Econometric framework and estimation strategy

The empirical challenge in impact assessment using observational studies is establishing a suitable counterfactual against which the impact can be measured because of self-selection problems. To accurately measure the impact of credit on crop output of farm households, decision to access credit should be randomly assigned so that the effect of observable and unobservable characteristics between the treatment and comparison groups is the same, and the effect is attributable entirely to the treatment. However, when the treatment groups are not randomly assigned, credit access decisions are likely to be influenced both by unobservable (e.g., managerial skills and motivation) and observable heterogeneity that may be correlated to the outcome of interest.

Econometric approaches to deal with selection bias in cross sectional data include propensity score matching (PSM), generalized propensity score (GPS) matching in a continuous treatment framework, instrumental variable (IV) approaches and endogenous switching regression (ESR). PSM only controls for observed heterogeneity while IV can also control for unobserved heterogeneity. The traditional IV treatment effect models with one selection and outcome equation assumes that the impact can be represented as a simple parallel shift with respect to the outcome variable. The endogenous switching regression (ESR) framework relaxes this assumption by estimating two separate equations (one for those with access to credit and one for those without access to credit) along with the selection equation (e.g. Kassie et al., 2008; Di Falco et al., 2011; Kabunga et al., 2012). In this research work, a binary ESR treatment effects approach was adopted to reduce the selection bias by controlling for both observed and unobserved heterogeneity despite its distributional (trivariate normal distribution) and exclusion

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restriction assumptions. The GPS is an extension of the binary PSM methods for the case of continuous treatment impact assessment (for details see Hirano and Imbens, 2004). Unlike the ESR and PSM, the focus is on assessing the heterogeneity of treatment effects arising from different treatment levels. It uses the same assumptions as in the standard PSM methods, including selection into different credit access based on a set of observed covariates.

3.5.2.1 Impact Evaluation Framework: Endogenous Switching Regression Model (ESR)

The research examines the impact of women farmers' access to credit on crop output. Many past studies have attempted to measure the impact of credit on some outcomes by estimating a supply and production functions separately for those with access to and without access to credit and then compare the two estimates. However, this approach implicitly assumes that all farmers are identical with respect to those with and without access to credit which serves as its weakness. Also there is the problem of endogeneity which may arise as a result of the nature of access to credit. This is because, access to credit is either voluntary or some farmers are in better position to have access to credit than others. The decision to access credit or not is voluntary and may be based on individual self-selection and also farmers who access credit may have decided based on expected benefit. For example, well-to-do, educated or productive farmers may choose to access credit and if not controlled for may lead to endogeneity and one way of accounting for such endogeneity is by estimating a simultaneous equation model ((Hausman, 1983).

More importantly the ESR is adopted specifically to correct for any possible sample bias (Lee, 1978; Madalla, 1983; Freeman et al., 1998).

In the ESR model framework, we estimate a two-stage estimation procedure simultaneously. The first stage is the factors that influence credit access and the second, the impact of credit access on crop output which is the outcome variable is specified for two regimes of those with access to credit and those without access to credit as;

Regime 1(With access): $Y_{i1} = X_{i1}\beta_1 + \varepsilon_{i1} \ if \ C_i = 1$ (3.12)

Regime 2(Without access): $Y_{i2} = X_{i2}\beta_2 + \varepsilon_{i2} \ if \ C_i = 0$ (3.13)

Where Y_{i1} and Y_{i2} are outcome variables for those with and without access to credit respectively; X_{i1} and X_{i2} are unobserved characteristics; β_1 and β_2 are vector of parameters to be estimated and $\varepsilon_{i1}, \varepsilon_{i2}$ and μ_i are the error terms assumed to have a trivariate normal distribution, with zero mean and non-singular covariance

matrix expressed as

$$\sum = \begin{bmatrix} \sigma_1^2 & \sigma_{12} & \sigma_{1\mu} \\ \sigma_{12} & \sigma_2^2 & \sigma_{2\mu} \\ \sigma_{1\mu} & \sigma_{2\mu} & \sigma_\mu^2 \end{bmatrix}$$

Where σ_1^2 and σ_2^2 are variance of error terms, ε_{i1} and ε_{i2}. σ_μ^2 is the variance of the error term, μ_i and $\sigma_{12}, \sigma_{1\mu}$ and $\sigma_{2\mu}$; are the covariance of ,

ε_{i1} and ε_{i2}, ε_{i1} and μ_i *and* $_{\varepsilon i2}$ and μ_i respectively. The term σ_μ^2 is assumed to be 1 because γ is estimable only up to scale factor (Maddala, 1983).

Because the error terms in equation are conditioned on the sample selection criterion and have non-zero expected values, estimating β_1 and β_2 with Ordinary Least Squares will suffer from sample selection bias yielding inconsistent estimates (Lee, 1977; Maddala, 1983).

The structure of the ESR model allows for an overlap of the selection and outcome equation but for identification purpose, at least one variable in the selection equation should not be included in the outcome equation. A valid instrument is expected to influence credit access and not crop output.

In this study, distance to district capital is hypothesized to affect credit access and not crop output and as such is considered as a valid and relevant instrument.

To account for selectivity bias, the variables X_{i1} and X_{i2} account for only observed factors. However, the ESR model is able to address selection bias due to unobserved factors within the framework of omitted variable problem. Following Heckman (1970) the inverse mills ratio from the selection equation $(\lambda_{i1} \; and \; \lambda_{i2})$ for those with and without credit respectively and the covariance terms $\delta_{i\varepsilon}, \delta_{2\varepsilon}$ are plugged into the above equations and specified as;

$$Y_{i1} = X_{i1}\beta_1 + \delta_{1\varepsilon}\lambda_1 + \vartheta_{i1} \; \; if \; \; C_i = 1 \qquad (3.14)$$

$$Y_{i2} = X_{i2}\beta_2 + \delta_{2\varepsilon}\lambda_2 + \vartheta_{i2} \; \; if \; \; C_i = 0 \qquad (3.15)$$

Where selectivity term $\lambda_{i1} \ and \ \lambda_{i2}$ correct for selection bias from unobserved factors and $\vartheta_{i1} \ and \ \vartheta_{i2}$ are the error terms with conditional zero means.

It is argued that the two-stage approach is disadvantaged in the sense that it generate residuals that are heteroskedastic and cannot be used to obtain standard errors that are consistent without adjustment (Lokshin and Sajaia, 2004). They, therefore, proposed a FMLA which can efficiently estimate the outcome and selection equation simultaneously where the FIML method was estimated using the movestay command available in the STATA statistical software. The FIML method has been adopted by Alene and Manyong (2007) and Asfaw (2010) among many others. The FIML method simultaneously estimates the probit equation and the regression equation to yield consistent standard errors. The log likelihood function for the ESR is specified as;

$$
\ln L\left(\beta_1, \beta_2, \sigma_1^2, \sigma_2^2, \sigma_{1\mu}, \sigma_{2\mu}\right) = \sum_{i=1}^n \left[\ln \left\{ F\left(\frac{\gamma^{z_i + \rho_1 \varepsilon_{1i}}/\sigma_1}{\sqrt{1 - \rho_1^2}} \right) \right\} + \ln \left\{ f\left(\frac{\varepsilon_{1i}/\sigma_1}{\sigma_1} \right) \right\} \right]
$$

$$
+ \left(1 - I_i\right) \left[\ln \left\{ 1 - F\left(\frac{\gamma^{z_i + \rho_2 \varepsilon_{2i}}/\sigma_2}{\sqrt{1 - \rho_2^2}} \right) \right\} + \ln \left\{ f\left(\frac{\varepsilon_{1i}/\sigma_1}{\sigma_1} \right) \right\} \right]
$$

(3.16)

Where F is a cumulative normal distribution function, f is a normal density distribution function, $\rho_1 = \sigma_{1\mu}/\sigma_\mu \sigma_1$ is the correlation coefficient between ε_{i1} and μ_i, and $\rho_2 = \sigma_{2\mu}/\sigma_\mu \sigma_2$ is the correlation coefficient between ε_{i2} and μ_i, . Only the values of Y, Y_{i1} and Y_{i2} is actually observed for any given household depending on the regime the

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household is, credit access or not. Therefore σ_{12} does not occur in the likelihood function and it is not estimable.

To examine the impact of credit access on crop output, we compare the expected output of those who had access credit with the expected outcome of the counterfactual (those without credit had access to credit). This is express below as;

$$E\left(Y_{i1} / C = 1\right) = X_{i1}\beta_1 - \delta_{1\varepsilon}\lambda_1 \tag{3.17}$$

$$E\left(Y_{i2} / C = 1\right) = X_{i2}\beta_2 - \delta_{2\varepsilon}\lambda_1 \tag{3.18}$$

The difference between

$$ATT = E\left(Y_{i1} / C = 1\right) - E\left(Y_{i2} / C = 1\right) \tag{3.19}$$

We can also compare the expected output of those who did not have access to credit with its counterfactual (those with credit if they did not have access). This is expressed below as

$$E\left(Y_{i2} / C = 0\right) \tag{3.20}$$

$$E\left(Y_{i1} / C = 0\right) \tag{3.21}$$

The difference gives us the ATU

$$ATT = E\left(Y_{i2} / C = 0\right) - E\left(Y_{i1} / C = 0\right) \tag{3.22}$$

The empirical equation of the ESRM to be estimated is demand of credit function, which is a Probit regression and a crop-output function. Access to credit decision equation is specified as:

Credit access (Access=1, 0=Otherwise) = f (Age, Hhgender, Educ, Hhsize, Extaccess, Famlabour, Memberfbo, Distance)

Creditaccess=β_o+ β_1Age + β_2Hhgender+ β_3Educ+ β_4Extaccess+ β_5Farmlabour+ β_6MemberFBO+ β_7Distance+μ (3.23)

The dependent variable is binary thus taking the value of 1 if the farmer has access to credit and 0 otherwise. The separate value of output function for the farmers that have access to credit and those that did not have access to credit was also specified. This was followed by an output model expressed as:

Ln (Output) = f (Age, Hhgender, Educ, Hhsize, Extaccess, Famlabour, Memberfbo)

Ln (Output) =β_o+ β_1Age + β_2Hhgender+ β_3Educ+ β_4Extaccess+ β_5Farmlabour+ β_6MemberFBO+ β_7Distance+μ

(3.24)

Where ln is a natural logarithm, value of output is the total output multiplied by price per bag of each crop as at the time of the research. It is important to note that all crops were measured in bags.

3.5.3 Conditional Mixed Process

In terms of the effect of credit participation and agricultural output on the welfare of women farmers, the study applied the conditional recursive process framework. This process consist of three structural models in the study: access to credit model, crop output model and welfare model. Access to credit is a discrete model and hence a farmer either has access to credit or not. The crop output and welfare model are continuous models measured as a value of output per crop and welfare as expenditure per capita. It is

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possible to analytically model these structural models as a stand-alone using single equation estimation techniques comprising of credit access model estimated by using a probit or logit while crop output and welfare can be estimated using ordinary least square. However, this study proposed a system approach known as the conditional mixed process (CMP) as proposed by Roodman (2011). The CMP framework is built primarily on a Seemingly Unrelated Regression (SUR) and thus allows mixing and building different models in multi equations (Roodman, 2011). The CMP framework employs the Maximum Likelihood Estimation (MLE) technique and assumes joint modelling of two or more equations while permitting correlation between error terms across the equations. The major advantage of this system of estimation is that it produces precise parameter estimates.

$$y_1^* = \theta_1 + \varepsilon_1 \tag{3.25}$$

$$y_2^* = \theta_2 + \varepsilon_2 \tag{3.26}$$

$$y_3^* = \theta_3 + \varepsilon_3 \tag{3.27}$$

$$\theta_1 = \beta_1 X, \qquad \theta_2 = \beta_2 X, \qquad \theta_3 = \beta_3 X_3$$

$$y = g(y^*) = \left(1\{y_1^* > 0\}, 1\{y_2^* > 0\}, y_3^*\right)$$

$$\in = (\varepsilon_1,\ \varepsilon_2,\ \varepsilon_3) \sim N(0, \Sigma)$$

$$\Sigma \begin{bmatrix} 1 & \rho & \sigma_{13} \\ \rho & 1 & \sigma_{23} \\ \sigma_{31} & \sigma_{32} & \sigma_{33} \end{bmatrix}$$

Where credit access= y_1, Crop output= y_2 and Welfare= y_3

Let's assume $y_i = (0,0, y_{i3})$ is observed, then the likelihood function can be specified as:

$$L_i\left(\beta_1, \beta_2, \beta_3, \Sigma; y_i \big| x_i = \int_{-\infty}^{-\theta_1} \int_{-\infty}^{-\theta_2} \phi_j \left\{ (\varepsilon_1, \varepsilon_2, y_{i3} - \theta_{i3})'; \Sigma \right\} d\varepsilon_1 d\varepsilon_2 \right) \tag{3.28}$$

According to Roodman (2011), this function is impossible to directly estimate using standard functions in statistical software. To directly estimate, we have to factor $\phi_j \{ (\varepsilon_1, \varepsilon_2, y_{i3} - \theta_{13}); \Sigma \}$ into probability distribution functions, $\varepsilon_1, \varepsilon_2 \big| \varepsilon_3$ and ε_3. The formula for then conditional distribution of a normal distribution leads to the factoring:

$$\phi_j \{ (\varepsilon_1, \varepsilon_2, \varepsilon_3); \Sigma \} = \left[\phi_1 \left(\varepsilon_1 - \frac{\sigma_{13}}{\sigma_{33}} \varepsilon_3; 1 - \frac{\sigma_{13}\sigma_{31}}{\sigma_{33}} \right) \phi_2 \left(\varepsilon_2 - \frac{\sigma_{23}}{\sigma_{33}} \varepsilon_3; 1 - \frac{\sigma_{23}\sigma_{32}}{\sigma_{33}} \right) \right] (y_{i3} - \theta_{i3}; \sigma_{33})$$

$$\tag{3.29}$$

Substituting this into equation (3.26) yields:

$$L_i(\beta_1, \beta_2, \beta_3, \Sigma; y_i | x_i) = \int_{-\infty}^{-\theta_1} \int_{-\infty}^{-\theta_2} \left[\begin{array}{c} \phi_1 \left\{ \varepsilon_1 - \frac{\sigma_{13}}{\sigma_{33}} (y_{i3} - \theta_{i3}); 1 - \frac{\sigma_{13}\sigma_{31}}{\sigma_{33}} \right\} \\ \phi_2 \left\{ \varepsilon_2 - \frac{\sigma_{23}}{\sigma_{33}} (y_{i3} - \theta_{i3}); 1 - \frac{\sigma_{23}\sigma_{32}}{\sigma_{33}} \right\} d\varepsilon_1 d\varepsilon_2 \end{array} \right] (y_{i3} - \theta_{i3}; \sigma_{33})$$

$$= \phi(y_{i3} - \theta_{i3}; \sigma_{33}) \int_{-\infty}^{-\theta_1} \int_{-\infty}^{-\theta_2} \phi_1 \left[\begin{array}{c} \phi_1 \left\{ \varepsilon_1 - \frac{\sigma_{13}}{\sigma_{33}} (y_{i3} - \theta_{i3}); 1 - \frac{\sigma_{13}\sigma_{31}}{\sigma_{33}} \right\} \\ \varphi_2 \left\{ \varepsilon_2 - \frac{\sigma_{23}}{\sigma_{33}} (y_{i3} - \theta_{i3}); 1 - \frac{\sigma_{23}\sigma_{32}}{\sigma_{33}} \right\} d\varepsilon_1 d\varepsilon_2 \end{array} \right]$$

$$= \phi \left(y_{i3} - \theta_{i3} ; \sigma_{33} \right) \left[\begin{array}{c} \phi_1 \left\{ - \theta_1 - \dfrac{\sigma_{13}}{\sigma_{33}} \left(y_{i3} - \theta_{i3} \right); 1 - \dfrac{\sigma_{13}\sigma_{31}}{\sigma_{33}} \right\} \\[2ex] \varphi_2 \left\{ - \theta_2 - \dfrac{\sigma_{23}}{\sigma_{33}} \left(y_{i3} - \theta_{i3} \right); 1 - \dfrac{\sigma_{23}\sigma_{32}}{\sigma_{33}} \right\} \end{array} \right]$$

In estimating the effect of credit and agricultural productivity on welfare, there is the tendency of the problem of endogeneity since the exogenous variables are bound to be endogenous. A recursive system will be taken into consideration likely influence of the unobserved factors which can jointly impact credit access, crop output and welfare leading to three (3) equations.

The first equation describes credit access as a binary choice that is 1 if a farmer have access and 0 otherwise with its associated independent variables.

The second equation describes crop output which depends on credit and other independent variable while the third equation describes welfare which is also dependent on credit, output and other independent variables. The empirical model is specified as

$$C = \alpha_0 + \alpha_2 x_i + \mu_i \tag{3.30}$$

Where C is the propensity to access credit.

$$Credit\ Access = \alpha_0 + \alpha_1 Age + \alpha_2 HHH + \alpha_3 Yrsedu + \alpha_4 Dep + \alpha_5 Mrst +$$

$$\alpha_6 HHS + \alpha_7 LandS + \alpha_8 Ext + \alpha_9 FBO + \mu_1$$

(3.31)

However, C is unobserved and what we observe instead is the following:

$$C = \begin{cases} 1\ if\ C > 0 \\ 0\ if\ C \leq 0 \end{cases}$$

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C= credit access, x_i is a vector of independent variables that can affect credit access and u_i represents the unobserved variation.

In the second equation we try to find out the effect of credit access on crop output.

$$Y = \alpha_0 + \alpha_1 C + \alpha_2 x_1 + \mu_i \tag{3.32}$$

$$Output = \alpha_0 + \alpha_1 CA + \alpha_2 ExpInput + \alpha_3 Yrsfarm + \alpha_4 LandS + \alpha_5 FamLab + \mu_2 \tag{3.33}$$

From the above, Y= crop output, C = credit access, x_i is a vector of independent variables that can affect crop output and μ_i is the error term.

The third equation jointly estimate the effect of credit and output on welfare

$$W = \alpha_0 + \alpha_1 C + \alpha_2 Y + \alpha_3 x_i + \mu_i \tag{3.34}$$

Where W= welfare, C= credit access, Y= crop output and μ_i is the error term.

$$Percapitaexp = \alpha_0 + \alpha_1 Credit + \alpha_2 Output + a_3 OffFarmI + \alpha_4 HH + \mu_3 \tag{3.35}$$

Based on literature, factors influencing credit access and its effect on output and welfare are explained in Table 3.1 in terms of the means of measurement as well as the *a prior* expectations. This factors are used in establishing the hypothesis of the study.

H₀: Access to credit do not influence women farmers welfare Savelugu municipal and Karaga district

H₁: Access to credit enhances women farmers' welfare in the Savelugu municipal and Karaga district.

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The following demographic and socio-economic factors were hypothesized to explain farmers' access to credit.

Age of the farmer is measured as a continuous variable. It is expected to have a negative/positive relationship with credit access. It is assumed that financial institutions will be reluctant to lend money out to older people who they fear may not live long to repay the money back (Kuwornu et al., 2012). Also, young farmers are likely to adopt new technologies and these technologies are accompanied with cost aside the benefit and hence influences younger farmers access to credit (Mwangi and Ouma, 2012). However, Tang et al. (2010) proved that because older farmers have social network or capital more the young farmers and hence they turn to borrow more.

Education variable is measured as the number of years of formal education attained by the farmer. It is expected to influence credit access positively. This is because educated farmers are able to accumulate knowledge and have better access to information and this makes them more likely to access credit (Musemwa et al., 2010).

Marital status is a dummy which takes the value 1 if a farmer is married and 0 otherwise. According to Saleem et al. (2010), farmers who are married are likely to use their income to cater for the large household and therefore may have higher expenditure which threaten their ability to repay the credit. The study, therefore, hypothesized that marital status negatively affects credit access.

Farming experience is hypothesized to have a positive influence on credit access and it is measured in number of years of farming. This implies that as a farmer becomes more experienced in farming, she/he learns to efficiently utilize resources to be more

productive, and will likely access credit since they have high potential for repayment (Kuwornu et al., 2012).

Another variable that is expected to influence credit access positively is the acreage of farmland under cultivation. It is expected that lager farm size owners can use their lands as collateral; hence, are more likely to access credit. Therefore, the expected sign for the coefficient of this variable is positive (Sebopetji and Belete, 2009).

With regards to total income, the study hypothesized that farmers with higher incomes are more likely to obtain credit. They are considered as more credit worthy compared with low-income class of farmers (Ng'eno et al., 2011). It is also likely that those with higher income may not access credit since they can invest their income on their farms without necessarily going for credit.

Extension service is measured as a dummy where a farmer is assigned a value of 1 is if she had accessed extension service and 0 otherwise. A farmer having access to extension service is hypothesized to have a positive influence on credit access. This is because through extension officers, farmers gain better access to information.

Member of Farmer Based Organization (FBO) is also measured as a dummy variable where 1 = member of FBO and 0 = otherwise. FBOs disseminate information to their members just as the extension agents and provide joint guarantee for association members (Armendariz de Aghion and Morduch, 2005; Akudugu et al., 2009).

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Table 3. 1: Measurement and A prior Expectation of Factors influencing credit access and its effect on output and Welfare

Variable	Measurement	Credit access	Crop output	Welfare
Age	Years	+/-	NA	+
Marital status	1if married, 0 otherwise	-	NA	+
Educational level	Number of years of education	+	NA	NA
Farm experience	Number of years spent in farming	+	+	NA
FBO membership	1 yes, 0 if no	+	NA	NA
Farm size	Measured in acres	+	+	NA
Extension access	1 if farmer had access, 0 otherwise	+	+	NA
Household size	Number of people eating from the same pot	+/-	+	+/-
Distance to district capital	Kilometers	-	NA	NA
Income	Ghana cedis	-	+	+
Credit access	1if a farmer had access to credit, 0 otherwise	NA	+	NA
Crop output	Bags	+	NA	+

Source: Author's Conceptualization

3.7 Data Analysis

The study employed various methods in analyzing the specific objectives. This involved descriptive statistics in form of frequencies, percentages, tables as well as rigorous econometric methods. The socio-demographic characteristics were presented in the form of tables, frequencies and percentages.

Both descriptive and inferential analysis were used. The proportions of farmers in the district and the sources of credit to farmers in the district was analyzed using, frequencies and percentages. Econometric models were also used in analyzing the data. The determinants of access to credit from the identified informal sources of credit in the district were analyzed using multivariate probit model. The effect of access to credit on agricultural productivity of credit beneficiary farm households in the districts was analyzed using the endogenous switching regression model and the effect of credit on agricultural productivity and welfare was analyzes using the conditional mixed process (CMP).

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

This chapter presents and discusses the results of the study. The chapter is divided into three major sections. Section 4.1 gives an overview summary statistics of demographic and socio-economic characteristics of farmers in the sampled districts of the Northern Region. Section 4.2 presents the results of the econometric analysis of the determinants of access to credit. Section 4.3 shows results of the impact of credit on crop output while Section 4.4 shows the results of the effect of credit access on crop output towards enhancing welfare.

4.1 Socio-Demographic Characteristics of Women Farmers in the Savelugu-Nanton Municipality

Table 4.1 presents the descriptive statistics of the demographic and socioeconomic characteristics of the farmers. From the Table, the average age of a farmer is 41 years with a minimum of 19 years and a maximum of 82 years. The majority are within the age bracket 19-40 years and 81 years and above constituted 0.33 percent. Generally, 56.33 percent are within the economically active age group which represent a potential for agriculture Savelugu and Karaga districts in the northern region. The average household size is observed to be 14.29 with a minimum of 2 and a maximum of 41 while the average land size of the sampled farmers is 2.04 hectares. This, however, ranges between 0.2 hectares and 6 hectares with 79.33 percent cultivating 2 hectares and below.

Table 4.1: Demographic and Socio-economic Characteristics of Surveyed women Farmers

Variables	Freq.	Percentage (%)	Mean	SD	Min	Max
Age	300	100	41.47	12.37	19	82
19-40	169	56.33				
41-60	101	33.67				
61-80	30	10.00				
81 above	1	0.33				
Household size			14.29	6.64	2	41
1-5	197	65.67				
16-25	83	27.67				
26-35	16	533				
36 above	4	1.33				
Marital status						
Single	6	2.00				
Married	256	85.33				
Divorced	11	3.67				
Widow	27	9.00				
Land ownership						
Inherited	41	13.67				
Rented	9	3.00				
Purchased	11	3.67				
Gifted	71	23.67				
Husband's land	168	56.00				
Land size						
0-2	238	79.33				
2.1-4	58	19.33				
4.1-6	4	1.33				
Income	1277.97	727.36	120	3960		
Educational level			0.80	2.21	0	12
Distance			4.65	2.87	0.1	11.3
Number of dependents			6.91	3.76	0	24
Access to extension			0.82	1.02	0	4
Farming experience			9.72	8.20	1	65

Source: Field Data, 2019.

Out of the 300 women farmers interviewed, majority (85.33 percent) were married while 2 percent were single, 3.67 percent were divorced, while 9 percent were widows. This indicates that majority of women farmers engaged in agricultural activities are married. This may be due to the physical, psychological and emotional support they get from their spouses (Bammeke, 2003). Furthermore, it is evident from Table 4.1 above that majority of the women farmers (86.67 percent) have never been to school. However, 10 percent had primary education, 2 percent had Junior High School (JHS) education, while 0.67 percent attained Senior High School (SHS) education. This reflects the situation in Ghana where about 62.5 percent of the population in the Northern region are not literate in any language (GSS, 2013).

This phenomenon has a greater negative impact on the productivity of women farmers, especially in the uptake, adoption and utilization of new and improved technology. Each farmer belongs to one of the dominant religions in Ghana. However, majority (96.67 percent) were Muslims and the remaining 3.33 percent were Christians. In terms of access to land for farm activities, majority (56 percent) received their lands from their husbands, 23.7 percent were gifts, 13.7 percent was by inheritance, 3.6 percent was by outright purchases while 3 percent acquired through renting. This indicates that women do not own lands and confirms the role of a long held tradition on land tenure and ownership in Northern Ghana. From the Table, 65.33 percent and 46 percent respectively had access to credit and extension services while a few (18.33 percent) belonged to farmer-based organizations.

4.2 Credit status of Respondents

The credit status of the women farmers in the study area as shown in Table 4.5 below indicates that majority (65.33 percent) do not have access to credit in the study area. This confirms that access to credit is still a challenge in Savelugu and Karaga in Northern Ghana largely attributed to the risky nature of agriculture.

Table 4. 2: Credit status of respondents

Credit status	With credit	Without credit	Total
Frequency	104	196	300
Percentage	34.67	65.33	100

Source: Field Data, 2019.

4.3 Pairwise correlation of farmers sources of credit

The pairwise correlation depicts whether pairs of credit sources are substitutes, complementary, or do not affect each other in their choices. From Table 4.6, results indicates that the estimated correlation coefficients are statistically significant in two of the sources of credit. Out of these two sources, one has a positive sign while the other has a negative sign. Since the correlation between Village Savings and Loans Association (VSLA) and susu is positive, it means that the two sources are complementary with a correlation coefficient of 0.8069 or 80.69 percent. The association of family and friends and VSLA is statistically significant but negative, implying that the two sources are substitutes with a correlation coefficient of -0.2971 or 29.71 percent.

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Table 4. 3: Pairwise correlation of farmers sources of credit

Source of credit	Correlation coefficient	Standard Error
'VSLA' and 'Susu'	0.8069***	0.1368
'F&F' and 'VSLA'	-0.2971***	0.0905
'F&F' and 'Susu'	-0.1160	0.1264

Note: ***, ** and * represent1%, 5% and 10% level of significance respectively.

Source: Field Data, 2019.

4.4 Determinants of women farmers access to credit

Results from the Multivariate probit model on the determinants of women farmers access to credit in the Savelugu and Karaga districts as presented in Table 4.7 indicates that age, dependence, household size, land size, expenditure on input and distance to district capital influenced access to credit. The results are confirmed by the significance of the Wald test and confirms the hypothesis that all the regression coefficients in each equation are jointly equal to zero is rejected. This means that exogenous variables within each model significantly explain the endogenous variable. Moreover, a statistical significant likelihood ratio test of 28.2529 of the null hypothesis that the covariance of the error terms across equations are not correlated is also rejected. The correlation among the error terms justify the use of the multivariate probit model which allows the interrelationship among the various sources and hence leading to unbiased and efficient estimates.

Findings from the study revealed that as women farmers increase in age, the likelihood of participating in VSLA increases but negatively influences access to credit from family and friends (F & F). This was statistically significant at 1%. Thus, older farmers are more likely to access credit from VSLA but less likely to access credit from F&F. This is attributed to the already low income level of family and friends making it difficult to rely

on them for farm credit. However, women farmers borrow more from VSLA because the group give them the sense of belongingness and the chance to interact with others which makes confortable. This however contradicts findings of the World Bank Global Financial Development Report (2014) which reported that adults in developing countries are three times more likely to borrow from family and friends than formal financial institutions.

Number of dependents was found to have a negative effect on VSLA and Susu but a positive effect on F&F. This was significant at 5%, 1%, and 5%, respectively. That is, the higher the number of dependents, the more income the farmer spends in taking care of these people hence less income will be available to participate in VSLA and Susu contributions. Because VSLA and Susu require regular contribution, the high expenditure may not permit them to contribute regularly and hence the negative sign. The positive sign for F&F is attributed to flexibility nature of this sources of credit. A farmer with more dependents is likely to source credit from family and friends since their expenditure is likely to increase coupled with the less income due to daily expenditures. This is in line with a study conducted by Pew (2016) who asserted that lower income households commonly borrow money from family and friends to take care of their daily expenses such as medication. The estimated coefficient of household size for both VSLA and Susu had a positive sign and significant at 10% and 5%, respectively. This indicates that an increase in household size enhances a farmer's likelihood of accessing credit from VSLA and Susu. This is attributed to the availability and low interest rate charged on VSLA and Susu credits relative to F&F which will be woefully inadequate or not available at all.

Also, land size showed a negative effect on access to credit from Susu at 1% significant level indicating a 1 acre increase in the size of woman's farm will lead to a decrease in the likelihood of accessing credit from Susu. This is may be attributed to the low amount made available by Susu merchants which makes farmers to switch to other sources of credit where they are likely to get more credit.

Expenditure on inputs (amount invested in the farm) showed a positive effect on farmer's access to credit from Susu, and also statistically significant at 10%. This means that an increase in the amount of money spent on farm inputs which is assumed to increase output, increases a farmer's access to credit from Susu. This is attributed to expected yields from the large application of farm inputs and Susu merchants hope of quick repayment of credit borrowed by women farmers.

Furthermore, distance to district capital negatively influenced women farmers access to credit and highly significant at 1%. This means that a 1 kilometer increase in the distance of a farmer to the district capital to access credit lead to a reduced likelihood of farmer accessing credit from that source. Farmers therefore prefer to access informal credit sources such as Susu, VSLA and Family and Friends which are closer to them than to go to the district capital to access formal credit sources from the bank. The proximity of the farmer to the source of credit is one of the most important factors that determines a household access to credit. Women farmers are often reluctant to access credit from far located vendors. Also, the cost of transportation could be a major deterrent to poor households (Hussien, 2007) .Table 4.4 below presents results of the multivariate probit estimates of the determinants of women farmers' choice of credit in the study area.

Table 4. 4: Determinants of farmers' choice of sources of credit from a Multivariate Probit Model

Variable	VSLA	Susu	Family and Friends
Age	0.0184***	0.0127	-0.0259***
	(0.0071)	(0.0130)	(0.0077)
Head of household	-0.4365	0.9791	0.9456
	(0.7111)	(0.9862)	(0.6680)
No of Dependents	-0.0746 **	-0.1201*	0.0742**
	(0.0370)	(0.0725)	(0.0367)
Marital Status	0.2960	-0.3291	-0.3211
	(0.3779)	(0.5133)	(0.3593)
Household Size	0.0365*	0.0761**	-0.0215***
	(0.0210)	(0.0352)	(0.0210)
Land Size	-0.1504	-0.9368***	0.0480
	(0.1006)	(0.3075)	(0.1031)
Expenditure on inputs	0.0005	0.0032*	-0.0002
	(0.0006)	(0.0014)	(0.0006)
Distance	-0.0951***	-0.2735***	-0.0849***
	(0.0298)	(0.0985)	(0.0296)
Number of obs	300	300	300
Wald chi2(24)	64.7		
Prob > chi2	0.000		
Log likelihood	-376.7536		

***, ** & * are significance at 1%, 5% & 10%, respectively
Source: Field Data, 2019.

4.5 Effect of credit access on crop output

This section presents the empirical evaluation of the impact assessment. The basic impact model adopted is the ESRM capable of controlling for all possible biases in the results.

The results of the estimation are presented in Table 4.4 below. The result of the estimates are presented in three parts. The first part consist of the Probit model estimates of the determinants of access to credit, the second part being the output of those farmers with access to credit and thirdly, the output of farmers without access to credit.

The result of the Probit model revealed that extension access, member of FBO, are positive and statistically significant in determining farmers' access to credit. However, the coefficient of household size and distance to district capital was statistically significant but negative.

The coefficient of the second stage estimates of the switching regression model for the crop output are shown in the third and fifth column of Table 4.4 of the crop output regression among farmers who have access to credit and those without access to credit, respectively. With respect to output, age has positive coefficient and was statistically significant for those with and without access to credit. This implies that farmer experience in terms of age has the potential of positively influencing farm output. This could be due to the fact that as the farmer grows older in farming, the experience gained increases and she is able to efficiently maximize output given a certain amount of inputs.

Similarly, household size was statistically significant and positive for the output of farmers with and without credit. This implies that the larger the household size, the more the farmer is endowed with family labour to increase farm size leading to increase in crop output. As more people from the household are used as farm labour, the farmer will not incur an explicit cost of hiring labour from outside thus reducing the cost of production and increasing output.

Also, extension access is significant and has a positive effect on output of farmers without access to credit. Farmers who have access to extension services are capable of improving their level of technology and having exposure to new methods of farming. This has the potential of raising the farmer`s level of productivity. This is consistent with the findings of Hussien (2007).

The correlation coefficients rho_1 and rho_2 were negative and positive respectively, but are statistically significant only for the correlation between access choice equation and crop output of farmers with access to credit. Since rho_1 was negative and statistically significantly different from zero, the model suggests that farmers who choose to acquire credit have lower output than a farmer chosen by chance from the sample otherwise would have gotten. Individual farmers without access to credit are not better or worse than a chanced farmer. This means that, women farmers with above average output are more likely to access credit and also indicates positive selection bias due to unobserved factors and therefore justified the use of the ESR. The likelihood ratio test for joint independence of the three equations was statistically significant implying that these three models are not jointly independent and should not be estimated separately. This means that selection bias due to unobserved factors occurred in the credit access equation hence the use of the model like the ESR which account for both observable and unobservable factors is appropriate for the study.

Table 4. 5: FIML Estimates of the Endogenous Switching Regression Model

Variable	Selection		With credit		Without credit	
	Coefficient	Std. error	Coefficient	Std. error	Coefficient	Std. error
Constant	1.3181***	0.3813	5.9306***	0.2823	5.2278***	0.5435
Age	-0.0116	0.0074	0.0147**	0.0059	0.0208***	0.0063
Household gender	0.2601	0.2788	-0.2126	0.2090	-0.0895	0.2237
Education	-0.0315	0.0362	0.0177	0.0289	0.0223	0.0342
Household size	-0.0333**	0.0138	0.0248**	0.0112	0.0243**	0.0139
Extension access	0.3168*	0.1666	-0.1325	0.1315	0.3947*	0.1799
Family labour	0.0218	0.0297	-0.0372	0.0240	0.0035	0.0264
Member of FBO	0.8981***	0.1954	-0.2030	0.1457	0.1405	0.2850
Distance	-0.0933***	0.0284				
/lns1	-0.0764	0.0926				
/lns2	-0.4320	0.0755				
/r1	-1.0553	0.3550				
/r2	0.0920	0.5198				
sigma_1	0.9264	0.0858				
sigma_2	0.6492	0.0490				
rho_1	-0.7839	0.1369				
rho_2	0.0917	0.5154				

LR test of indep. Eqns. : LR chi2(8)   =   23.23 Prob > chi2   =   0.0031

Note: ***, ** and * are statistically significant at 1%, 5% & 10% respectively

Source: Field Data, 2019.

Table 4. 6: One-sample t-test

Variable	Obs	Mean	Std. Err.	Std. Dev
ATT	300	-0.4854	0.0361	0.6245

Source: Author's computation, 2019

	With Credit	Without Credit	ATT	t-value
Value of output	6.734	7.220	-0.485***	13.462

Table 4.6 revealed mean Average Treatment effect on the Treated (ATT) to -0.4854 and the t-test of the ATT was statistically significantly different from zero. This implies that those farmers that have access to credit have lower crop output than those that did not have access to credit.

4.6 Effect of Credit and Crop output on Welfare

The CMP framework consist of three equations. The first equation consist of the effects of farm characteristics on credit access; the second consist of the effects of credit on crop output and the third equation consist of the joint effect of credit access and crop output on welfare.

4.6.1 Effect of farm characteristics and other factors on credit access

Age of a farmer in the results was found to be negatively significant at 10% on access to credit. For every additional unit increase in the age of a farmer, all other things being equal decreases the probability of the farmer accessing credit by 0.04. This findings is in line with that of Mpuga, 2008 who maintained that access to credit decreases with increase in age. However, this finding is contrary to Tang et al. (2010) who proved that old farmers are more likely to borrow than younger farmers.

Household size was significant but negative at 1% on access to access to credit. The implication is that, farm households with fewer members per house, have higher probability of accessing credit. For every additional member added to a farm household decreases the probability of a farmer accessing credit by 0.017. This study confirms the findings of Tang et al, (2010) who maintained that there is a negative correlation between household size and access to credit. That is larger household size tends to spend huge portion of credit on the livelihood of the family, particularly children and the elderly. The results also conforms to a study conducted by Danso-Abbeam et al. (2014). The study found out that increasing household size lowers the probability of accessing credit. This however contradicts the findings of Weber & Mushof (2012) who found household size to be an increasing function of the probability of accessing credit.

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Extension access was positive and significant at 1% on access to credit. This implies that farmers who have access to extension service have 0.119 probability of accessing credit than their counterparts who do not have access to extension service. This is in line with (Sanusi and Adedeji, 2010; Muhongayirea et al., 2013; Anang et al., 2015) who found out that access to extension increases farmers access to credit since extension agents help link farmer groups to credit sources.

Farmers who join FBO have higher probability of accessing credit since most of them join for financial service. From the findings, member of FBO was positively significant at 1% on access to credit. That is farmers who belong to FBO have 0.245 probability of accessing credit than their counterparts who do not belong to any FBO. This is consistent with the findings of Akudugu (2012) who found out that membership of social group was positive and statistically significant at 1% and that farmers who join these social groups have higher probability of demanding credit from rural banks.

4.6.2 Effect of credit on crop output

The second stage of the equation in the CMP model estimates the effect of credit on crop output. Out of five variables in the equation, all were found to be statistically significant influence on crop output. The variables include credit access, expenditure on inputs, years of farming, land size and member of FBO.

From the estimates, credit access was surprisingly revealed to be statistically significant and negative at 1%. This implies that farmers who have access to credit decrease their output by GH¢1.136 holding other factors constant. This could be because most of the farmers spent little of the credit on their farms and the rest on household needs leading to

diversion of credit. This results is in line with Kocher, (1977) findings that credit has no effect on farm output and also Selasi et al. (2017) findings of low contribution of credit to maize output.

The results from the Table above revealed that the influence of expenditure on inputs on output was positive and statistically significant at 1%. In other words, for every increase in expenditure on inputs in the farm, increases crop output by Ghc 0.09. This could be due to the fact that the more a farmer invest in purchasing inputs such as farm equipment and fertilizer needed to enhance productivity, the more they are likely to get from their farms. Years of farming (experience) in the study reveals a positive value and was statistically significant at 10%. The results shows that farmers with more experience in farming, reported Ghc 0.070 increase in output. This implies that though women farmers may not have access to credit as they grow older, their long experience in farming still have a significant effect on their output. They are able to utilize resources more efficiently and be productive hence increase output. Land size was reported to be positive and statistically significant at 10%. In other words, for every hectare, an increase in crop land size leads to a Ghc 0.096 increase in crop output. Valerio (2014) confirmed the importance of land in productivity in Philippines by observing that land is an important resource in increasing rice productivity. Family labour had a positive and significant influence on output suggesting that farmers who use family labour are likely to have higher output than those who do not. One of the major elements of agricultural production is whether family labour is available as it provides ready labour to support household farm production. From the empirical results, family labour was revealed to be positive and statistically significant at 5%. That is, for any increase in available family

labour results in Ghc 0.246 increment in crop output (Table 4.8 above). The economic intuition is that migration of youth from the study area to major cities in the country reduces availability of family labour for agricultural activities, crop output and overall economic wellbeing of farm households. Banerjee *et al*. (2014) confirmed that lower yields of farmers are mainly associated with availability of family labour.

4.6.3 Effect of credit access and crop output on welfare

The third stage equation of the CMP model estimates the effect of credit access on crop output and welfare (measured in per capita expenditure). The estimated coefficient of output on per capita expenditure was statistically significant at the one percent level. A kilogram increase in output will lead Ghc61.4419 decrease in per capita expenditure. The findings revealed an inverse relationship between crop output and per capita expenditure. This implies that farmers with low output spend more as compared to those with high output. Expenditure made by farmers in the study was basically on food. Thus, farmers with low output spent more on food to augment what they have to cater for their household. However, farmers with high output spent less on food since they had enough for household consumption.

Off farm income had a positive impact on welfare of farmers and significant at 1%. This implies that as the farmer earns income from farm activities, it increases the farmers' welfare by Ghc 0.214. Off farm work is a form of diversification which enhances income mobilization and household risk reduction. Most farmers often reinvest their off farm income into their farm activities to generate more income and hence the positive influence on welfare. This finding is not in isolation since it supports the findings of

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Osarfo et al. (2016) who found out that engagement in off farm activities lead to improved income and food security.

Household size had a negative impact on welfare and was statistically significant at (1%).This is an indication that an additional person to a household decreases welfare by Ghc 5.862. Larger number of household members exerts pressure on household assets/ resources and this makes it more difficult for household to meet their basic need such as adequate nutrition and housing as well as education of their children which tend to reinforce poverty. This findings is in line with Gardiner & Miller (2006) and Ukoha et al. (2007) who observed that larger household have higher poverty and hence lower welfare.

Table 4. 7: Estimated coefficients of the effects of credit and crop output on welfare of women farmers-Conditional Mixed Process

Variables	CMP estimation		Marginal effect	
	Coefficient	Std.error	Coefficient	Std.error
Equation 1 (Credit access)				
Age	-0.0115*	0.0055	-0.0353*	0.0166
Household head	0.0511	0.5627	0.0157	0.1729
Years of education	-0.0792	0.0285	-0.0243	0.0875
No of Dependents	-0.0997	0.0312	-0.0306	0.0960
Marital Status	-0.0938	0.3037	-0.0288	0.0933
Household size	-0.0555***	0.0184	-0.0171***	0.0546
Land size	-0.0540	0.0832	-0.0166	0.0255
Extension access	0.3885***	0.1280	0.1194***	0.0386
Member of FBO	0.7978***	0.1809	0.2452***	0.0515
Constant	1.5391**	0.6855		
Equation 2				
logvoutput				
Credit access	-1.1361***	0.1407		
Expenditure on input	0.0877***	0.0265		
Years of farming	0.0701*	0.0395		
Land size	0.0964*	0.0534		
Family labour	0.2456**	0.0987		
Constant	6.3780***	0.1374		
Equation 3				
percapitaexp				
logvoutput	-61.4419***	15.66166		
off farm income	0.21433***	0.0463		
Household size	-5.5688***	0.5294		
Constant	496.3887***	97.6408		
$\ln \sigma_2$	-0.1729***	0.0557		
$\ln \sigma_3$	4.419596***	0.0917364		
atanh ρ_{12}	4.4196***	0.0917		
atanh ρ_{13}	0.0147182	0.0792101		
atanh ρ_{23}	0.8733***	0.1445		
σ_2	0.8412595	0.0468353		
σ_3	0.0147	0.0792		
ρ_{12}	0.7030269	0.0730579		
ρ_{13}	0.5827	0.1289		
ρ_{23}	0.5246076	0.0934593		

Note: ***, ** & *are statistically significance at 1%, 5% and 10% respectively

Source: Author's computation, 2019.

UNIVERSITY FOR DEVELOPMENT STUDIES

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This section presents the summary, conclusions as well as some useful policy recommendations.

5.2 Summary

This study has examined the impact of access to credit on the welfare of women farm households in the Savelugu and Karaga district of the Northern region. The study specifically examined the factors influencing women farmers' choice of credit sources as well explored the effect of credit access on crop output. Finally, it explored the combined effect of credit access and crop output on welfare of women farmers. Findings from the study indicate that farmers rely on VSLA, susu, and family and friends as their major sources of credit in the study area. The results further indicates that farmers concurrently access credit from different sources. For instance, VSLA" and " susu" sources of credit are positively correlated (complementary) with a correlation coefficient of 80.68%, suggesting that farmers access credit from VSLA to complement credit sourced from susu, and vice-versa. For" family and friends" and "VSLA" source, the correlation coefficient is 29.71% and negative suggesting that the two sources are substitutes.

Among the factors that influence farmers' access to credit, it is evident that age, household size, extension access, and member of FBOs have significant influence.

With regards to crop output, all the variables were found to be significant. They include credit access, expenditure on inputs, land size and member of farmer based organization.

In the context of the determinants of welfare, crop output (value of output) and off farm income have significant influence on welfare.

5.3 Conclusions

Improving the production capacity of agriculture in developing countries like Ghana through productivity increase is a significant policy goal, particularly in Ghana where agriculture represents a key sector in the economy. Majority of the farmers are within the economically active age group, cultivating an average of 2.04 ha of farm land, most of which belong to their husbands.

Sources of credit among women farmers comprise of Village Savings and Loans Associations, susu and Family and Friends. However, there is over reliance on Village Savings and Loans Association and Family and Friends. These constitute informal source of credit. This implies that majority of women farmers within the study area rely more on informal sources of credit due to the fact that they do not own physical assets to be used as collateral.

Age and household size significantly affect credit access negatively while extension access and membership of famer based organization significantly affect credit access positively.

Also, women farmers with access to credit surprisingly had lower crop output than those without credit.

Expenditure on inputs (amount invested on the farm) leads to increase in crop output.

Extension access positively and significantly explain the variation in crop output of those without access to credit.

Credit access by women farmers does not necessarily translate into higher crop output and welfare attributed to the low output added to low prices of the commodities. Hence, the fight for agriculture development must not only be targeted at increasing crop output but instead, include welfare in their policies.

5.4 Recommendations

On the basis of study findings, summary and conclusion drawn, some policy recommendations surfaced for the government and its agencies as well as other concerned NGOs.

Government, NGOs and other stakeholders should adopt a policy of organizing more women farmers in to VSLA groups since more women accessed more credit from VSLA than the other sources. By organizing them in groups, they can be provided with other auxiliary services such as training on sheabutter processing, groundnut oil processing, "kulikuli" processing among others especially in the off-farming season since they were engaged in these economic activities aside farming. The income generated from these activities can be used to augment the credit received from VSLA to support their farming activities which may help improve their crop output.

Efforts should be made by lenders (especially those managed by VSLA groups, mostly NGOs) to ensure that the borrowers received training regarding how best to manage the credit given on their farms and also to train them regarding best farming practices. When this is done, it may lead to increase in output of those receiving the credit. This is important since those with access to credit in the study area had lower output.

Women farmers should be encouraged by lenders to invest the credit received on their farms since expenditure on inputs (amount invested on the farm) had a positive effect on output. If possible, the credit can be converted in to input credit and monitored to be used on the farm.

Women farmers should also be encouraged to engage in off-farm activities since off-farm income had positive effect on their welfare. Income from the off-farm activities can be used to cater for the health, educational, social needs of the family among others. This will may lead to improvement in welfare of women farmers.

Government should intensify extension services available to women farmers and train more extension officers to be deployed to rural areas. This is necessary since extension service had a positive effect on output. This will ensure that women farmers are better educated on the best methods of farming, how and when to apply inputs among others. The role of agricultural extension goes beyond the transfer of technology and improvement in productivity but also improvement in farmers' technical and managerial skills through training, coaching and facilitation among others.

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Appendix

University for Development Studies
Faculty of Agribusiness and Applied Economics
Department of Agricultural and Resources Economics

Credit Participation, crop output and Welfare of Women farmers in the Northern Region of Ghana.

Introduction:

This research questionnaire is to assist in the study on credit participation, agricultural productivity and welfare of women farmers in the northern region of Ghana .This forms part of the requirement for the award of M. Phil Agricultural Economics which the researcher is currently pursuing at University for Development Studies. Nyankpala, Tamale. The interview will take approximately 45 minute. This research is solely for academic purpose and respondents are therefore assured of the confidentiality of any information given and anonymity guaranteed. Do I have your permission to start the interview?

[0]   No I don't want to participate in the interview

[1]   Yes I do want to participate in the interview

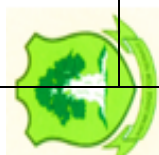| Date of interview:	Enumerator's ID:	Respondent Telephone:
Name of District:	Name of Community:	Community ID:
Name of Respondent	Respondent's ID:	Questionnaire Number:

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SECTION A: GENERAL INFORMATION

A1 What is/are the main languages spoken at home?	A2 What is your ethnicity?	A3 What is your settlement status in the community?	A4 For how long (years) have you settled in the community?	A5 What is the highest level of educational attained?	A6 Is the household head a male or female?	A7 How many household members are not working? **(Aged and children)**
Codes [1] Dagbani [2] Gonja [3] Frafra [4] Mamprusi [5] Ashanti [6] Others(specify)	**Codes** [1] Dagbani [2] Gonja [3] Others (specify)	**Codes** [1] Native [2] settler		**Codes** [1] Primary [2] JHS [3] SHS [4] Middle/Vocational [5] Others(specify)	**Codes** [1] Male-headed [2]Female-headed	

SECTION B: SOCIO-DEMOGRAPHIC CHARACTERISTICS

B1 What is the age (years) of the respondent?	B2 What is the respondent's completed years of schooling	B3 What is the respondent's Religious affiliation?	B4 What is the respondent's marital status?	B5 What is the number of people living in a household?	B6 What is the number of active labor force within the household (age between 16-60)
		Codes [0] no religion [1] Christianity [2] Islam [3] ATR [4] other (specify)	**Codes** [0] Never married [1] Married [2] Divorced [3] widow	**Codes** [0] Children [1] Male adult [2] Female adult	

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B7	B8	B9	B10	B11	B12	B13
What is the annual income of respondent?	What is the monthly income of respondent?	What is the distance of farming community from the district capital (Km)	What type of road do you have in the community?	Do you have access to extension services?	If yes to **B11,** how many times in a year?	Do you have access to credit?
			Codes [0] untarred [1] tarred	**Codes** [0] No [1] Yes		**Codes** [0] No [1] Yes

SECTION C: Determinants of Various Sources Credit Participation by Women Farmers

Effects of credit participation on output of women farmers.

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Would you like to be given a credit facility?	Have you ever applied for a credit facility?	If yes to C2, how much (GHC)?	If yes to **B13**, which of the following sources of credit do you have access to? (multiple response)	How much (GHC) credit did you receive from VSLA last farming season?	How much (GHC) credit did you receive from SUSU last farming season?	How much (GHC) credit did you receive from MF last farming season?	How much (GHC) credit did you receive from Banks last farming season?	How much (GHC) credit did you receive from Family and friends last farming season?	Is there interest on the credit accessed?	If yes, what is the rate?	Have you been able to pay back credit received during last farming season?	If no why?	How many family labors assist you in the farm?
Codes [1] Yes [2] No	**Codes** [1]Yes [2]No		**Codes** [1] VSLA [2] SUSU [3] MF [4] Banks [5] Family &friends						**Codes** [1] yes [0]No		**Codes** [1] yes [0]No		

C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25
What are the inputs used in the farm? (Multiple response)	On average what is the monthly expenditure on inputs?	On average what is the yearly expenditure on inputs?	Which of the inputs have you used the credit accessed to procure?	At how much have you purchased the selected?	How many years have you been farming?	What type of crop do you farm most?	Size land cultivated	What type of seed	What is the quantity of seed used in kg?	What is the cost of seed used in GHC?
Codes [1] Insecticides [2] Pesticides [3] Fertilizer [4] Manure [5] Knapsack sprayer [6] Cutlass			**Codes** [1] Insecticides [2] Pesticides [3] Fertilizer [4] Manure [5] Knapsack sprayer [6] Cutlass					**Codes** [1] improved [0]otherwise		

C26	C27	C28	C29	C30	C31	C32	C33	C34	C35	C36
What is the output of the crop you cultivated? (No. of 100kg bags/acre	How much did you sell each bag?	Do you belong to any FBO	If yes in **C28**, for how long (yes)?	Where do you sell your farm produce?	What is the distance (km) from the farm to the point of sale of your farm produce?	What is the ownership status of the land used for farming?	What is the fertility state of the land?	Do you participate in any credit program?	If yes to **C34** what is the name of that program?	How long have you participated in the program?
		Code [1] yes [0] No		Market Farm-gate At home Others (Specify)…		**Codes** [1] inherited [2] rent [3] purchased [4] gift [5] shared	Codes [1] Fair [2] Good [3] Poor	**Codes** [1] yes [0] no		

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LABOUR COST:

ACTIVITY	FAMILY LABOUR						HIRED LABOUR						WAGE RATE	TOTALS
	MALES			FEMALES			MALES			FEMALES				
	No.	Days	Average Hrs/Day	No.	Days	Average Hrs/Day	No.	Days	Average Hrs/Day	No.	Days	Average Hrs/Day		
Land Preparation														
Sowing/Planting														
Fertilizer application														
Chemical application														
Weeding/Weed control														
Watering														
Harvesting														
Other cost:														

SECTION D: Agricultural Output on the Welfare of Women Farmers in the Northern Region

D1	D2	D3	D4	D5	D6	D7	D8	
Apart from farming, what off-farm activities are you engage in?	What is the monthly off-farm income	What non-farm activities are you engaged in?	What is the monthly non-farm income	What is the annual expenditure on food?	What is the annual expenditure on clothing?	What is the annual expenditure on health?	What is the annual expenditure on others?	

E1	E2	E3	E4
How much does your household spend on food in a month?	How much does your household spend on other non-food items in a regular month? (e.g. soap, pomade, clothing)	How much does your household spend on other social expenditure in a regular month? (e.g. weddings, outdooring, funerals)	Other miscellaneous expenditure not part of **E1, E2** and **E3**

Assets	How many do you own?	Is asset in good condition? [0] No [1] Yes	How long have you owned asset? (in years)	How did you acquire asset? [1] Purchased [2] Gift [3] Inherited	If purchased, how much did you buy it?
Mobile phone					
Bicycle					
Motor bike					
Sewing machine					
Refrigerator					
Blender					
Electric iron					
TV-set					
Radio					
Others (specify)					

SECTION E (1): CONSTRAINTS TO CREDIT ACQUISITION

What constraints do you encounter in credit acquisition? Determine the extent of constraint

Constraints / problems	Rank	Remarks/comment if any
Distance to financial institution		
Delays in credit acquisition		
Bureaucratic process		
Credit diversion		
Lack of collateral		
Credit default rate		
Gender bias in credit acquisition		
Lack of education		
Others (specify)…………………………….		

SECTION E(2): PRODUCTION CONTRAINTS

Constraints / problems	Rank	Remarks/Comment if any
Access to mechanization services		
Cost of mechanization services		
Access to inputs(seed, fertilizer, chemicals etc)		
Cost of inputs		
Access to extension services		
Road network		
Inadequate storage facilities		
Access to markets		
Reliance on rainfall		

NOTE: 1=Very high, 2=High, 3=Low, 4=Very low and 5=None

THANK YOU FOR THE TIME

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