UNIVERSITY FOR DEVELOPMENT STUDIES

THE EFFECTS OF WIENCO MASARA N'ARZIKI INPUT-CREDIT PROJECT ON OUTPUT AND INCOME OF FARMERS IN THE SAVELUGU-NANTON MUNICIPALITY OF THE NORTHERN REGION

BY

ADAM IDDRISU

A THESIS SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL AND RESOURCE ECONOMICS, FACULTY OF AGRIBUSINESS AND COMMUNICATION SCIENCES, UNIVERSITY FOR DEVELOPMENT STUDIES, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PHILOSOPHY DEGREE IN AGRICULTURAL ECONOMICS

NOVEMBER, 2015

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NOVEMBER, 2015

DECLARATION

Student

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this University or elsewhere:

Candidate's Signature:……Date:……

Adam Iddrisu

Supervisors

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

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Mr. Ansah Isaac Gershon Kodwo

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Dr. Samuel Donkoh

ABSTRACT

The high number and concentration of farmer support projects in recent years in northern Ghana does not seem to solve the chronic problem of food insecurity and low productivity. This result from the fact that many farmer support projects explicitly targeting smallholders were not designed to impact at the scale required to make a difference at the socio-economic level of the farmers. The case study of Masara N'Arziki Input-Credit Support Project basically sought to find out whether this project is able to give smallholder farmers a competitive edge to improve their farm output and income and the challenges they face in this project. Through Cochran's and Yemane's sample size determination, the study selected 195 respondents; with 118 participant and 77 non-participants through stratified and simple random sampling techniques from Savelugu-Nanton Municipality. The research revealed that the household size, farm experience, project experience and farm size of smallholder farmers' were the significant factors that influence their decision to participate in the project. The farm output by propensity score matching estimation revealed a statistically significant difference in maize output (ATT= 1895.35 kg) between the participants and non-participants at 1% significant level but there was no significant statistical relation between their farm income. The high cost of Input-Credit during recovery and difficulty in accessing tractor services at the beginning of the season were the pressing problems of participant farmers. The effect of project on outcomes are somehow unsatisfying, in the sense that participation only raises output, but not income. Greater benefits to farmers from programme participation would require project management to review the contractual arrangement so that the high cost of Input-Credit is significantly reduced by taking care of the cost hired labour incurred by farmers in land preparation and harvesting of farm produce on time.

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DEDICATION

This thesis is dedicated to my parents and to my good friends and brothers for their unflinching support and prayers throughout the programme and to the entire Konayili family.

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LIST OF ACRONYMS AND THEIR MEANING

ATE	-	Average Treatment Effect
ATT	-	Average Treatment Effect of the Treated
ATU	-	Average Treatment of the Untreated
CIA	-	Conditional Independence Assumption
CIMMYT	-	International Maize and Wheat Improvement Centre
EAT	-	Enabling Agriculture Trade
FAO	-	Food and Agriculture Organisation
GSS	-	Ghana Statistical Service
IFAD	-	International Food and Agriculture Development
MoFA	-	Ministry of Food and Agriculture
NGOs	-	Non-Governmental Organsations
PNDC	-	Provisional National Defence Council
PSM	-	Propensity Score Matching
RCC	-	Regional Coordinating Council
SMEs	-	Small and Medium Scale Enterprises
USAID	-	United States Agency for International Development

UNEFP	-	United Nations Environment Programme
IEA	-	Institute of Economic Affairs
Kg	-	Kilogrames
Ha	-	Hectares
GH¢	-	Ghana Cedi

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Ghana is well-endowed with natural resources and agriculture accounts for roughly one-quarter of GDP and employs more than half of the workforce, mainly small landholders (Index mundi-Ghana Economy Profile, 2014).Over the past decade, the performance of agriculture sector declined from 51 per cent to 36 per cent of Gross Domestic Product (GDP), with the rural poor now accounting for about three-quarters of all Ghanaians living below the poverty line and living smallholder farmers (whose farms average just 1.2 ha) with limited opportunities for prosperity (Zaney, 2016). Agriculture is a vital development tool for achieving the Millennium Development Goal that calls for halving the share of people suffering from extreme poverty and hunger by the year 2015 (WDR, 2008).It plays an active role in determining the economic and social system of the rural communities in Ghana. In other words, agriculture is the main source of food supply for domestic consumption and for marketable items, especially in the developing world. Statistics show that three out of every four poor people in developing countries live in rural areas, and most of them depend directly or indirectly on agriculture for their livelihoods (WDR, 2008).

The three most targeted regions in Ghana for most agricultural development projects are Northern, Upper East and Upper West Regions. The regions are plagued with high incidence of food insecurity and poverty due to over-reliance on rain-fed agriculture and low improved farm input utilization conditions (Martey et al., 2014).

According to Pingali et al. (2005), smallholder farmers in most developing economies find it difficult to participate in markets because of numerous constraints and barriers; the inadequate access of smallholder farmers to productive assets and formal source of credit challenge them to overcome food insecurity and making their living out of farming. Some of these problems also include not only credit to expand production, but also lack of proper technology, improved agronomic practices, crop management techniques, timely availability of water and modern inputs, marketing and supportive infrastructure, raising production cost, volatile year to year prices and supply of credit when they most need it (Ahmad, 2007).

Northern Ghana has witnessed myriads of smallholder support projects over the years with the goal of addressing the major challenges faced by smallholder and resource poor farmers. The region has been categorized among the poorest in the country with per capita income lower than the national average (Ghana Statistical Service, 2010). In addition, about half of the population of northern Ghana face annual food deficits and are net buyers of food (GSS, 2008).

According to Dan-Azumi (2011), poverty and thus food insecurity is generally high among food crop farmers. In response to this plight of the farmers, several agricultural related interventions have been implemented in the past (for example, Sasakawa Global 2000, Agricultural sub-Sector Improvement Program (AgSIP), Root and Tuber Improvement Program (RTIP), Purdue Improved Cowpea Storage (PICS), among others. Again numerous interventions are currently being implemented (for example, Agricultural Value Chain Mentorship Project(AVCMP), Alliance for a Green Revolution in Africa's Soil Health Project(AGRA-SHP), Block Farm Project, Northern Rural Growth Program across the three northern regions).

Masara N'Arziki project is among the major smallholder support projects in maize cultivation operating in the Northern, Upper East and Upper West regions of Ghana. This project has been in operation in these regions since 2008.The primary focus of this support project is to assist smallholder farmers with technologies coupled with management practices that are expected to boost production as well as improve their livelihoods. According to Ashley and Maxwell (2001), the performance of the agricultural sector has a direct impact on livelihoods, environment, poverty and malnutrition. In order to enhance the performance of the agricultural sector and more specifically the performance of agricultural projects, there is the need to identify factors, which delimitate farmers' participation in such agricultural projects which are intended to inure to the benefits of the farmers.

Faridet al. (2009) defines participation as playing a role or taking part in an activity usually with others. Participation also refers to involvement of individuals and groups in development processes with the aim of ensuring self-reliance and better standard of living (Nxumalo and Oladele, 2013). A farmer may not participate in development project if the marginal utility derived from participation is lower than the cost incurred. The smallholder farmers in northern Ghana usually opt to participate in farmer support projects with the notion that participation contributes to the improvement of their livelihoods. Perhaps the true success of any comprehensive, economic and social development programme is primarily dependent upon the extent to which it contributes to the well-being of the beneficiaries despite the fact that some of them are profit oriented.

1.2 Problem Statement

Agriculture has been embraced as the pivot for rural development. In a developing country like Ghana, a developing agricultural sector promotes economic growth by releasing labour and generating raw materials for industries, increasing availability of food and expanding domestic market for industrial goods. This core function agriculture plays constitutes the basis for various efforts made by government through the Ministry of Food and Agriculture (MoFA) as well as non-governmental organizations (NGOs) and private sector actors in the planning of agricultural projects to ensure sustainability and growth in the sector. The dominant role of these agricultural support projects stems from among other impacts, increased farm outputs and rural income generation intended to ameliorate the effects of hunger, food scarcity, increased food prices and social problems of unemployment (Raphael, 2012).

Masara N'Arziki Input-Credit Support Project is among the major farmer support projects in the Northern region. Masara N'Arziki project is incorporated as a company limited by guarantee, and a subsidiary of Wienco Incorporation. The Masara farmer support project operates with the overall aim of ameliorating the sufferings of the rural poor through their Input-Credit model. The project facilitates the adoption and utilization of new and improved technologies for maize production. The project model ensures that farmers receive timely and quality inputs.

Wienco are the sole agents of the agro-input brands used and the sole suppliers for Masara; they are able to ensure that the inputs are delivered on time. Masara project in the Northern region consists principally of smallholder farmers. These farmers involved in the project are provided with hybrid seeds, agrochemicals (including fertilizer, herbicides and insecticides) and innovative farm implements on credit basis. The project operates with the following model:

willingness to belong to a group of between 8 to 10 members and signing up to two contractual forms for Masara N'Arziki project. Farmers go into a contract to sell all realized production to Masara, while Masara in turn facilitates the harvest and credit recovery from beneficiary farmers.

There is a legally enforceable contract that binds the farmer into contract for which he/she is compelled to sell all the products to the company. Farmers must therefore proactively source other inputs to produce a separate plot for household consumption if the cost of the credit is not paid by the farmer after recovery. Farmers who encounter low yield might be challenged to sell household assets (for example livestock) to supplement household food demand. In addition, the inability for Masara project to accurately assess farm sizes in the contract agreement, results in farmers either receiving more inputs than they actually need, or less than they require, which in turn results in yield estimates based on input provision being either over- or understated, and this directly or indirectly increases the cost of credit recovery after harvest by the participant farmers.

According to United States Agency for International Development (USAID) EAT programme (2012), the Masara N'Arziki programme indirectly contributes to a reduction in food insecurity for participating households. But in this same programme document, it is also reported that farmers participating in the project do not have a voice. A relevant question to pose is what accounts for these contrasting remarks and what is the real situation pertaining to the farmers participating in the programme? Are they indeed benefitting or losing from this support project? Although the Masara programme is promoted as farmer-owned, farmers complain of high cost of input which is repaid from their output after harvest. In addition, the costs of labour in production to harvest of farm produce are not accounted for by the Masara project, thereby

increasing the cost of production and invariably affecting the income received after harvest by the smallholder farmers in the project.

According to Sikwela (2013), agricultural productivity has continued to decline partly due to the reduction in support for farmers. Many smallholder farmers resort to the option of participating in support project similar to Masara N'Arziki due to their inability to afford farm inputs for crop production. Others major objective of participating is to maximize the amount his family has to live on before the next cropping season. This case was similar to the smallholder farmers in the Savelugu-Nanton municipality who were assisted with farm inputs on credit to repay after harvest by Masara project. The case study of Masara project was considered to evaluate the performance of these smallholder farmers by their Input-Credit support model. This study bring to light the significant differences that exist between the output and income of smallholder farmers participating in farmers support project and those producing with their own resources. It is against this background that this research on Masara N'Arziki Input-Credit Support Project was undertaken to determine whether this project is able to give the smallholder farmers a competitive edge to improve their farm output and income. This was also to determine the factors influencing farmers' decision to participate in Masara N'Arziki project and its effects on their farm output and income and the challenges faced by beneficiary farmers on the project.

1.3 Research Questions

The main research question posed for investigation is what are the factors influencing farmers' decision to participate in Masara N'Arziki Input-Credit Support Project and what effects does

participation have on the smallholder farmers' output and income? This main research question is addressed by pursuing the following specific questions:

1. What are the factors that influence farmers' decision to participate in Masara N'Arziki Project;
2. What are the effects of participation in the project on smallholder farmers' output and income; and
3. What are the challenges faced by smallholder farmers participating in Masara N'Arziki Project?

1.4 Objective of the Study

The main objective of the study is to determine the factors influencing farmers' decision to participate in Masara N'Arziki Input-Credit Support Project and its effects on their farm output and income. The specific objectives of this study are:

1. To determine the factors influencing farmers decision to participate in Masara N'Arziki Project.
2. To evaluate the effects of participation on smallholder farmers' output and income.
3. To identify the challenges of smallholder farmers on Masara N'Arziki Project.

1.5 Justification of the Study

Agriculture remains a significant sector of the economy of the rural poor farmers with significant impacts on their socio-economic condition and livelihood. Every modern business is operated on own capital or borrowed capital. Similarly, farming also requires capital which is usually given to farmers by support project on Input-Credit basis. The need for farm credit in

increasing production and effective utilization of farm resources is very important in agricultural production especially among rural poor crop farmers.

According to Anka (1992), these interventions on Input-Credit bases are considered as major ways of eliminating persistently poor income of small farmers due to low per acre yield and perpetual losses encountered due to no recovery of credit after the harvest season which gives farmers an independent economic and social identity. Access of small and marginal farmers to credit from support project can significantly help them to avoid sliding down the poverty ladder (Naushad et al., 2011).

The case study of Masara N'Arziki Input-Credit Support Project operating in the Northern region was to examine the effect of these support projects on smallholder farmers' output and income. The finding is envisaged to bring to light some of the factors that influence farmers to participate in input-credit support project and to find out whether the net effects after recovery significantly benefit these farmers. The results of this study will be considered as an important source of information to MoFA and a wakeup call to other organizations and development agencies operating with smallholder farmers in Northern Ghana to ensure that the welfare and income of these farmers would be considered in their project implementation. In addition, the findings will also fill the knowledge gap of the effects of Input-Credit support on smallholder farmers in the Northern region of Ghana.

1.6 Scope of the Study

The study is aimed at finding the effects of farmer support projects on smallholder farmers' output and income in the Northern region, based on a case of Wienco Masara N'Arziki project.

The project assists farmers on credit with the necessary inputs and technical assistance in yellow maize at the field level till it is harvested which is basically grown for export. The project involves smallholder farmer in group of 8 to 10 membership who signs a contractual agreement to sell all their produce to the project after harvest at an agreed price. The project operates in four districts in the Northern region; Savelugu-Nanton (16 farmer groups), Karaga (4 farmer groups), Central Gonja (2 farmer groups) and Bunkpurugu-Yunyoo (6 farmer groups) districts. The study was limited to Savelugu-Nanton municipality due to the higher participation of farmers in the Masara project and as well the financial constraints of collecting data from all their operational districts in the Northern region. In addition Peil et al. (1982) point out that if a group is truly homogeneous, a larger sample is unnecessary or as Miller and Rollnick (1991) puts it there is no need interviewing a larger number of people saying the same thing. In all, 195 smallholder farmers were interviewed with 118 participants in the project as treatment and 77 non-participants control group for the study.

The findings of this study would serve as the basis to ascertain whether these smallholder farmers really meet their goal of improving their incomes and household food security through the Masara support project in the Northern region of Ghana.

However the case study on Masara N'Arziki project was only limited to the Savelugu-Nanton Municipality hence cannot be generalised for Masara project operations in the Northern region of Ghana

1.7 Organization of the Study

This study is organized into five chapters. Chapter One spelled out the background of the study, statement of the problem, objectives of the study, research questions, justification of the study, the scope and organization of the study.

Chapter Two deals with literature review. The issues discussed in the literature review include: Background and Prospect of Farmer Support Project, Definition Small Scale farmer, Guiding Principles of Farmer Support Project, Factors influencing farmer's decision to participate in a Support Project, Determinants of Small Scale farmers Participation in Support Project, Farmer learning and Adoption of technology from project participation, and the Challenges of Small Scale farmers in the Northern Region.

Chapter Three outlines the methodology of the study, giving a clear explanation of how it was conducted: the study area, study population, sampling procedure and sample size, sources of data, instruments of data collection, data processing and analysis.

Chapter Four discusses results of the study and provided detailed qualitative and quantitative analysis of the results for a clear presentation of the findings from the study.

Chapter Five, which is the final chapter, provides a summary of findings, conclusions and relevant recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

The chapter covers the relevant literature review on the research topic under study. In addition literature on the specific research objectives are also thoroughly discussed for a vivid background and highlights on the related literature on the research study. These include; background and prospects of farmer support project, factors that influences smallholder farmers' participation in support project, farmer learning and adoption of technology from project participation and challenges of smallholder farmers in support project in the northern region.

2.1 Background and Prospect of Farmer Support Project

Agriculture remains the significant sector of the economy of the rural poor farmers with significant impacts on their socio-economic condition. Agriculture is not only a source of food and fibre but also the major supplier of the raw materials and labour force in the urban cities (FAO, 2010). No strategy of economic development can be realized without sustained and broad based agriculture development (GOP, 2008). Most rural farmers have inadequate access to productive assets and very insignificant access to formal source of credit. As a result, they pass through a process of losing their scanty resources and join the pool of poor people. Some of these problems also include not only credit to expand production but also lack of proper technology, improved agronomic practices, crop management techniques, timely availability of water and modern inputs, marketing and supportive infrastructure, rising production cost, volatile year to year prices and supply of credit when they most need it (Ahmad, 2007).

The participation of the marginalised smallholder farmers is a pre-condition for success of any developmental programme or projects. Their participation means a voluntary involvement in situations and actions which enhance their wellbeing. It depicts a process where they are provided with opportunity to make inputs into matters concerning their wellbeing and work actively to solve their problems (Shitu, 2008).

Rural development strategies usually take the form of programmes which implement projects in a specific rural area. Such programmes form the basis of most government and non-government efforts to assist rural communities to raise their income and livelihood through agriculture.

Research has revealed that smallholder farmers, especially in northern Ghana, are still very poor and they depend on agricultural practices that have benefited them little from modern technology (FAO, 2008). It can also be argued that agriculture is a vital part of the economy of any country and that its development is critical to the development of the country's economy as a whole. Developing the livelihood of the smallholder farmer is building up their potential so that they can build sustainable future for themselves through agribusiness opportunities. Every modern business is operated on own capital or borrowed capital. Similarly, farmers also require capital which usually is given to them on Input-Credit bases. The need for farm credit to increase production and effective utilization of farm resources is quite clear.

According Naushad et al. (2011), agricultural credit support project to smallholder farmers is an important capacity building intervention that these farmers can get in order to bridge the gap between their income and expenditure in their farm production. Agricultural credit is an essential ingredient in the growth strategy of agricultural sector. Farming not only requires

credit in the form of improved seeds, fertilizer and modern implements but also extension training even if the farmer has to pay for it from any service provider and other similar farm operations which require capital from harvest and processing till it is ready at farm gate.

According Anka (1992), the interventions on Input-Credit are considered as one of the major ways of eliminating persistently poor income of small farmers due to low per acre yield and perpetual losses encountered due to no recovery of credit after the harvest season which gives farmers an independent economic and social identity.

Indeed from previous experience of Input-Credit support to farmers, many farmer support projects find it difficult to invest in credit support to small-scale farmers mostly due to poor recovery (Naushad et al., 2011). This challenge is coupled with perceived problems which include risk of investment in agriculture; seasonality of agricultural production, poor credit repayments performance of agriculture lending; and technical nature of agriculture production system (Ahmed, 2007).Access of small and marginal farmers to credit from support project can significantly help them to avoid sliding down the poverty ladder (Naushad et al., 2011).

Agricultural credit is an integral part of the process of modernization of agriculture and commercialization of the rural economy, and its introduction is the quickest way of boosting agricultural production (Naushadet al., 2011). Credit may provide them opportunity to earn more money and improve their standard of living (Abedullah et al., 2009).

2.2 Definition of Small Scale Farmer

Smallholder farmers are defined in various ways depending on context, country and ecological zone. There is no unique and unambiguous definition of smallholder farmers. Different indicators have been identified in order to define small scale farmers. Land ownership is one of

them (Harriet & Panagiotis, 2009). The limit most frequently takes the form of a threshold that is usually selected in an ad hoc basis (2 hectares, mean or median land size). For example, households with less than a threshold land size of two hectares may be characterized as smallholders. There are an estimated 450 million Small scale farms worldwide defined by IFAD as farms of two hectares or less of land (IFAD, 2008).

Dixon et al. (2003) explain that the term smallholder only refers to their limited resource endowment relative to other farmers in the sector. According to Ellis (2005), smallholder farmers are farm households with access to means of livelihoods in land relying primarily on family labour for farm production to produce for self-subsistence and often f or market sale. In addition, Todaro (1989) defines smallholder farmers as owning small-based plots of land on which they grow subsistence crops and one or two cash crops relying almost exclusively on family labour.

In addition, Dixon et al. (2003) suggest that most smallholders have diverse sources of livelihood including significant off-farm income yet are still vulnerable to economic and climatic shocks. Smallholder farmers differ in individual characteristics, farm sizes, resource distribution between food and cash crops, livestock and off-farm activities, their use of external inputs and hired labour, the proportion of food crops sold and household expenditure.

Small scale farming is a natural outgrowth of sustainable agriculture, which is essentially agriculture that produces abundant food without depleting the earth's resources or polluting its environment.[1]It is agriculture that follows the principles of nature to develop systems for raising crops and livestock that is, like nature, self-sustaining.

[1]Seehttp://sift.ncat.org/small_scale.php

Small scale farmers in the rural areas whose source of livelihood depends much on agriculture, in the contrast to urban families, require savings or the facility to borrow capital to cope with household money management, for example to pay for household equipment and for education and health care. They also require capital to manage the seasonality of their incomes arising from the nature of agricultural activities. They require inputs such as access to seeds and fertilizer when farming season sets in and to invest in equipment at the start of the planting season that will not produce an income until the harvest is collected and sold.

Small scale producers are often marginalised by their lack of access to decent inputs, including good quality land, smart technologies (including irrigation), and good quality seeds. Lack of access to capital markets, credit and information about both growing conditions and markets are also areas that further marginalise small scale producers (Sophia, 2012). Marginalisation is also to food insecurity. Marginalised farmers are farmers who are 'farming yet are hungry' (Sophia, 2012). These are people for whom farming is a major livelihood activity, yet who have insufficient assets to produce a surplus from their agricultural activities and whose non-farm activities are insufficiently reliable or remunerative for them to rely on market purchases for adequate food intake (Kent & Poulton, 2008).Together they limit the producers' ability to take risks, and reduce the scope for realising a profit. It is argued that Small scale farmers are potentially competitive in certain activities and that, with proactive policy support; these opportunities could be developed into "viable niches" for a future smallholder sector (Kirsten & Van Zyl, 2007). It has been estimated that about 70 percent of the world's poor are concentrated in rural areas where two out of three billion rural people reside in about 450 million small farms (Byerlee et al., 2002; WDR, 2008; Hazell et al., 2007). Other complementary metrics are necessary to explain why small scale farmers have received so much attention from

development agencies. These additional metrics, in one way or another, address marginalisation in terms of geography, assets, resources, markets, information, technology, capital, and non-land assets (Sophia, 2012). In fact most small scale farmers are net food buyers, creating an ambiguous relationship to food prices: higher prices, if captured by the small scale producer, are clearly a good thing, yet if the cost of household food purchases increase as a result, the net outcome has to be measured over time as well (Sophia, 2012).

The role of the smallholders has not been fully addressed in association with recent challenges in the global economy and with respect to the changing role of agriculture along development transition. There is a need for appropriate characterisation of smallholders and the identification of the constraints that they face (Byerlee et al., 2009). Perhaps, the roughness and lack of further information on the characteristics and the constraints they face, makes its necessary for more thorough research to determine methods of targeting their needs and effectively include them in agricultural development strategies through efficient farmer support project. Agriculture in developing countries remains dominated by small scale farms who are characterised by low productivity and are vulnerable to food insecurity (FAO, 2010). Perhaps many smallholder farmers who participate in farmer support do not seem to achieve their goal of improving their farm output to cater for their household food needs. Challenges such as high cost of farm inputs and difficulty in accessing credit makes it difficult for some smallholder farmers to increase their yield without the support of farmer support projects.

2.3 Guiding Principles of Farmer Support Project

Farmer support project must be guided by principles that enhance and influence the decision of farmers to participate which basically depends on the satisfaction and its ability to meet the

needs and expectation of the farmers. It is important, however, for all such programmes to establish beforehand a set of principles to guide their activities. These principles include the following:

Access: Farmer support project must ensure that the programme and its benefits can reach beneficiaries in need, and beware of the consequences if some farmers have access to the programme while others do not.

Independence: The support programme structure should help and support the farmer but which does not make him or his livelihood dependent upon the programme.

Sustainability: The overall impact of support project must ensure that it plans and solutions are relevant to the local economic, social and administrative situation. Short-term solutions may yield quick results, but long-term programmes that are suitable to the local environment have greater access.

Participation: The project must necessarily try to consult the local people, seek out their ideas and involve them as much as possible in the programme.

Effectiveness: A programme should be based on the effective use of local resources and not necessarily on their most efficient use. While efficiency is important, its requirements are often unrealistic. For example, the maximum use of fertilizer is beyond the means of most farmers. But an effective use of resources, which is within the capabilities of most farmers, will have a better chance of a wider impact. One of the main constraints to development that many farmers face is isolation, and a feeling that there is little they can do to change their lives (MoFA, 2008). Some farmers will have spent all their lives struggling in difficult circumstances to provide for their families with little support or encouragement.

2.4 Agricultural Technology Adoption

2.4.1 Definitions and theory

Agricultural technologies include both physical objects such as seeds or fertilizer, as well as new farming methods. The technology may not be new as such, but novel to the farmer (Heike, 2012). Following Rogers (2003), a new technology (or innovation) is defined as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (p.12). Rogers (2003), identifies two characteristics of innovations (from the perspective of the farmer) that best explain different adoption rates, i.e. the perceived relative advantage of using the technology vis-à-vis the technology it supersedes, and its perceived compatibility with existing values, needs and experiences (Rogers, 2003). In addition, Rogers notes that innovations are more likely to be adopted if they are less complex, lend themselves to trying and whose results are observable to others.

Adoption of a technology may be measured by "both the timing and extent of new technology utilization by individuals" (Sunding & Zilberman, 2001, p.229). Diffusion, in turn, is defined as "the process in which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003, p.5). The timing of adoption and diffusion can be split into three levels, i.e. the decision process of the farmer whether to adopt or not (or to abandon a technology once adopted), the innovativeness of the farmer in terms of when to adopt in the diffusion process, and the rate at which a technology is adopted in the system (Rogers, 2003). The extent of adoption can be measured by intensity of cultivation e.g. in terms of number of farmers, total area, area within farms or harvest (CIMMYT, 1993).

Innovations are first adopted by a few early adopters. Then adoption rates accelerate as the majority adopts the technology before it gradually slows again as fewer and fewer remaining individuals adopt the innovation (the so-called 'laggards') (Rogers, 2003).

Experience has shown that a new technology may not be appropriate in every context, but rather its suitability depends on how well it fits the particular farming context (CIMMYT, 1993). However, much of the focus of the adoption literature has been on the individual farmers (e.g. the attitude or personality of the farmers or their socio-economic characteristics, such as wealth, landholding or education) and the characteristics of the technologies, rather than the context in which technology adoption and diffusion takes place (CIMMYT, 1993; Marra et al., 2003). Similarly, during the Green Revolution only limited attention was paid to the complexity and diversity of the farmer's physical, economic and social environment while attention has been shifting towards a focus on farming systems (Barker et al., 1985).

The willingness and ability to adopt new technologies, the relative weight of the influencing factors and the associated needs for support may change over time (Heik, 2012). For instance, the willingness to adopt may change with age and experience (CIMMYT, 1993). Older farmers may be less willing to invest in technologies that only pay off in the longer term (Feder& Umali, 1993), but may also have more resources to invest in new technologies. Younger farmers on the other hand may be more educated or be more open to trying out new technologies. Moreover, farmers often modify their perceptions of the riskiness of new technologies over time as they acquire more information (O'Mara, 1980 cited in Marra et al., 2003).

Also, adoption is not necessarily a binary decision. Rather, the intensity of adoption may change over time, e.g. as a result of learning or through better access to farm resources (Heik, 2012).

Some technologies may also be abandoned again (CIMMYT, 1993). There is also some evidence of a 'technological ladder'. Kaliba et al. (2000), note that the majority of adoption studies had found that smallholder farmers tended to adopt simple technologies first before moving on to more complex ones, while cheaper technologies may be adopted before the more expensive ones. Moreover, researchers have been increasingly recognising the need to look at agricultural technologies as a package where farmers may adopt components at different times and speeds (Feder& Umali, 1993).

2.5 Factors influencing agricultural technology adoption from farmer support programmes

Technology may be broadly defined as the knowledge, skills, methods, and techniques used to accomplish specific practical tasks (US General Accounting, 2004). This is explained in broader context as the inclusion of people, policies, and procedures which ensures the application of a particular technology. Rogers (1995) also defines technology as a design for instrumental action that reduces the uncertainty in the cause-effect relationship involved in achieving a desired outcome. According to Jackline (2002), a more meaningful definition of technology is a set of 'new ideas'. These ideas are associated with some degree of uncertainty and hence a lack of predictability on their outcome. For a technology to impact on the economic system, blending into the normal routine of the intended economic system without upsetting the system's state of affairs is required (Jackline, 2002). Hence it entails overcoming the uncertainty associated with the new technologies.

Technology has played an important role in agriculture in the area of plant varietal improvement, integrated nutrient management, integrated pest management and agricultural

engineering (Antwi, 2009). The rapid modernization of agriculture and the introduction of new technologies such as those that characterized the Green Revolution have had a great impact. Studies on the impact of the Green Revolution have shown that technological change in agriculture can generate major social benefits (FAO, 2000).

Technology generation is widely recognized in agriculture sector as one of the major determinants of economic growth, but has to be transferred and adopted by farmers in order to realize growth and food security (Antwi, 2009).

Clearly, a technology that is being adopted has an edge over conventional practices. Usually, a technological innovation encompasses at least some degree of benefit for its potential adopters (Rogers, 1995). Several stages precede adoption. Awareness of a need is generally perceived as a first step in adoption process (Rogers, 1983). The other stages are: interest, evaluation, acceptance, trial, and finally, adoption (Lionberger, 1960). The Lionberger analysis also notes that these stages occur as a continuous sequence of events, actions and influences that intervene between initial knowledge about an idea, product or practice, and the actual adoption of it.

Most recent literature suggests that these stages may occur concurrently and some may/not occur in adoption decision processes (Jackline, 2002).

According to Cameron (1999) the dynamic process of adoption involves learning about technology over time. In fact many innovations require a lengthy period often of many years from the time they become available to the time they are widely adopted (Lionberger,1960; Rogers, 1995; Enos and Park, 1988). The average time between initial information and final adoption varies considerably by person, place and practice. Alston, Norton and Pardley (1995) demonstrate that the time after the initial investment in research through the generation of pre-technology knowledge up to maximum adoption by producers involves many long, variable and

uncertain lags. The literature on adoption (Griliches, 1957; Lionberger, 1960; Rogers, 1983; Alston, Norton and Pardley, 1995), describes the process of adoption as taking on a logistic nature. It increases with time (as the stock of knowledge increases), reaches a maximum level, and later decreases as the technology depreciates or becomes obsolete.

There are several extensive body of literature on the economic theory of technology adoption. Several factors have been found to affect adoption. These include government policies, technological change, market forces, environmental concerns, demographic factors, institutional factors and delivery mechanism (Jackline, 2002). Based on the objective of this research study in examining the effects of farmer support project on Smallholder farmers' income and output, the following four although not tested appears to be related to the objective of the study.

They include Market forces: availability of labour, technology resource requirements, farm size, level of expected benefits, and level of effort required to implement the technology;

Social factors: Age of potential adopter, social status of farmers, education level and gender-related aspects, household size, and farming experience; Management factors: membership to and past experience with organizations, the capacity to borrow and repay credit. Institutional/technology delivery mechanisms: information access, extension services, and prior participation in, and training in Good Agricultural Practices (GAPs).

The benefits result of knowledge based agriculture requires expeditious transfer of research results from the laboratory to land. Hence the transfer of technology is very critical for a successful adaption and dissemination of a new by farmers. According to Feder and Umali (1993), the three basic models of agricultural extension include: technology transfer, farmer first, and the participatory model.

Some studies classify the above factors into broad categories: farmer characteristics, farm structure, institutional characteristics and managerial structure (McNamara, Wetzstein and Douce, 1991) while others classify them under social, economic and physical categories (Kebede, Gunjal and Coffin 1990). Others group the factors into human capital, production, policy and natural resource characteristics (Wu and Babcock, 1998) or simply whether they are continuous or discrete (Shakya and Flinn, 1985). By stating that agricultural practices are not adopted in a social and economic vacuum, Nowak (1987) brought in yet another category of classification. He categorizes the factors influencing adoption as informational, economic and ecological. There is no clear distinguishing feature between elements within each category. Some factors can be correctly placed in either category (Jackline, 2002). For instance, experience as a factor in adoption is categorized under 'farmer characteristics' (McNamara, Wetzstein and Douce, 1991; Tjornhom, 1995) or under 'social factors' (Kebede, Gunjal and Coffin 1990; Abadi Ghadim and Pannell, 1999) or under 'human capital characteristics' (Caswell et al., 2001).

Categorization usually is done to suit the current technology being investigated, the location, and the researcher's preference, or even to suit client needs (Jackline, 2002). Categorization may be necessary in regard to policy implementation. Extensive work on agricultural adoption in developing countries was pioneered by Feder, Just and Zilberman, (1985). Since then the amount of literature on this subject has expanded tremendously.

The transfer of agricultural technology also plays a critical role for its adoption and dissemination by a farmer. Hence it is very important that the transformation of traditional agriculture into knowledge based agriculture requires expeditious transfer of research results

from the laboratory to land. The technologies must be adapted and disseminated among farmers and this calls for successful technology transfer.

2.5.1 Technology Transfer

This approach to technology transfer involves a top-down approach where scientists determine research priorities, generate innovations they believe are good for farmers and provide the results to extension agents and subsequently to farmers (Antwi, 2009). Information about the innovation, including its likely benefits, is then passed to individual farmers on the assumption that this will encourage them to adopt the innovation. This conventional extension theory which is based on the central source model of technology development and diffusion, examines the role of various organizational arrangements and communication techniques in persuading farmers to adopt a recommended technology. In practice, farmers often do not adopt the new technologies and practices extended, for quite sound reasons. The research-driven nature of the top-down process can result in products that do not fulfil genuine needs of the farmer (Chamala et al., 2004). According to Antwi (2009) assumptions in the conventional paradigm or the technology transfer model include the following; knowledge is with the researcher, farmers receive knowledge from elsewhere, technology is "something" that can be transferred, technology is either adopted or rejected. The problems of non-adoption associated with this approach are due to poor communication of the technology between extension providers and farmer, or with the farmers themselves (Chamala et al., 2004).

2.5.2 The Farmer First

The farmer first model acknowledges that farmers often have sound local knowledge and good reasons for their behaviour, which may not be understood by scientists (Antwi, 2009). Farmers'

experience with experimentation and evaluation provides a basis on which scientists can learn from and with farmers to set research priorities. The farmer first approach objective is to empower farmers to learn and create better situations for themselves rather than being passive recipients of new technology. The process is bottom-up with emphasis on bringing about changes that farmers want. An important limitation of the farmer first approach is that significant off-farm structural forces (social, political and cultural), which inevitably shape farmer priorities and decision-making, can be overlooked (Antwi, 2009).

2.5.3 The Participatory Approach (model)

The participatory model is based on cooperation and participation. It arises from the recognition by many agricultural researchers, extension personnel, and farmers of the need to view agricultural problems as a complex human activity system (Antwi, 2009). The emphasis of this approach involves key stakeholders in a cooperative and flexible process that facilitates the implementation of activities to achieve practical improvements.

The focus of farmer participatory research is the development of agricultural technology to increase productivity. This centres on the identification, development or adaptation, and use of technologies specifically tailored to meet the needs of small, resource-poor farmers. Technology must emerge from the farmers' needs (demand – driven) as they identify them. Examples of this model that are employed in rural community level include; Rapid Rural Appraisal (RRA), Farmer Participatory Research (FPR) and Participatory Action Research (PAR).

2.6 Accessing Agricultural Technologies

Information regarding the existence of (new) agricultural technologies is of course a prerequisite for technology adoption. Such information can be obtained from various external sources, such as extension agents, fellow farmers or different media such as mobile phones, TV or radio (Heike, 2012). Importantly, farmers will also require the necessary information to assess the suitability of the technology for their farming system and to understand the potential risks associated with the use of the technology. For instance, farmers may be uncertain about the profitability of the new technology or differences in economic returns between new and old technologies. Such uncertainties may arise due to insufficient knowledge about yields of new technologies, the types and costs of needed inputs, or expected market prices and demand for the produce (Abadi & Pannell, 1999). Weather conditions and climatic shocks also increase uncertainty and risk, in particular among subsistence farmers who are dependent on rainfall (Kaliba et al., 2000).Information from external sources, such as agricultural extension agents, radio, TV or newspapers, can play a central role in the assessment of suitability and risk of a technology (Heike, 2012).

A study of maize adoption in Tanzania, for instance, showed that high intensity of extension services was one of the major factors positively influencing the adoption of improved seeds (Kaliba et al., 2000). Farmers may also gather information through experimentation (‘learning by doing’). Evidence suggests that imperfect knowledge of the technology as a barrier to adoption decreases with experience (Abadi & Pannell 1999; Foster & Rosenzweig, 1995). Foster and Rosenzweig (1995) found that farmers with experienced neighbours were more likely to devote more land to new technologies. Vicinity alone may not be sufficient, rather farmer’s proximity is crucial (Conley &Udry, 2001).

Access to financial resources and services is another important enabling factor for technology adoption from a support project, in particular where financial capital is required to obtain the technologies and associated inputs (Heike, 2012). Wealthier farmers or those with off-farm income may be more willing to bear the financial risk in case the technology does not perform well (CIMMYT, 1993; Kebede, 1992 cited in Marra et al., 2003). Financial resources may also be available to smallholder farmers through loans. Perhaps the seasonality of agriculture and climatic variability can hinder regular repayments. In particular, in the case of smallholder farmers, limited access to credit may provide an important constraint to technology adoption as lenders may be unwilling to bear the high transaction costs of small disbursements (Poulton et al., 2006). At times, access to credit may also be linked to the use of particular inputs, thus limiting technology choices (CIMMYT, 1993).

Famers may also be more willing to adopt new technologies if their financial risks were reduced through insurance schemes to protect against crop failure e.g. due to drought or floods (Heike, 2012). Insurance schemes for smallholders are subject to similar challenges as credit, however. In particular monitoring and paying out dispersed and small insurance claims can be costly for the insurer (Poulton et al., 2006).

2.7 Factors Influencing Farmers' Decision to Participate in a Support Project

Farmers' participation in agricultural projects has a direct bearing on technology awareness, adoption, livelihoods, environment, nutrition, poverty, performance of the agricultural sector and the macro economy (Chambers, 1983). Smallholder farmers are dispersed, and this makes provision of support services expensive and ineffective (Edward et al., 2013). Production is also largely rain-fed with limited mechanization and inadequate use of improved technologies such

as high and stable yielding crop varieties, good agricultural practices, fertilizers, and other agro-inputs. These among many other things have contributed to the observed low levels of productivity in the agricultural sector (Chamberlin, 2007).

Cereals are major crops of importance to the agricultural sector of Ghana. Northern Ghana, which comprises - Northern, Upper East and Upper West regions - accounts for over 40 percent of agricultural land in Ghana and is considered the breadbasket of the country (MoFA, 2010). This has established the baseline of the type of food crop that is cultivated by most project and agricultural improvement intervention by many private investors and nongovernmental organisations project implementation. The most important food crops in northern Ghana are maize, rice, sorghum, pearl millet, cassava, groundnut, cowpea and soybean. For most farm families, cereals are the most important staples. The importance of maize is demonstrated in its expansion to even the drier areas of northern Ghana where it has virtually replaced sorghum and millet which were traditional food security crops in the region (Edward et al., 2013).

The northern region however is inundated with high levels of food insecurity and poverty and its inhabitants face annual food deficit and are net buyers of food (GSS, 2008), which is a major concern to the government and its development partners. About 80 percent of the population depends on subsistence agriculture with very low productivity and low farm income (MoFA, 2010). These worsen poverty and high food insecurity due to over reliance on rain-fed agriculture under low farm input conditions. Masara N'Arziki project in its project intervention has tapped these food stable as a potential to grow maize across the northern region on Input-Credit and provide extension training to farmers in groups.

The importance of maize to Masara N'Arziki project is demonstrated in its expansion to even the drier areas of northern Ghana where it has virtually replaced sorghum and millet which were traditional food security crops in the region. Most smallholder and emerging farmers are faced with a range of technical and institutional factors influencing marketing access. Whereas the marketing infrastructure is poorly developed, smallholder and emerging farmers lack supportive organizations that represent and serve them (Magingxa and Kamara, 2003). These factors reduce smallholder and emerging farmers' incentives to participate in formal markets. In the opinion of Aliber et al. (2010), a reduction in formal market participation, in turn, makes it difficult for these farmers to shift into commercial farming and thus, a reduction in economic development.

The majority of the farm communities in the Northern region consist of subsistence farmers who are not in a position to use high quality seeds, sufficient fertilizers and improved farm implements due to the lack of finances available to them. Lack of finance is one of the main reasons for low per acre productivity in our agriculture (Naushad et al., 2009). The matter of enhancing agricultural productivity therefore depends on the availability of finance and credit facilities available to the farmers in their respective areas (Ahmad, 2007).

The behaviour of farmers, by the study of Burton et al. (2008), clearly states that, rural farmers are very rational and are economic actors who can prioritise financial gain above all other factors. For many, farming is expressed as a lifestyle choice as well as a business, with a range of complex factors coming into play affecting how they make business and wider management decisions. Nevertheless, financial motivations are listed alongside the fit with existing management plans as the main reasons for farmers' participation in any farmer support project

schemes. This demonstrates that economic priority is still central, if not always the final determinant of decisions.

Ervin and Ervin (1982) and Feder et al. (1985), noted that most of the studies related to adoption of conservation practices have simply used farm and farmer characteristics without providing the rationale for their inclusion based on theory. McConnell (1983), used production theory where a farmer has an objective to maximize profit; Ellison and Fundenberg (1995), employed a version of innovation diffusion whereas studies such as Swinton and Quiroz (2003a; 2003b), Marra et al. (2001), and Norris and Batie (1987) used household model based on utility maximization.

A farmer may depend on information diffusion from external parties to learn about a new technology (Shaw 1985; Ellison and Fudenberg, 1995; Knox et al., 1998; Marra et al., 2001). Before making his or her decision to participate in any support project that is brought to a farmer's attention, he/she looks at the monetary incentives, whether the capacity is there to implement the practice, and what constraints he/she is facing (Ervin and Ervin, 1982; Reardon and Vosti, 1995; Clay et al., 2002).

According to Etwire et al. (2013), farmers' participation in agricultural projects has a direct bearing on technology awareness, adoption, livelihoods, environment, nutrition, poverty, performance of the agricultural sector and the macro economy.

Participation refers to involvement of individuals and groups in development processes with the aim of ensuring self-reliance and better standard of living (Nxumalo and Oladele, 2013).According to Nxumalo and Oladele (2013), without participation there would be no

program and no development. Farmer's participation in agricultural projects can either be nominal, consultative, action-oriented or collegial (Etwire et al., 2013).

Empirical work on factors that influence farmer's participation in agricultural projects is limited especially with respect to Ghana and the Northern region (Etwire et al., 2013).

The more technically complex an innovation is, the less attractive it is to farmers. The decision of whether or not to adopt or participate in a new technology will be based on careful evaluation of a large number of technical, economic and social factors associated with the technology. The economic potential of new technology in terms of yields, costs of production and profit are also very important factor for adoption decision. Typically, however, the economic impact of an innovation is not known in advance with certainty. Unfamiliarity with the new technology makes the initial impact on yields and input usage uncertain.

The adoption of modern technology is urgently required to increase productivity so as to meet the increasing demand of food for rapidly growing population. According to Karki (2004), the adoption of modern technologies, especially in subsistence farming, would be governed by a complex set of factors such as human capital, information, location, resource endowments and institutional support. Within this frame condition, farmers' decision depends on their needs, cost incurred and benefit accruing to it would be the major motivating factors for the acceptance or rejection of a particular technology (Karki, 2004).

The determinants of farmer participation in a new technology or project, which is also considered as variables which greatly affect or influence their decision, depends largely on the objectives of the project or technology as well as how a farmer clearly makes rational decision which convinces him or her to make an informed judgment to participate or not. This informed

choice of small scale farmer also has a direct relation with how positively or negatively his output is affected in the long run. For example, farm size, timely availability of credit, extension service, technical training, family size, off-farm income, education level, affiliation to farmers' groups, and participation in the project activities, experience of the farmers (age), and food security are some of the determinants or factors that can influence a small scale farmer's decision to participate in a new technology or project (Karki, 2004).

Literature suggests several theoretical or conceptual models on farmers' decisions to adopt new technology (Feder & Slade, 1984; Abadi & Pannel, 1999; Negatu & Parikh, 1999; Isham, 2002). According to Ephraim (2005), factors influencing technology adoption decisions include farm size, risk exposure and capacity to bear risks, human capital, labour availability, land tenure, access to financial and produce markets, access to information, participation in off-farm activities, social capital, household characteristics and ecological and environmental factors. Feder & Slade (1984), develop a model of technology diffusion based on human capital and land constraints. Their model postulates that farmers with more education and larger land will have more knowledge of improved farming systems and are likely to adopt technology more rapidly. Isham (2002) extends the model of Feder & Slade (1984), by incorporating social capital as a fixed input into the decision to adopt technologies. This extended model predicts that farmers with neighbours who adopt the technology, and those with higher levels of social capital, accumulate more information and adopt technology more rapidly. Abadi& Pannell (1999), place emphasis on the role of learning by doing and the impact of the learning on personal perceptions of the innovation.

In summary the decision of farmer to participate in any support programme and adoption of practices under consideration are made based on the following assumptions:

i. The farmer's primary objective is to be food secure;
ii. The farmer wants to generate farm revenues to meet household cash obligations;
iii. The farmers are risk averse hence those living in geographical areas with erratic rains want to reduce risk as much as possible and thus those soil and water conservation (SWC) practices that have a quick effect on productivity and reduce yield variability are more appealing to them;
iv. The farmers are discouraged to engage in land management practices due to input and output price variations, poor accessibility to output and input market, and poor flow of information (e.g. on technologies, markets and cropping practices) brought about by poor infrastructure;
v. The farmers face constrained resources in land, labour, management skills and capital hence activities and practices that ameliorate the pressure on these resources are more appealing to farmers.

2.9 Farmer Learning and Adoption of Technology from Project Participation

The process by which a new idea spreads among people in an area is known as diffusion. Not all farmers will accept a new idea at the same time. In any rural community, the readiness to accept new ideas and put them into practice varies from farmer to farmer depending on each farmer's previous experience with new ideas, the personality of the farmer and the amount of land and other resources available. The different categories of farmers in terms of their abilities to adopt new ideas involve the following:

Innovators: Innovators are farmers who are eager to accept new ideas. Usually there are only a few people in this class in a farming community. They are often farmers who, having spent some years outside the village, feel that they can make their own decisions without worrying about the opinions of others. In rural communities, innovators are often looked on with suspicion and jealousy. Yet they are important to the success of an extension programme since they can be persuaded to try new methods and thereby create awareness of them in the community.

Early adopters: Farmers who are more cautious and want to see the idea tried and proved under local conditions are known as early adopters. They express early interest but must first be convinced of the direct benefit of the idea by result demonstration. Usually this group of farmers includes local leaders and others who are respected in the community.

The Majority: If the rest of the farmers adopt a new idea, they will do so more slowly and perhaps less completely. Many farmers will lack the resources to adopt the new idea at all, while others may only do so slowly and with caution. The majority who can and do adopt the idea are likely to be more influenced by the opinions of local leaders and neighbours than by the extension agent or the demonstrations he arranges.

Different types of learning are involved in extension. Before a group of farmers can decide to try out a new practice, they must first learn of its existence. They may then have to learn some new skills. Four stages can be identified in the process of accepting new ideas.

i. **Awareness**: A farmer learns of the existence of the idea but knows little about it. Interest: The farmer develops interest in the idea and seeks more information about it, from either a friend or the extension agent.

ii. **Evaluation**: How the idea affects the farmer must now be considered. How will it be of benefit? What are the difficulties or disadvantages of this new idea? The farmer may seek further information or go to a demonstration or meeting, and then decide whether or not to try out the new idea.

iii. **Trial**: Very often, farmers decide to try the idea on a small scale. For example, they may decide to put manure or fertilizer on a small part of one field and compare the result with the rest of the field. To do this they seek advice on how and when to apply fertilizer or manure.

iv. **Adoption**: If the farmers are convinced by the trial, they accept the idea fully and it becomes part of their customary way of farming.

Negatu and Parikh (1999), review three groups of models on the adoption of agricultural technologies by smallholder farmers:

i. The innovation-diffusion or transfer of technology model, in which technology is transferred from its source to the smallholder farmer through an intermediary such as an extension system, and the diffusion of the technology depends on the characteristics of the farmer.

ii. The economic constraint model takes the view that farmers have different factor endowments and that the distribution of endowments determines the adoption of technology.

iii. The technology characteristics-user's context model assumes that the characteristics of the technology and the underlying agro-ecological, socio-economic and institutional circumstances of farmers play a central role in the adoption of technology.

2.10 Challenges of Smallholder Farmers in Support Project

There are various constraints that impede the growth of smallholder farmers varying from systems constraints and allocative constraints to environmental-demographic constraints (Kirsten et al., 2006). Some of the systems constraints are lack of access to land, poor physical and institutional infrastructure. The background of smallholder farmers from literature suggests that one of the main constraints that smallholder farmers face is poor access to sufficient land. According to Van Rooyen et al. (1987), smallholder farmers in traditional agriculture will generally be capable of making rational economic decisions if the technical and economic constraints they face are removed. The fast increasing urbanization of Northern region is fast catching up with the peri-urban and rural communities which invariably make farming lands very difficult to access. Land is arguably the most important asset in primarily agrarian rural societies especially in the rural areas of Northern region but is lacking in both ownership and size (MoFA, 2010). There are restrictive administrative and social structures such as land tenure that should be improved. Most smallholder farmers have limited access to land and capital and have received inadequate or inappropriate research and extension support resulting in chronically low standards of living (Kirsten & Van Zyl, 1998). This is due to the unproductive and inefficient use of land in the absence of appropriate research and extension services.

Agriculture is largely carried out under increasing pressure of scarce land resources managed under insecure customary land ownership and communal grazing land are due to fast increasing rate of arable lands converted to construction projects. These insecure tenure systems such as communal land tenure system constrain the farmers from producing to their highest potential (ECA, 2009). The plight of small scale farmers in the Northern region necessitates the need to invest in land improvements and maintain existing improvements to increase productivity. Most smallholder farmers are located in the rural areas, particularly in the former homelands where they are challenged with an array of problems ranging from high cost of inputs, difficulty in accessing credits, efficient markets, road network and low productivity.

Lack of access to proper roads, for example, limits the ability of a farmer to transport inputs, produce and also access information (Delgado, 1998). Lack of assets, information and access to services hinders smallholder participation in potentially lucrative markets. A poor road network and unreliable distribution will force farmers to grow their own food and less of perishable commodities causing a lower productivity of resources employed. Increased costs of transportation will also affect inputs used and the market strategies followed by the farmers. This means that provision of good infrastructure is a requirement for achieving higher levels of agricultural productivity and profitability.

Many farmers receive low prices for their cash crops by selling them at their farm gate or local market. However, these same farmers could receive much higher prices by selling their goods in urban centres (Ashraf, Gine & Karlan, 2008). In addition, small scale farmers face a lot of challenges participating in agricultural project in finding reliable markets for their perishable goods which is one of the sources of transaction costs, due to low bargaining power of a farmer whose product is spoiling.

Smallholder farmers have little marketing knowledge and selling skills as well as little recognition of opportunities for product diversification or the links between market research and product development (Kirsten & Van Zyl, 1998). This affects their competitiveness on the markets. The smallholder farmers' lack of knowledge also limits and challenges them in terms of adopting new technologies. Delgado (1998) suggests that market reforms are necessary to lift the barriers to market participation by smallholder farmers but they often fail to address the more hidden reasons for non-participation in markets, such as lack of information, fear of unenforceable contracts and lack of skills for dealing with foreign buyers.

The investments of private and non-governmental farmer support project into credit delivery to small scale farmer in Northern region with less or no government participation create an opportunity for some famers to be exploited by these private institutions or organizations. Improving access to credit is often regarded as one of the key elements in raising agricultural productivity. Allocative constraints are those factors which directly affect the farmer in making optimising decisions and over which the farmer has some control such as liquidity (Kirsten et al., 1998). This implies that smallholder agricultural growth will not be achieved without access to support services.

Perhaps, the need to be food secured drives many of these Smallholder farmers to participate in support project since acute food insecurity at the household level is directly related to poverty. Poverty remains the main factor in household food insecurity. Poverty has various manifestations including lack of income and productive resources sufficient to ensure sustainable livelihoods, hunger and malnutrition, ill health, limited or lack of access to education and other basic services, increased morbidity and mortality from illness,

homelessness and inadequate housing, unsafe environments, social discrimination and exclusion (Frye, 2005). Enhancing food security and poverty alleviation have been a central preoccupation for mankind especially in sub-Saharan Africa where hunger persists and has been increasing in recent years (Dixon & Minae, 2006). Food security at the individual, household, regional and global level is achieved when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active healthy life (Drimie & Mini, 2003, citing Overseas Development Institute, 1997). This definition implies that the concept of food security is made up of important aspects of availability, accessibility and nutritional value of food.

Doni (1997) suggests that factors such as information sources, uncertainty and compatibility of the development objectives are factors that led to the farmer support programmes being rendered unsuccessful to some extent. It therefore follows that the factors affecting the success of smallholder farmers after intervention start right from the implementation stages of the initiative.

According to the findings of Doni (1997), the most important reason for not participating in the farmer support programme was lack of information and clarity on the programme. This means that dissemination of information is an important factor that determines farmer participation in any development initiative. Farmers should understand what is embodied in the initiatives. It should also be noted that to some extent the understanding of farmers depends on their level of education and experience in business. Lack of understanding is a reflection of poor clarity of the information given to farmers by implementing agencies. The role of extension officers actually determines sustainability of development initiatives in the long run, because the

knowledge the farmers gained and understood from extension officers will enable them to be sustainable and succeed in the future (Oettle & Koelle, 2003).

Uncertainty on the outcomes and conditions attached to those benefiting from development initiatives is ignored if information dissemination is very poor on the part of project technical managers. Coetzee et al. (1991) suggest that good intentions in development often result in failures and pain for those at the receiving end due to the neglect of the risk factors inherent in financial transactions. As far as formal credit is concerned, where a selection criteria is used, farmers are not certain of their outcome probably because of the dynamic nature of the farming business such that they do not seek credit even when the initiative is available.

A study by Coetzee et al. (2002) shows that households do not seek formal credit for reasons such as, they are not aware of the availability of formal credit, they lack profitable investment opportunities, and they may be too timid to request formal loans because of the cost of borrowing. Doni (1997) also came up with the same conclusion that farmers may not participate because they are afraid of debt. The final decision is made by farmers to make an informed choice whether they would be able to produce enough to meet their debt commitment. It is pointed out that the default rate for the credit facility in this study was extremely high as some farmers thought that the facility was a government grant and they were not obliged to pay it back. According to MoFA (2010), this situation persists in northern Ghana which appears to be one of challenging problems of poor recovery rate of block farm programme under the Youth in Agriculture Programme. This affects and scares farmers to participate in similar project especially private organizations since the consequences of a poor defaulter rate will be dire for the smallholder farmers.

Smallholder farming is the dominant agricultural activity in most developing countries, particularly the northern part of Ghana. Invariably most of Ghana undernourished people and people living in absolute poverty are concentrated in northern part of Ghana (FAO, 2010).

Despite views that small farms are not viable and are not competitive with more mechanised and capital intensive larger farms, and hence the prediction that they will soon disappear (IFAD, 2009), smallholder farms have proved remarkably persistent. Indeed, the area operated in small farms in the developing world appears to be rising rather than falling, although average farm sizes continue to decline in large parts of the developing world. Investments in smallholder farms can pay off handsomely in terms of increases in income in rural areas, and through linkages effects, to poverty reduction on a sustainable basis (IFAD, 2009). Globally, significant changes in the political, economic and social circumstances are affecting the smallholders, many of them adversely, but some positively. Climate change, low investments and declining productivity, withdrawal of state support and institutions helping the development of the smallholder sectors are constraining them in becoming the engine of growth that many would like them to be.

Although there is a significant body of knowledge on the problems faced by smallholders, recent years have seen a lively debate about their future because of significant changes in their economic environment which are caused by challenges, some of which include:

- Rapid integration and globalization of food market chains that have opened up new high value opportunities for some farms, but made market access more difficult for many small farms due to high transactions costs by many projects which they benefit from and the need to meet credence requirements.

- Inability of smallholder farmer to withstand the growing competition from larger and more capitalized farms that can capture economies of scale in production and marketing, especially for food staples.
- The continuing miniaturization of small farms makes it difficult to provide viable farm incomes to support a family, especially from food staples and other low value products. Smallness in combination with poverty can also lead to resource degradation, which over time can cause downward spirals of worsening degradation and poverty.
- Privatization of agricultural research has led to the neglect of many small farm problems.
- Climate change is adding to the risks that small farmers must manage and may eventually undermine their longer term productivity.
- Private financial institutions, NGOs, relief agencies, and community and producer organizations have also emerged as important players in supporting small farms. Too often these different agencies do not work together in a coordinated way and many small farms fall between the cracks and do not receive the support they need to operate as successful farmers.
- Challenge of improving productivity and sustainability of small farms: Shifting to higher value products can add significantly to land and labour productivity, but small farms also need access to improved technologies and knowledge to remain competitive, raise productivity and improve environmental stewardship and sustainable natural resource management.

- Access to profitable modern inputs and credits for production: Credit based farming system from support projects have not profitably benefited many smallholder farmers due to high cost of repayment of input received for production.

Smallholder farmers in northern Ghana have been recipients of various forms of agricultural support over the years, but that notwithstanding their situation does not appear to have improved very much. Careful examination reveals certain challenges that have contributed to the poor performance of small scale farming and the lack of improvement in farmers' situations. The support they have received and continue to receive does not address the totality of their needs (Selasi, undated). For instance, farmers have been supported with productive inputs and technology, with infrastructural support, with credit and market information or with support with processing and storage.

According MoFA (2010), there are many projects and programmes which are scattered in different geographic locations in northern Ghana but are totally de-linked from each other thus denying farmers the synergies that different levels of support could offer. The lack of continuity in the chain of support, with production level support being subsequently complemented with support with processing and then with marketing has contributed to denying small farmers the benefits they should derive from their farming activities (Selasi, undated).

In addition, many of these support projects place more emphasis on food production to the neglect of more market oriented production systems which is the most vital stage where famers must pay attention to their production. According to IFAD (2009), the problem of food security in the farming communities of northern Ghana must not be only concentrated on availability alone since it has not demonstrated to be sufficient and adequate in ending hunger and poverty.

Food insecurity today is also an access problem, which denies even farmers the economic entitlements necessary to access food so that supporting intensified production or diversification must be complemented with market access in order to raise rural people's incomes (Selasi, undated).

In the words of Rottger (2002), small farmers cannot remain only producers of foodstuffs, but have to take on the additional role of entrepreneurs in order to improve their livelihoods and move beyond subsistence farming. Quite obviously, addressing rural poverty and food insecurity using agriculture requires investments of farmers growing beyond producing to meet household food needs but take agriculture as a business and must be assisted to produce to meet basic market standards of quality and safety and to effectively package their produce.

2.12 Summary of Issues in the Review

The chapter highlighted detailed review of literature on the objectives of the study. The main objective of the study was to examine the effects of the farmer support project on Smallholder farmers' output and income, a case study on Masara N'Arziki project. The literature review presented background information on the specific objectives of the study. The first topic under literature review presented a background and prospect of farmer support project to Small scale farmers. Small scale farmers according Todaro (1989) are farmers owning small-based plots of land on which they grow subsistence crops and one or two cash crops relying almost exclusively on family labour. Research has revealed that smallholder farmers, especially in northern Ghana, are still very poor and they depend on agricultural practices that have benefited them little from modern technology (FAO, 2008).

Literature on the adoption of agricultural by smallholder farmers initiate with the process of awareness of a need for the technology by the farmer. This is preceded by the interest of the farmer, evaluation, acceptance, trial, and finally adoption. The study extensively reviewed the three basic model of agricultural extension delivery which include; technology transfer, farmer first, and the participatory model. The transfer of technology generate innovations for farmers and provide the results to extension agents and subsequently to farmers referred to as top-down approach. The farmer first model also build on the knowledge of the where farmers' experience with experimentation and evaluation provides a basis on which scientists can learn from and farmers to set research priorities. This model is a bottom-up approach with emphasis on bringing about changes that farmers want. The participatory model involves more of participation and involves key stakeholders in a cooperative and flexible process with the goals of increasing productivity. In addition this also build on the theory technology must emerge from the farmers' needs (demand – driven) as they identify them.

The literature on the factors that determines smallholder farmers' participation in support projects has a direct bearing on whether or not to adopt or participate in a new technology with a careful evaluation of a large number of technical, economic and social factors associated with the technology. Some of the determinants of farmers' participation in support project include; farm size, risk exposure and capacity to bear risks, human capital, access to financial and produce markets, access to information, participation in off-farm activities, social capital, household characteristics and ecological and environmental factors.

However the readiness to accept new ideas and put them into practice varies from farmer to farmer and also depends on the farmer's previous experience with new ideas, the personality of

the farmer and the amount of land and other resources available. The different categories of farmers in terms of their abilities to adopt new ideas involve the following: Innovators (farmers who are eager to learn new ideas), early adopters (farmers who express early interest and must first be convinced of the direct benefit of an idea) and the majority (farmers who adopt a new technology on a slow pace and perhaps less completely).

The challenges that impede the growth of smallholder farmers are lack of access to land, poor physical and institutional infrastructure. The background of smallholder farmers from literature suggests that one of the main constraints that smallholder farmers face is poor access to sufficient land. In addition lack of access to proper road limits the ability of a farmer to transport inputs, produce and also access information in potentially lucrative markets.

More so many farmers receive low prices for their cash crops by selling them at their farm gate or local market. This is as results of some smallholder farmers have little marketing knowledge and selling skills as well as little recognition of opportunities for product diversification or the links between market research and product development.

Indeed small farmers must not remain only as producers of foodstuffs, but have to take on the additional role of entrepreneurs in order to improve their livelihoods and move beyond subsistence farming. Smallholder farmers must take up the challenge to grow beyond producing to meet household food needs and probably go into agriculture as a business, and with the required assistance they would produce to meet basic market standards of quality and safety and to effectively package their produce for bigger market.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the study area and the methodology that was used to carry out the research. It provides an explanation of how this study was conducted. Specifically it deals with the sampling procedure and size, data collection and sources, instruments of data collection, field work, data processing and analyses. Panneerselvam (2004) defines research methodology as 'a system of models, procedures and techniques used to find the results of a research problem.'

The individuals in the sample frame from the study area were selected with the appropriate procedures and techniques to respond to the survey questions. Data collection was done by methods of survey, interviews and focus group discussion. The data analysis for this research employed econometric models including probit model, propensity score matching. In addition simple tools like statistical tables, charts and frequency distributions were also used in the data analyses process.

3.2 Research Design

The research design refers to the overall strategy that you choose to integrate the different components of the study in a coherent and logical way, thereby ensuring effective address of the research problem (De Vaus, 2006). It articulates what data is required, from whom, and how it is going to answer the research question. The function of a research design is to ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible (USC Libraries, 2016). The research design specifically for this survey was the case

study design. Thomas (2011) defines case study design as "analyses of persons, events, decisions, periods, projects, policies, institutions, or other systems that are studied holistically by one or more method". The case study research is the subject of the inquiry which gives an instance of a class of phenomena that provides an analytical frame, an object within which the study is conducted and which the case illuminates and explicates.

Robert (2014) also defines it as an empirical inquiry that investigates a phenomenon within its real-life context. The research design for this study was a mix case-study research of both quantitative and qualitative data. The study described the operations of Masara N'Arziki project in the Northern region as well as evaluates the effects of the project on the smallholder farm output and income. The case study design was employed with a narrowed outcome of Masara project operations in the Savelugu-Nanton Municipality of the Northern region of Ghana.

3.3 Study Area

The Northern region, occupies an area of about 70,384 square kilometers or 31 percent of Ghana's area, and it is the largest of the ten regions in Ghana in terms of land mass (GSS, 2010). It has a total population of 2,479,461 (GSS, 2010) with more females (1,249,574) than males (1,229,887) and it is the fastest growing region in Ghana after Central and Greater Accra region (GSS, 2010). The region shares boundaries with the Upper East and the Upper West regions to the north, the Brong Ahafo and the Volta regions to the south, Togo to the east, and Côte d'Ivoire to the west (see Fig. 3.1). The land is mostly low lying except in the north-eastern corner with the Gambaga escarpment and along the western corridor. The region is drained by the Black and White Volta Rivers and their tributaries such as the Nasia and Daka rivers.

The region currently has 25 districts including one Metropolis and 3 Municipalities. Each Municipality/District Assembly is headed by a Chief Executive who administers the district (GSS, 2010). The districts are autonomous with regard to planning and budgeting of projects. The main administrative structure at the regional level is the Regional Co-ordinating Council (RCC), headed by the Regional Minister. Other members of the RCC include representatives from each District Assembly, regional heads of decentralized ministries, and representatives of the Regional House of Chiefs. The Regional Coordinating Director acts as the secretary to the Council (RCC-Tamale, 2010).

Figure 3.1: Map of Northern region **Source:www.google.com/search**

Agriculture, hunting and forestry are the main economic activities in the region. Together, they account for the employment of 71.2 percent of the economically active population, aged 15 and 45 years. About 7.0 percent of the economically active people in the region are unemployed. The private informal sector absorbed 83.4 percent of the economically active population. An additional 11.5 percent are in the private formal sector leaving the public sector with only 4.3

percent. The climate of the region is relatively dry, with a single rainy season that begins in May and ends in October. The amount of rainfall recorded annually varies between 750 millimetres and 1,050 millimetres. The dry season starts in November and ends in January/February with maximum temperatures occurring towards the end of the dry season (January/February) and minimum temperatures in December and January. The harmattan winds, which occur from December to early February, have a considerable effect on temperatures in the region, making them vary between 14ºC at night and 40ºC during the day. Humidity is very low, aggravating the effect of the daytime heat. The rather harsh climatic conditions adversely affect economic activity in the region and in the health sector, enable cerebrospinal meningitis to thrive, to endemic proportions. The region also falls in the onchocerciasis zone. Even though the disease is currently under control, a vast area is still under-populated and under-cultivated due to past ravages of river blindness. The main vegetation is grassland, interspersed with guinea savannah woodland, characterised by drought-resistant trees such as acacia (Acacia longifolia), mango (Mangiferaindica), baobab (Adansoniadigitata), shea nut (Vitellariaparadoxa) and neem (Azadirachtaindica).

3.3.1 Profile of Savelugu-Nanton Municipality

The Savelugu-Nanton Municipality was carved out of the Western Dagomba District Council in 1988 under the PNDC Law 207. It became a Municipality in 2012 under the Legislative Instrument (LI) 2071. Savelugu-Nanton municipality is located at the northern part of the northern region of Ghana. It shares boundaries with West Mamprusi to the north, Karaga to the east, Kumbungu to the west and Tamale Metropolitan 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 1,790.70 sq. Km (wikipaedia, 2015).

The municipality is generally flat with gentle undulating low relief. The latitude ranges between 400 to 800 ft. above sea level with the southern part being slightly hilly and sloping gently towards the North. The middle and upper Voltaian sedimentary formation characterise the geology of the municipality. The middle Voltaian covers the northern part of the municipality and comprises sandstone, shale and siltstone. The upper Voltaian covers the southern part of the municipality and consists of shale and mudstone. Underground water potential is generally determined by this underlying rock formation. Savelugu-Nanton municipality was 91,415 (2000 population census).This has grown to 139,283 during the 2010 Population and Housing Census (PHC) (GSS, 2010). This shows an unprecedented growth rate of 52% within ten years. The population is broken down into 67,531representing 49.7% male and 71,752 representing 50.3%, female, and a population density of about 78 persons per sq. Km (GSS, 2010). The communities are administratively demarcated into one urban/town council (Savelugu, the district capital) and five area councils, namely, Nanton, Diare, Pong-Tamale, Moglaa and Tampion. The 143 other communities could be described as rural. Nearly 80% of the populace resides in these rural communities and 20% in the few urban towns. Income levels are generally low (Savelugu-Nanton district information, 2015). This is due to the fact that majority of the populace depends on rain-fed agriculture. Income levels are low for women than for men. Gender distribution and access to resources is one factor for the poor income levels of women. The culture of the people posits the male sex at an advantageous position in resource ownership such as land for farming and leadership positions. Positions held by women are those that may not command authority. Giving that agriculture is the mainstay, less access to land for agricultural purposes is a possible

reason for the low level of income among women. The cash crops include sheanut, cotton and cashew. The sheanuts are found in the whole area and they form part of the natural vegetation. In the north, from around Disiga into the Nasia Tributaries Forest Reserve, there is vast natural sheanut vegetation cover.

The municipality is blessed with vast arable land with potential for both livestock and crop production. There are a number of tourism potentials in the municipality among which include the Saakpuli slave market, Tuunaayili, the former seat of the Dagomba Kingdom, Yoggu, which is said to be where the chief priest settled long ago and an Oxbow lake at Zonchangni (Savelugu-Nanton district information, 2015). Among the tourism potentials, it is the Saakpuli Slave Market that attempts are being made to develop and preserve. The state of development is a tourist reception constructed through community initiative. The river Kuldanali, a tributary of Volta River near Kodugzegu village, provides beautiful scenery which could be developed into a boating and water recreational resort. It is located about 17km west of Savelugu. The historic village of Yeni Dabarii is located some five kilometres off the main Tamale – Bolgatanga trunk road near Gusheigu. It is claimed that the village was a major slave trade route. It was once an active and busy slave market and a commercial centre and it served as a stopover or resting point for slave traders. The municipal remains an agriculture-based economy. The sector engages about 97 percent of the labour force, majority of who produce staple crops at subsistence level. Cash crop production is very minimal and includes sheanut, soya beans, cotton and cashew. Agro-processing is generally done by traditional methods and on very Small scale basis. There are, however, efforts by external support agencies to upgrade technologies, especially for women in the processing of sheanut, groundnuts, rice, cotton ginnery, and soap manufacturing.

The municipality is located in an area of the country with unfavourable natural environmental conditions. There is little tree cover and it suffers harsh harmattan season, which leads to many bushfires set up by farmers clearing their lands and hunters searching for game. Farming along river courses has also caused vast silting of the few drainage systems which therefore dry up quickly in the dry season and flood easily in the wet season.

3.4 Sampling Techniques and Data Collection

Choosing the appropriate sample depends on the kind of data analysis the researcher plan on. The accuracy of the sample depends largely on the researcher's purpose and the populations' characteristics (Neuman, 2003). Statistical equations such as Yemane and Cochrane were used to arrive at an appropriate sample size. Indeed practical limitations like cost also played a role in choosing a sample size for the study. Generally the larger the sample size, the smaller the sampling error. Also, the greater the homogeneity (the less the diversity) in a sample, the smaller its sampling error. However, Peil et al., (1982) point out that if a group is truly homogeneous, a larger sample is unnecessary or as Miller (1991) puts it there is no need interviewing a larger number of people saying the same thing. The research was made up of smallholder farmers participating in Masara N'Arziki project in the Savelugu-Nanton Municipality. The study considered Masara N'Arziki smallholder farmers in the Savelugu-Nanton Municipality due to the availability of Smallholder farmers of the project in the area to respond to the research questions. Farmers who have worked with the project for the past two years or more were the target population for the study. The study considered a sample of 118 of Smallholder farmers in the area. This sample was chosen by the Yemane's sample size calculation method, this procedure of calculation are shown in section 3.5.

The study employed stratified random sampling and simple random sampling approach to select respondents for the study. Stratified random sampling is a method of sampling that involves the division of a population into smaller groups known as strata. In stratified random sampling, the strata are formed based on members' shared attributes or characteristics. The population of the survey was stratified into participants and non-participants groups. A random sample from each stratum was taken in a number proportional to the stratum's size. These subsets of the strata were then pooled to form a random sample. The simple random is a type sampling method where every individual in the population has equal probability of been chosen. Simple random sampling was then used to randomly select the participants and non-participants from each stratum to form the respondents for the study. The sample size was determined by Cochran's and Yemane's sample size determination formulae (calculations in section 3.5). In all, a total of 195 farmer respondents were selected for the study.

Masara N'Arizki operates in four districts/municipality in the Northern region; Savelugu-Nanton municipality was selected due to the higher farmer groups the project has in the municipality. Masara N'Arziki project has a total of 16 farmer groups existing in the area (with an average membership of 10), across 24 operational communities. The study randomly selected 195 smallholder farmers among 14 communities of Masara project in the Savelugu-Nanton municipality (calculations in section 3.5). The survey interviewed 118 participants in the project who were considered as the treatment group. A control group of 77 non-participant farmers were selected by simple random sampling technique to form a total of 195 sampled respondents. Primary data forms the core of the data that was used in this study. The formal survey was preceded by an informal survey to obtain qualitative data on farmers' characters and practices

to develop the questionnaires. Primary data for the research was supplemented by informal interactions with Masra N'Arziki project technical field workers.

The validity and reliability of the research depends to a large extent on the appropriateness of the instruments (Godfred, 2015). The instruments used in the data collection were interviews with the help of questionnaires and supplemented by focus group discussion and observations. The data was collected from farmer respondents at the community level by direct interviews using structured and semi-structured questionnaires. Structured questionnaires provide predetermined closed-ended questions with option for respondents to choose from, and semi-structured questionnaires, both open-ended and closed-ended questions are used and respondents are at liberty to give unrestricted answers (Karma, 1999; Twumasi, 2001). Sample of the questionnaires used is found in the appendix.

The questionnaire for this study was pre-tested to reduce the state of ambiguities and unanswered questions as indicated by Ahuja (2007). The questionnaire was pre-tested in Libga community in the Savelugu-Nanton Municipality with three research assistants. After the pre-test the suggestions, comments and opinions given by the research team were incorporated to enhance the efficiency of the data collection process.

3.5 Sample Size Calculation Methods

Statistical equations and methods used for the study include; Yemane and Cochran sample calculation formulae were chosen as appropriate methods for the study. The finite population correction factor was then used to determine the adjusted minimum sample size appropriate for the study.

3.5.1 Masara N'Arziki Operational Communities

Masara project had 16 farmer groups operational in 24 communities. The study adopted the Yemane sample determination to select 22 communities out of the total of 24. This was further adjusted by the finite population correction factor and finally chose 14 communities to select individuals to respond to the survey as shown below.

According Yemane (1967), the sample size for a known population can be determined by the formula: $$n = \frac{N}{1+N(\propto)^2} \quad (3.1)$$

Where n = calculated sample size, N = sample frame (population) of the study and $\propto$ = margin of error (0.05) or a confidence level of 95%. Therefore the sample frame for the study was 24.

This implies $n = \frac{24}{1+24(0.05)^2}$ = 22 communities

This was then adjusted by the finite population correction factor. The principle behind this method states; when a sample represents a significant (for example 5%) proportion of the population, the finite correction factor can be applied (Smith, 1975). This will reduce the sample size required. The formula is written as:

$$n_a = \frac{n_r}{1+\frac{(n_r-1)}{N}} \quad (3.2)$$

Where n_a = the adjusted sample size, n_r = the original required sample size (22) and N = the population size (24)

This implies $n_a = \frac{22}{1+\frac{(22-1)}{24}} = \frac{22}{1.875}$ = 11.73 approximately 12

Therefore the adjusted minimum sample size was 12. However the study added additional 2 communities for the circumstance of inadequate/low response rate or non-availability for the adjusted sample size (12). Hence the study chose 14 communities to respond to the study.

3.5.2 Participants and Non-participants in Masara N'Arziki project

The Cochran's sample size formula was used to calculate the required sample for the participants in Masara project. The Cochran's formula is written as:

$$n_1 = \frac{n_0}{(1+\frac{n_0}{Population})} \quad (3.3)$$

Where n_1 is the final required sample for the study, n_0 is the Cochran's sample size for continuous data and the population is the size of the population of Masara project participants in the 24 operational communities. The population was determined by proportion. According to the 2010 population and housing census, Savelugu-Nanton Municipality has 149 communities with an estimated population of 139, 283 peoples. This implies the 24 operational communities of Masara project by proportion will be equivalent to 22434.

But Cochran's sample size for continuous data, $n_0 = \frac{t^2 \times s^2}{d^2}$ (3.4)

where t is the value for selected alpha level in each tail = 1.96, s is the estimate of standard deviation in the population = 1.167 and d is the acceptable margin of error = 0.21.

This implies $n_0 = \frac{(1.96)^2 \times (1.167)^2}{(0.21)^2} = 118$, substitute into Cochran final required sample formula, $n_1 = \frac{n_0}{(1+\frac{n_0}{Population})} = \frac{118}{(1+\frac{118}{22434})} = \frac{118}{1.0053} = 117.38$ Type equation here.

The total sample required was approximated to 118 participants for the smallholder farmers needed to respond to the study. The non-participants required to respond to the study were determined by the intuitive method and based on the judgment of the researcher; the study chose 48% of the total membership (160 farmers) of smallholder farmers in Masara project in the study area. Average samples of 5 smallholder farmers were chosen in Masara operational communities. Participants in Masara project were drawn through simple random sampling technique. Communities that had more than one group, samples drawn were more than the average 5 farmers selected. In all a total of 77 non-participants smallholder farmers were selected in the 14 communities for the study.

3.6 Data Analysis

The data collected for this research were analysed by the use of both descriptive and inferential statistical tools and techniques. Data collected were managed and analysed in order to give a good reflection of the work done. The data were thoroughly edited after entering to eliminate errors in order to ensure consistency. Coding was done manually for all respondents by grouping and compiling the questionnaires.

The econometric models employed to analyse the objectives were estimated with the help of Stata computer software, specifically this was used to analyse the factors that influence farmers' decision to participate in Masara project. In addition, propensity score matching estimation for farm output and income of the smallholder farmers was carried out with the Stata software. The spread sheet of Stata was designed for data entry, followed by coding and inputting the data from the survey questionnaires and running the analyses of the data. The results of data processing and analyses were generated in the form of percentages, tables and graphs for further

descriptive and inferential analysis. Percentages, graphs, chart and cross tabulation were used to present the data to make the results clear and accurate for understanding and correct interpretation of the information on the study. Qualitative data were analysed using descriptive statistics.

3.6.1 Theoretical Framework

Given the objective of the study, which is to determine the factors influencing farmers' decision to participate in Masara N'Arziki Input-Credit Support Project and its effects on the smallholder farmers' output and income, it is assumed that smallholder farmers choose between participating and not participating in Masara project. Assuming that farmers are risk-neutral, it may be assumed that in the decision-making process on whether to participate in Masara credit support project or not, they compare the expected utility of farm output from participation denoted as $U_A^*(\pi)$against the expected utility of farm output from not participating in the credit support project represented as $U_N^*(\pi)$ with net returns (π) representing farm income. The decision to participate in the project then occurs if $U_A^*(\pi)>U_N^*(\pi)$. Dropping other subscripts for expositional purposes, farmers' expected utility of participation can be related to a set of explanatory variables (Z) as follows:

$$U_A^*(\pi) = \gamma' Z + \varepsilon_i \quad (3.5)$$

Withγbeing a vector of parameters, the error term ε with mean 0 and variance σ^2captures the measurement errors and factors unobserved to the researcher but known to the farmer. The variables in Z include determinants of the participation decision such as Input-Credit support and extension training and household characteristics.

The utility derived from participation is not observable, but only the choice of participation or nonparticipation can be observed. This can be represented by a latent variable $D(\pi)$ that equals 1, if $U_A^*(\pi) > U_N^*(\pi)$ and 0 if $U_A^*(\pi) < U_N^*(\pi)$.

The probability of participation may then be expressed as:

$$\Pr(D = 1) = \Pr(U_A^*(\pi) > U_N^*(\pi)$$

$$= \Pr(\varepsilon_i > -\gamma' Z_i) \quad (3.6)$$

The decision of a farmer to participate in Masara project is as result of the higher expectation of farm output and net returns from the project. The decision to participate in the project is assumed that farmers are risk-neutral and that they maximize expected net returns instead of expected utility. This can be represented as:

$$Max\ E[PQ(W,Z) - RW] \quad (3.7)$$

where $E$is the expectation of the project information currently available to farmers; $P$is the output price and $Q$is the expected output level; $W$is a column vector of inputs and Za vector of farm and household characteristics; whereas $R$is a column vector of input prices. Net returns can be expressed as a function of the variable inputs, the output price, the household characteristics, and the technology choice $d$as follows:

$$\pi = \pi(R, d, P, Z) \quad (3.8)$$

With a specified normalized profit function, direct application of Hotelling's lemma yields the reduced-form specifications for input demand and output supply:

$$W = W(R, d, P, Z)$$

(3.9)

$$Q = Q(R, d, P, Z)$$

(3.10)

Equations (3.8), (3.9), and (3.10) indicate that net returns, input demand, and output supply are influenced by the technology choice, farm and household characteristics, output price, and input prices. The utility derived from participation (U_j^*)isnot observable, but only the decision of participation or non-participation is, which can be represented as a latent variable, D_j, expressedas:

$$U_j^* = \gamma' Z + \varepsilon_j j(j = Masara\ Project\ Credit\ Support)$$

(3.11)

$$D_j = 1\ if\ U_j^* > 0$$

$$D_j = 0\ if\ U_j^* \leq 0$$

Where$Z$are the independent variables used to explain the participation decision, $\gamma$is a vector of parameters to be estimated, and $\varepsilon$is the error term with $\varepsilon \sim N\ (0, \sigma)$.

The relationship between project credit support choice and the outcome variables can be analysed by considering the reduced form specification:

$$Y_i = X'\beta + u_i$$

(3.12)

Where$Y_i$represent outcome variables such as output supply, and net returns; $X$is a vector of explanatory variables consisting of household characteristics, output price, input price, and project support choice; and u *is* the error term with $u \sim N\ (0, \sigma)$.

3.6.2 Probit Model for Participation

The respondents for the survey are divided into participant group and non-participant group in Masara N'Arki Project. The latent variable y_i is defined, which is the utility index and stands for the utility a farmer enjoys participating in Masara N'Arzki Project; thus

$y_i = X\beta + \varepsilon$. Where the subscrip i t stands for the individual households, β is the coefficient and ε is the random disturbance and it is assumed to follow normal distribution. It is assumed that the decision of a farmer to participate in the project depends on the unobservable maximum utility index y_i. The utility index depends on series of independent variables X, which is a vector of influencing factors that potentially affect the participation decision of Smallholder farmer. Thus the larger the utility index, the higher the probability of participating in the Masara N'Arizki Project. There is threshold utility level y_i^*: if $y_i$exceed y_i^*, then the households would participate in the Project; if not, the farmer would be a non-participant. Since the utility is unobservable,$y_i$is assumed to be normally distributed. The probability that y_i exceeds y_i^*could be derived from the standard normal cumulative distribution function as follows:

$$P(Y = 1|X) = P\left(y_i^* < y_i\right) = F(yi) = \frac{1}{2\pi}\int_{-\infty}^{T} e^{\frac{-t^2}{2}}dt = \frac{1}{2\pi}\int_{-\infty}^{X\beta} e^{\frac{-t^2}{2}}dt$$

The variable "t" follows standard normal distribution. Y represents the farmer participate in the Masara Project or not.Y takes the value 1 if households choose to participate in the project and 0 if not. The Probit model of participation is as follows:

$$Y = \{ {}^{1}_{0} \; if \; y_i^* < y_i \; and \; if \; not \; otherwise$$

Accordingly, the empirical model is specified as follows:

$$(Y_{ir}) = \beta_0 + \beta_1 X_{1ir} + \beta_2 X_{2ir} + \cdots .. + \varepsilon_{ir}$$

The Participation(Y_{ir}) is a binary variable representing a Smallholder farmer $i$in community r participate in Masara Project or not, X_{1ir} is a vector of explanatory variables that may affect the probability of a farmer participating in the Project or not and ε_{ir} is the normal distributed random error term.

The empirical model for Masara N'Arziki project participation is specified as follows:

$$Y_i = \beta_0 + \beta_1 Mar + \beta_2 Edu + \beta_3 HHs + \beta_4 Age + \beta_5 \text{Pr}\_Exp + \beta_6 FExp + \beta_7 Off\_frInc + \beta_8 Fsize + U_i$$

(3.13)

Y_i and U_i represent decision to participate and the error term, respectively..

The probit model estimation is interpreted with the marginal effects; which is the partial probability effects of each explanatory variable on the observed dependent variable.

The marginal effect of the variables is calculated using the formula $\beta_i \emptyset(Z)$where β_i are the coefficients of the variable and $\emptyset(Z)$ is the cumulative normal distribution value associated with the mean dependent variable from the probit estimation.

The explanatory variables expected to influence the farmers' decision to participate in Masara project are presented in Table 3.1 below.

Table 3.1 Explanatory Variable in Probit Model

Variable	Definition	Expected Sign
Marital Status (Mar)	1 if male and 0 otherwise	+
Education (Edu)	Number of years of formal education	+
Household Size (HHs)	Number of Household members that assist in the farm	+
Age (Age)	Age of Household Head/farmer in years	-
Farming Experience (FExp)	Years of Experience of the farmer in farm production	+
Off farm Income (Off_frInc)	Dummy, 1 if a farmer engages in Off farm income and 0 otherwise	+/ -
Farm size (Ha) (Fsize)	Total farm size cultivated in hectares	+
Project Experience(Pr_Exp)	Dummy, 1 if a farmer has project experience and 0 otherwise	+

Married household head were expected to be willing to participate in Masara project than single household head. Nnadi and Akwiwu (2008), noted that marriage increases a farmer's concern for household welfare and food security which is therefore likely to have a positive effect on their decision to participate in an agricultural project.

Education is expected to positively influence a farmer's ability to source and decipher information including information on available agricultural projects and the benefits of participating in such projects. According to Nnadi and Akwiwu (2008), educated farmers are more likely to participate in agricultural projects in order to put into practice the knowledge they may have acquired in school. Faridet al. (2009), and Kahn et al. (2012), however observed a negative relationship between education and smallholder farmers' participation in agricultural activities.

A farmer with a large household can easily participate in an agricultural project whiles delegating other important activities to other household members and vice versa. Also, each adult household member could be a source of information or beneficiary of an agricultural project hence as a household size increases, the higher the likelihood of coming into contact with an agricultural project. Nxumalo and Oladele (2013) did not find any significant relationship between household size and farmer's participation in an agricultural project. Whereas Nnadi and Akwiwu (2008), and Faridet al. (2009), both found a positive relationship between household size and smallholder farmers' participation in agricultural activities, Oladejoet al. (2011), rather reported a negative relationship.

Age was expected to influence decision to participate in Masara Project negatively. According to Etwire et al. (2013), younger farmers are usually innovative, risk loving and may want to try new concepts.

Off-farm income was expected to be positively and negatively associated with participation. Household head that earns off-farm income may have little time to participate in any support project that is more labour intensive and demands frequent supervision and management due to the competing needs. Alternatively, household heads that earn off farm income may invest in adoption of improved varieties to increase their production.

The relationship between farm size and farmer's decision to participate in an agricultural project was expected to be positive. Farm size may be a proxy for level of commercialization hence farmers who decide to cultivate an additional hectare of land are usually moving away from subsistence production and are therefore more likely to participate in an agricultural project in order to have access to inputs, technology and output market. Most researchers have found a

positive relationship between farm size and decision to join a project or adopt a technology (Adimado, 2001; Kheralla et al., 2001).

The farmer experience was expected to increase his ability to participate and learn new technology of farming, especially the Masara project model to ensure that he is able to achieve much efficiency in the use of farm inputs to increase his yield. Highly experienced farmers are likely to have more information and knowledge on the agronomy of crop management practices. The project experience was expected to have positive effect on the output of the beneficiary farmers in the project since his previous experience and understanding of the model in Input-Credit crop production in other projects will definitely advise and guide him to manage his farm to pay for the input cost and increase his household food security after harvest season.

3.6.3 Propensity Score Estimation

The propensity score matching (PSM) technique was used to assess the effect of Masara farmer support project on farmers' output and income which draws from the work of Godtland et al. (2004) and Bernard et al. (2008). The PSM was used to determine whether the Masara Project actually influenced participant outcomes or is merely associated with successes (or failures) that would have occurred anyway.

The objective was to estimate the effects of factors influencing their decision to participate in farmer support project and how participation affects farmers' output and income. The greatest challenge in evaluating any intervention or programme is obtaining a credible estimate of the counterfactual: what would have happened to participating units if they had not participated. Without a credible answer to this question, it is not possible to determine whether the

intervention actually influenced participant outcomes or is merely associated with successes (or failures) that would have happened by chance.

The propensity score matching (PSM) model has been suggested by Rosenbaum and Rubin (1983, 1985) to account for sample selection bias due to observable differences between treatment and comparison groups (Dehejia and Wahba, 2002). PSM controls for self-selection by creating the counterfactual for the group of adopters. PSM constructs a statistical comparison group by matching every individual observation on participants (participating in project with a new technology) with individual observations from the group of non-participants with similar characteristics. In effect, the matching procedure creates the conditions of a randomized experiment in order to evaluate a causal effect as in a controlled experiment (Rosenbaum and Rubin, 1983). To achieve this, the matching approach employs the conditional independence assumption (CIA), which states that technology selection is random and uncorrelated with the outcome variables, once we control for *Z*.

The CIA or "strong unconfoundedness" can be given as: $Y_1, Y_0 \coprod D|Z$.

The effect of participation on the outcome variables can then be expressed as:

$$\tau_{ATT}(Z) = E(Y_1 - Y_0|Z)$$

$$= E(Y_1|D = 1, Z) - E(Y_0|D = 0, Z) \quad (3.14)$$

The average participation effect can then be represented as:

$$\tau = E\{\tau(Z)\} \quad (3.15)$$

The conditional probability to participate in the project, given the control of Z, is as follows:

$p(Z) = P(D = 1|Z) = E(D|Z)$,where $D = \{0,1\}$,is the indicator of exposure to treatment, and $Z$is the multidimensional vector of pre-treatment characteristics.

Given the propensity score, which can be estimated by any standard probability model, the ATT can be estimated under the CIA as follows (Becker and Ichino, 2002):

$$\tau_{ATT} = E(Y_1 - Y_0|D = 1)$$

$$= E\{(Y_1 - Y_0|D = 1, p(Z)\}$$

$$= E\{E(Y_1|D = 1, p(Z)\} - E\{Y_0|D = 0, p(Z)\}|D = 1\} \quad (3.16)$$

3.6.4 The Propensity Score Matching Method

The major policy interest in non-experimental framework is the average treatment effect for the treated population (ATT) expressed as:

$$\tau_{ATT} = E(Y_1 - Y_0|D = 1) = E(Y_1|D = 1) - E(Y_0|D = 1) \quad (3.17)$$

Where Y_1 denotes the value of the outcome when smallholder farmers participate in Masara project (1), and Y_0 is the value of the same variable when the farmer does not participate in the project (0).

The problem that arises with un-observability is by virtue of the fact that $E(Y_1|D = 1)$ can be estimated but not $E(Y_0|D = 1)$. Although $\tau = E(Y_1|D = 1) - E(Y_0|D = 0)$, can normally be estimated, it is potentially a biased estimator of τ_{ATT}. This kind of bias is a central concern in non-experimental studies (Smith and Todd, 2005).

In defining the effect of Masara NArziki Project, the impact or effect of a treatment for an individual $i$denoted τ_i is defined as the difference between the potential outcome in case of treatment and the potential outcome in absence of treatment, that is:

$$\tau_i = Y_{1i} - Y_{0i} \quad (3.18)$$

To estimate the mean effect of the project (Masara) known as Average Treatment Effect, we have:

$$ATE = E(\tau) = E(Y_1 - Y_0) \quad (3.19)$$

Where$E(.)$ represents the expected or average value.

Average Treatment Effect on the Treated (ATT); which measures the effect of the project on those individuals who participated in Masara N'Arziki Project is given as;

$$ATT = E(Y_1 - Y_0|D = 1) \quad (3.20)$$

Average Treatment Effect on the Untreated (ATU); measures the effects of the Project on those who did not participate:

$$ATU = E(Y_1 - Y_0|D = 0) \quad (3.21)$$

These parameters are not observable, since they depend on counterfactual outcomes. For instance, using the fact that the average is the difference of the averages, the ATT can be rewritten as:

$$ATT = E(Y_1|D = 1) - E(Y_0|D = 1) \quad (3.22)$$

Where$E(Y_0|D = 1)$is the average outcome that the treated individuals would have obtained in the absence of treatment, which is not observed and $E(Y_0|D = 0)$ is the value of $Y_0$for the untreated individuals.

The difference Δ is calculated as: $\Delta = E(Y_1|D = 1) - E(Y_0|D = 0)$ (3.23)

The difference between Δ and ATT=$E(Y_0|D = 1)$ is:

$$\Delta = E(Y_1|D = 1) - E(Y_0|D = 1) + E(Y_0|D = 1) - E(Y_0|D = 0)$$

$$\Delta = \text{ATT} + E(Y_0|D = 1) - E(Y_0|D = 0)$$

$$\Delta = \text{ATT} + \text{SB} \quad (3.24)$$

where SB= Selection Bias; which is difference between the counterfactual for treated individuals and the observed outcome for the untreated individuals. If this term is equal to 0, then the ATT can be estimated by the difference between the mean observed outcomes for treated and untreated, that is:

$$ATE = E(Y|D = 1) - E(Y|D = 0) \quad (3.25)$$

3.6.5 Matching Estimators

During estimation, the propensity scores matching estimator is selected and it describes how comparison units relate to treated units. This is also to check the matching quality of the propensity to score estimation, that is, to check if the matching procedure is able to balance the distribution of the relevant variables in both the control and treatment group (Smith and Todd, 2005). According to Dehejia and Wahba (2002, p.153), "matching on the propensity score is essentially a weighting scheme, which determines what weights are placed on comparison units when computing the estimated treatment effect". The average treatment effect may be expressed as follows:

$$\overline{\Delta Y} = \frac{1}{T}\sum_{i-1}^{T}\left[Y_{i1} - \sum_{j-1}^{C} W(i,j)Y_{ijo}\right] \quad (3.26)$$

where $Y_{i1}$is the post-treatment outcome of treated unit i,Y_{ij0} is the outcome of the jth non-treated unit matched to the ith treated unit, T is the total number of treated units, C is the total number of non-treated units and $W(i,j)$ is a positive valued weight function.

The propensity score matching estimation was implemented by two matching methods. First, for each treated case, the nearest neighbour matching assigns a weight equal to one to the nearest comparison unit in terms of propensity score (Smith and Todd, 2005).The method is implemented with replacement, creating the possibility of matching a given comparison unit to

more than one treated unit. Secondly, the Kernel estimator was used to match each treated unit to a weighted sum of comparison units, with the greatest weight assigned to units with closer scores (Heckman et al., 1998). The Gaussian kernel estimator is calculated as follows:

$$W(i,j) = \frac{K\left(\frac{P_i - P_j}{h}\right)}{\sum_{je\{D=0\}} K\left(\frac{P_i - P_j}{h}\right)} \quad (3.27)$$

WhereP_i is the propensity score of treated unit i, P_j is the propensity score of comparison unit j and h a bandwidth parameter.

3.6.6 Balancing Test

The primary purpose of the propensity score is that it serves as a balancing score. Consequently, the idea behind balancing tests is to check whether the propensity score is an adequate balancing score, that is, to check to see if at each value of the propensity score, for the covariates X has the same distribution for the treatment and comparison groups. Thus the more interest for balance test is to verify if:

$$D \perp \mathrm{X}|\ \mathrm{P(X)}$$

Where X is a set of covariates that are chosen to fulfil the Conditional Independence Assumptions (CIA). The basic intuition is that after conditioning on P(X), additional conditioning on X should not provide new information on D. The propensity scores themselves serve only as devices to balance the observed distribution of covariates between the treated and comparison groups. The success of propensity score estimation is therefore assessed by the resultant balance rather than by the fit of the models used to create the estimated propensity scores (Lee, 2006). Given that propensity score methods are typically used to estimate some

kind of a treatment effect, balancing tests are really a means to an end, and can be considered useful only if passing a balancing test leads to more unbiased treatment effect estimates.

3.6.7 Verifying the Common Support Condition

Another important step in investigating the validity or performance of the propensity score matching estimation is to verify the common support or overlap condition. The assumption for this condition is that the probability of participation in Masara N'Arziki support project, lies between 0and 1(implying participation is not perfectly predicted, that is $0 < P(D = 1| X) < 1$). The assumption is critical to the propensity score estimation, as it ensures that units with the same X values have a positive probability of being both participants and nonparticipants.

Checking the overlap or region of common support between treatment and comparison groups can be done by visual inspection of the propensity score distributions for both the treatment and comparison groups. The visually check of overlap condition is to see if the matching is able to make the distributions more similar. This can be displayed by simple histograms or density-distribution plots of propensity scores for the two groups, along with a comparison of the minimum and maximum propensity score values in each distribution (Carolyn et al., 2010).

Another strategy for checking the overlap of common support between the treatment group and control group is to look for areas within the common support interval (defined by the minima and maxima) where there is only limited (or no) overlap between the two groups. This is sometimes more common in the tails of the density distribution, suggesting that units most (or least) likely to participate in the intervention are very different from the large majority of cases

(Carolyn et al., 2010). In the other way is also to observe substantial distance from the cases at the very tail of the distribution to the cases with the next largest (or smallest) propensity scores.

3.6.8 Sensitivity Analysis: Unobserved Heterogeneity - Rosenbaum Bounds

If there are unobserved variables which affect the assignment into treatment and the outcome variable simultaneously, a `hidden bias' might arise (Marco and Sabine, 2005). The sensitivity of matching estimates was tested to unobserved heterogeneity following Duvendack and Palmer-Jones (2011). According to Rosenbaum (2002), the matching procedures are based on the conditional independence assumption which states that selection in the treatment group is only based on observable characteristics. Sensitivity analysis is done to determine how strongly an unmeasured variable must influence the selection process in order to undermine the implications of matching analysis by creating a hidden bias.

Assuming that the treatment probability is:

$$P_i = P(X_i, u_i) = P(D_i = 1|X_i, u_i) = F(\beta X_i + \gamma u_i) \quad (3.28)$$

Where X_i are the observed covariates, u_i is an unobserved covariate, γ is the effect of u_i on the treatment selection and F is the logistic distribution,the ratio of the odds that a treated case i has the unobserved characteristic to the odd that the control case j has it is given as:

$$\frac{P_i/(1-P_i)}{P_j/(1-P_j)} = \frac{\exp(\beta X_i+\gamma u_i)}{\exp(\beta X_j+\gamma u_j)}$$

As implied by matching procedure, i and j have the same covariates, which implies:

$$\frac{P_i/(1-P_i)}{P_j/(1-P_j)} = \exp[\gamma(u_i - u_j)] \quad (3.29)$$

If the unobserved variable has no influence on the probability of treatment ($\gamma = 0$) or if the unobserved variable is the same for the treated and the non-treated cases($u_i = u_j$), the odds ratio is equal to one, indicating the absence of hidden bias linked to unobservable variables.

Sensitivity analysis assesses how much the treatment effect is modified by changing the values of γ and $u_i = u_j$.Assuming that $\Gamma = e^{\gamma}$, Rosenbaum(2002), identifies the following bounds on the odds ratio:

$$\frac{1}{\Gamma} \leq \frac{P_i/(1-P_i)}{P_j/(1-P_j)} \leq \Gamma \qquad (3.30)$$

$\Gamma = 1(\text{i. e.}\gamma = 0)$, means that no hidden bias exists where as increasing values of Γ imply an increasing influence of unobserved characteristics in the treatment selection. Rosenbaum bound method uses matching estimates to calculate confidence intervals of the treatment effect, for different values of Γ. As explained by Duvendack and Palmer-Jones (2011), if the lowest Γproducing a confidence interval that includes zero is small (i.e. less than two), it is likely that such an unobserved characteristic exists and therefore the estimated treatment effect is sensitive to unobservables, and thus PSM is inappropriate.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents and discusses the results of the data collected from 195 respondents in the study area. The main purpose of this study was to determine the factors influencing farmers' decision to participate in Masara N'Arziki Input-Credit Support Project and its effects on the smallholder farmers' output and income. The chapter is divided into five sections. Section 4.2 deals with the demographic characteristics of respondents of the study area. The rest of the sections discuss the four objectives of the study. Section 4.3 deals with degree of awareness and participation of smallholder farmers in Masara Project. Section 4.4investigates the factors influencing farmer's decision to participate in Masra N'Arziki Project. Section 4.5 covers the effects of participation on smallholder farmers' output and income. Finally section 4.9 deals with the challenges of smallholder farmers on Masara N'Arziki Project.

4.2 Socio-Demographic Characteristics of Respondents

A number of socioeconomic and demographic variables were recorded during the survey. These characteristics are expected to influence the decision to participate in the Masara N'Arziki project. In this section, we summarize these characteristics and discuss how certain characteristics are related to others. The characteristics include age, level of education, marital status, level of experience in farming and the professional skill other than farming of the respondents in the study area.

4.2.1 Descriptive Statistics of Respondents

Table 4.1 shows the descriptive statistics of the respondents in the survey. The mean output of the participants' farmers was 3026.27 kg against 1129.87 kg of the non-participant farmers. The t-test for these results was significant at 1% level; this explains the significant difference between the output of participants and non-participant.

In addition, the mean farm income of the participant farmers was GH¢/ha225.72 and that of non-participants was GH¢/ha193.36. More importantly, the participant farmers were rather better off despite the high cost of farm credit inputs of the project; hence it pays for their participation than producing with their own resources.

The results show a relative significant difference in the ages of participants and non-participants; the mean age of the participant was 47 years against 46 years of the non-participants in the study. However the farm size and experience of the respondents were also significant at 5% level; the mean farm experience (24 years) of the participants was 6 years higher than the non-participant. In addition there was a relative significant difference in the mean farm size (4.09) of the participant and that of the non-participants (3.09).

Table 4.1Respondents Descriptive Statistics

Variable	Participants N= 118			Non-Participants N= 77			Pooled(T-Test) Total=195	
	Mean	Min	Max	Mean	Min	Max	t-test	Difference
Output	3026.69	800	9400	1129.87	300	2900	-20.59***	-2277.09
Farm Income (GH¢/ha)	225.72	36	726	193.36	0	560	17.076***	-212.33
Yield	777.39	266.67	1466.67	400.53	850	60	-28.98***	-627.97
Age	47.14	24	66	46.12	25	66	46.738	-1.027
Household Size	15.52	3	33	10.54	1	23	13.518***	-5.06
Farm Size	4.09	2	20	3.09	1	8	3.697**	-1.002
Farm Experience	24.41	8	55	18.69	10	45	22.148**	-5.718
Extension	4.08	3	6	0.78	0	2	2.779***	-3.305

Source: Own Calculation

4.2.2 Age of Respondents

The results presented in Table 4.1 show that the youngest participant in the Masara project was 24 years while the oldest participant was 66 years. The results shows a relatively low participation of the youth in the project, this could be attributed to the migration of the youth to cities and towns in the southern part of Ghana as well as the regional city (Tamale) in search of white collar jobs. The mean age of Masara project participants was 47years, falling within the age group of 41-50. This group of participants dominated all other age groups in the project (33.45%), which comprises the economically active age group of the sample respondents for the survey. This was followed by the age group 51- 60 (24.58%), and those under 30 years (9.32%). The lowest age group was those above 60 years. The minimum age of the non-participant farmers was 25 which was about 1 year older than that of the project participants. However, the maximum age of the non-participants was 66. The mean age of the non-participant

farmers was 46years, which was younger than of that of the Masara project participants. However, 40.26% of the non-participants (41-50) recorded the highest figure, which also represented the economically active age group. This was followed by age group 51-60 (27.27%). People under 30 formed the least age group (9.09%).

Table 4.2 Respondents' age

Age	Participant		Non-participant (%)		Pooled (%)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Under 30 years	11	9.32	7	9.09	18	9.23
31 – 40	27	13.84	13	6.66	40	20.51
41 – 50	43	22.05	31	15.90	74	37.95
51 - 60	30	15.38	21	10.77	51	26.15
Above 60 years	7	3.58	5	2.57	12	6.15
Total	**118**	**100.00**	**77**	**100.00**	**195**	**100.00**

Source: Field Survey, February, 2015

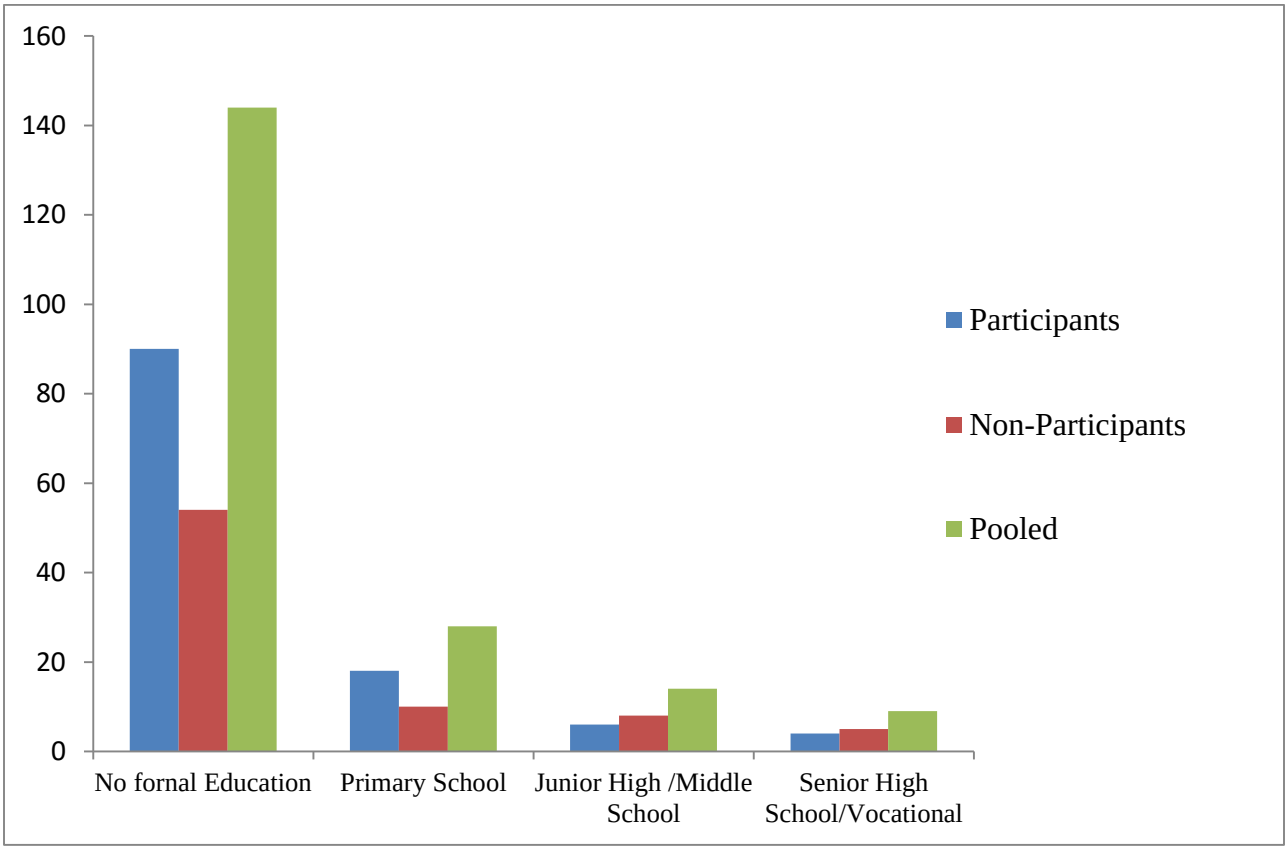
4.2.3 Educational Level of Respondents

The survey revealed that majority of the respondents had no formal education, while few others had some form of formal educational training ranging from primary school to senior high/vocational level. Figure 4.1 shows that participants with no formal education constitutes the majority (76.27%),15.25% attained primary school education, 5.08% were junior high or middle school leavers and 3.39% had senior high/vocational school certificate. The results show

that the highest level of education attained by the participants in Masara project is either SHS or Vocational education.

This distribution of education among the participants could have implications for technology use as well as other innovations that require high level of educational training. Therefore, it can be inferred that Masara project participants are dominated by people with no formal education and this reaffirms the findings from the Ghana Statistical Service's 2010 report of the high illiteracy rate in northern Ghana.

Figure 4.1 Level of education of respondents



Source: Field Survey, February, 2015

The highest educational level attained by non-participant farmers was senior high/vocational school (6.49% of the total sample). About 70% of the non-participant respondents had no formal

education, with 12.98% and 10.38% educating up to primary and junior high school/middle levels, respectively. However the pooled samples of primary and junior high school/vocational level of the non-participant in Masara project were higher than those who participated. This implies that even the literate farmers in the study area who were expected to participate more in the project were not interested.

However, it is also possible that education could increase the chances of the farmers in the study earning non-farm income and opting for white collar jobs as compared to farming. This could reduce the household dependency on agriculture and thus participation. This is contrary to the findings of Etwire et al. (2013), in which education has a positive effect on participation since it enables an individual to make independent choices and to act on the basis of the decision, as well as increase the tendency to co-operate with other people and participate in group.

4.2.4 Distribution of Respondents' Age by Educational Attainment

Masara project was dominated by farmers within the age group of 41 – 50 and thus the economic active group. The smallholder farmers under this age category also had the highest level of farmers with no formal education (20.93%), with 36.4% (43) of the respondents having received formal education in the age category. The low participation of educated farmers also accounted for the farmers' assertions that they are cheated by the project and do not benefit from the project, which is contrary to the results that participant farmers are better off in farm output and income than non-participants. According to Sharada (2009), increasing literacy and numeracy may help farmers to acquire and understand information and to calculate appropriate input quantities in a modernizing or rapidly changing environment. In addition, education may be a substitute for or a complement to farm experience in agricultural production, since it increases

farmers' prior access to external sources of information or enhance the ability to acquire information through experience with new technology. Table 4.2 highlights the distribution of age and the participant educational attainment. The Chi-square test ($\chi^2 = 128.71 \quad p - value = 0.164$) between educational attainment and age of respondent shows no independence since there was no significant relationship between the two variables, hence the independence of age and educational attainment of respondents did not influence farmers decision to participate in Masara N'Arziki project as shown in the table below.

Table 4.3 Age Distribution of Participant by Education Attainment

Educ. Attainment	**Age Category**					
	<30 years	31 – 40	41 – 50	51 - 60	Above 60	**Total**
No Education	5	21	34	22	11	**93**
Primary	0	5	7	6	0	**18**
JHS/Middle	0	1	1	3	0	**5**
SHS/Vocational	1	0	1	0	0	**2**
Total	**6**	**27**	**43**	**31**	**12**	**118**

[$\chi^2 = 128.71 \quad p - value = 0.164$]
Source: Filed Survey February, 2015

4.2.5 Marital Status of Respondents

Married household heads were expected to have a higher probability of participation as compared to single-headed households, hence the divorced and widows were treated single-headed households in this study. The participants in the project were dominated by married household heads (95.76%). This finding reaffirms the result of Edward et al. (2013), that married household heads have a higher probability of participation in agricultural projects.

Table 4.4 Respondents' marital status

Marital Status	Participants (%)		Non-Participants (%)		Pooled (%)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Married	114	58.46	74	37.95	188	96.41
Single	4	2.05	3	1.54	7	3.59
Total	**118**	**100.00**	**77**	**100.00**	**195**	**100.00**

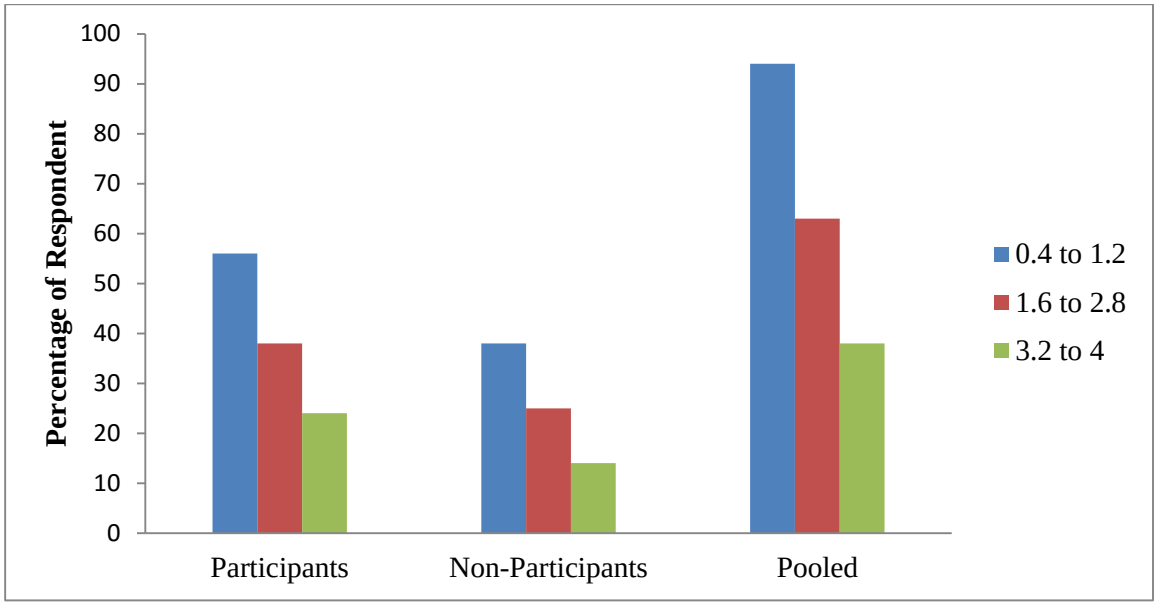
Source: Filed Survey February, 2015

In addition, Nnadi and Akwiwu (2008) noted that marriage increases a farmer's concern for household welfare and food security which is therefore likely to have a positive effect on their decision to participate in agricultural projects. However, 96.1% of the non-participant were married household heads, with the remaining being single smallholder farmers. The high percentage of married household head of both participants and non-participants farmers is attributed to married women serving as family labour with children assisting in farming activities to provide food for the family.

4.2.6 Farm Characteristics

Generally, the results indicate relatively small farm holdings by both participants and non-participants, and this often characterizes smallholder farmers in Ghana. The farm sizes are depicted in Fig. 4.2.

Figure 4.2 Distribution of farm size among respondents



Source: Field Survey February, 2015

The average farm size of the respondents in the project was 1.66hectares and that of the non-participants was 1.16 hectares from the survey. The largest farm size of the Masara project participants was 4 hectares with minimum of 0.8 hectares. About 47.6% of the participants had their farm size between 0.4 to 1.2 hectares which basically signify the smallholder nature of the respondents in the study area. In addition, 49.35% of the non-participants also had their farm size between 0.4and 1.2 hectares. However, Masara project participants had larger farm sizes than the non-participants; this implies that the project encouraged smallholder farmers to cultivate more farm lands due to the inputs credit model of the project. In all, the pooled statistics revealed that very few farmers in the survey had farm sizes between 3.2 to 4 hectares with majority of the farmers cultivating between 0.4 to 1.2 hectares which signifies the Smallholder nature of farm characters of the respondent in the study area.

4.2.7 Household Size of Respondents

The Ghana Living Standard Survey (GLSS) 2010, defines a household as "a person or a group of persons, who live together in the same house or compound and share the same house-keeping arrangements". In general, a household consists of a man, his wife, children and some other relatives or a house help who may be living with them. It is, however, important to state that membership of a household does not necessarily depend on consanguinity or blood ties. The number of persons who belong to a household constitutes the household size. The field survey revealed that the average household size of the participant farmers was 15 people and that of the non-participants was 10 people per household. These were all higher than the study area's average of 9.50 persons per household and also higher than the regional average (Northern) of 7.7 persons, and the national average of 4.4 persons (GSS, 2010). The possible reasons for the large household sizes in the study area are polygyny, high fertility and the common practice of nuclear and extended family members living together

4.3 Mode of Introduction of Respondents into Masara Project

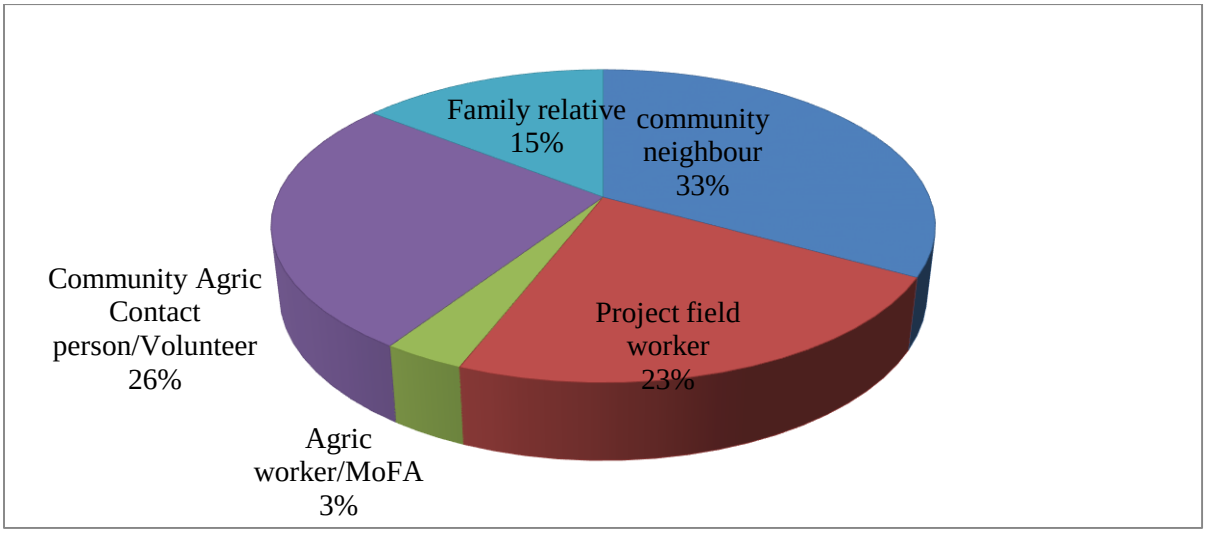
Masara N'Arziki Project operates under the Masara N'Arziki farmers Association (MAFA) in the Northern region. The project was established almost a decade ago with the concept of lending support to small and medium scale farmers to adopt good agricultural practices. The project was initiated in the study area for about 5 years with the least being 3 years in all the 14 communities that were sampled for the study.

Masara N'Arziki has over the years supported maize farmers to receive more income through the use of improved technology. The Input-Credit model of the project includes the provision of fertilizers, hybrid seeds, herbicides, insecticides, spraying equipment and training of farmers

on innovative farming practices. Smallholder farmers who were registered to participate in the project were all provided with these inputs as a package in the study area.

Out of the 118 respondents participating in the project, a high number of the smallholder farmers (33.1%) participated through the influence of their neighbours, and 26.3% participated through community agricultural contact person/volunteer (see Fig. 4.3). On the other hand, few of the participants (22.9%) were introduced by the project field worker who introduced the project to the communities. This underscores the important role played by community neighbours and the community agricultural contact person/volunteer in farmers' participation in the project in the 14 communities of the study area. Valera et al. (1987) reported that the community is composed of different groups of people; in general, diffusion of innovation will take place only within groups of people who are homogenous in terms of problems, aspirations and needs. However, the community agricultural volunteer also plays a key influential role in the awareness and participation of the project through personal interaction with his colleague farmers who reposed their confidence in him with his experience as the contact and lead person in agricultural project in the community. The remaining farmers participated through their family relatives and MoFA technical workers in the community (representing 14.4% and 3.4%, respectively).

Figure 4.3 Pie chart showing participants' introduction into Masara project

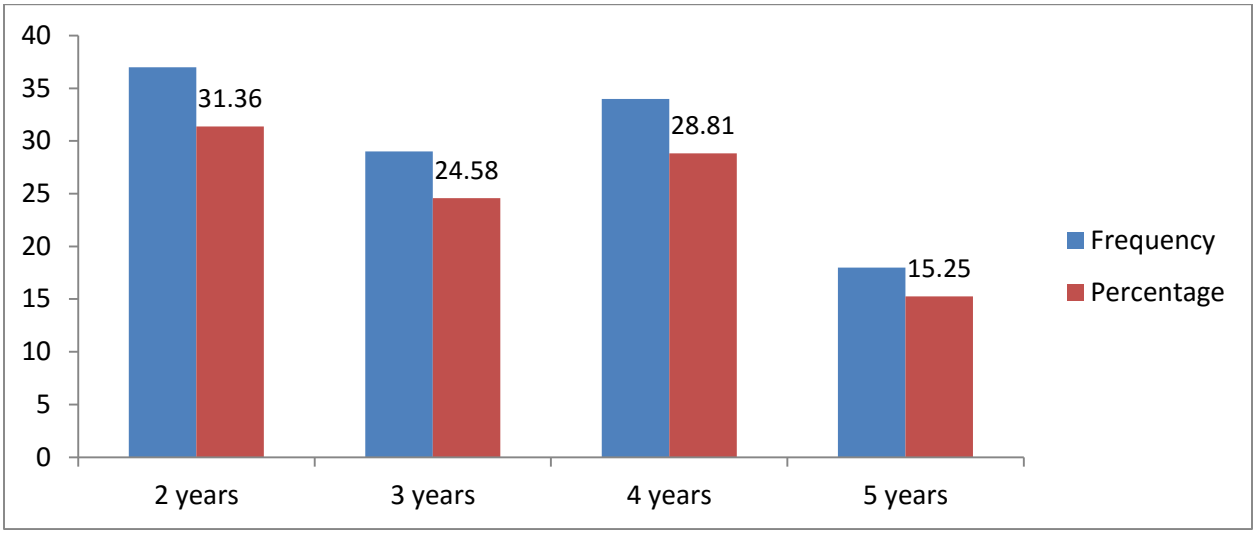


Source: Field Survey, February, 2015

4.4. Length of Membership of Participants in the Project

Masara N'Arziki project has operated in the study area for five years. The results show that Masara project had scaled up to cover more farming communities. About 15.25 % of farmers had worked with the project since its inception in the Savelugu-Nanton municipality. Majority of the participant farmers had worked with the project for the past 2 years representing 31.36%. 24.58% and 28.82% of respondents indicated that they have worked with project for 3 and 4 years respectively. This is illustrated in figure 4.4 below.

Figure 4.4 Membership length of participants in the project

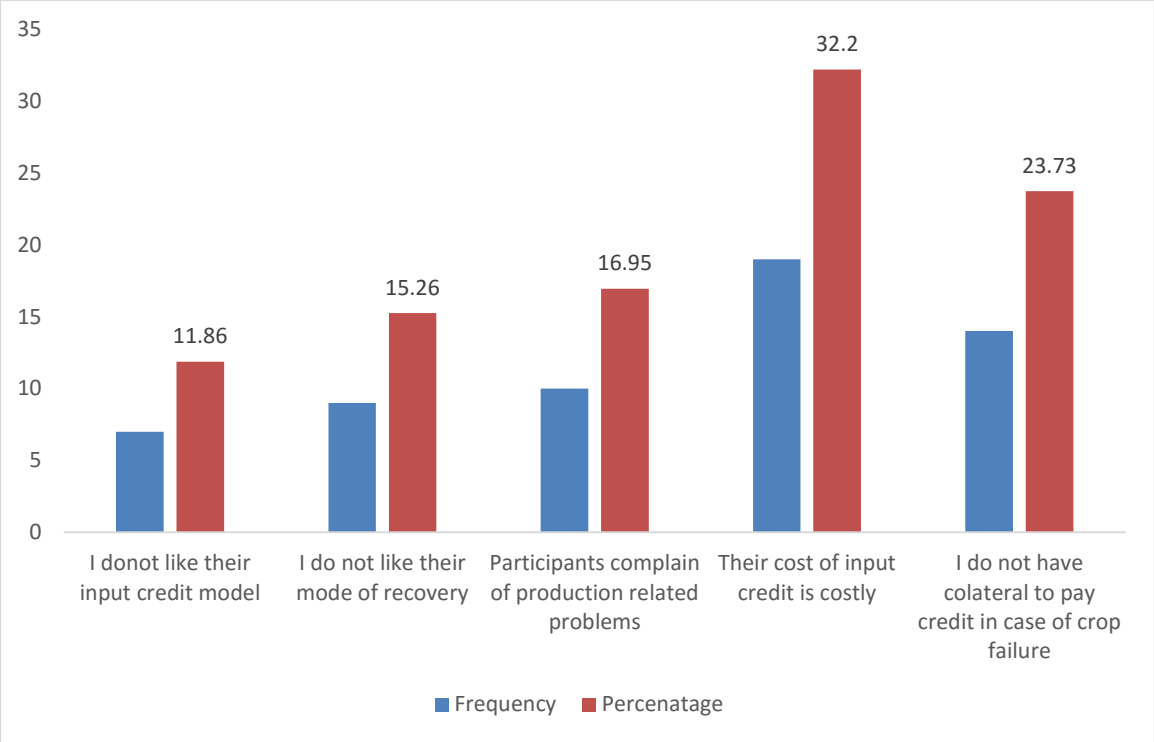


Source: Field Survey, February, 2015

4.5 Reasons some non-participants were not willing to participate in the project

The results from the survey revealed that some of the non-participants responded they will not participate in Masara project due to it challenging problems to farmers. About 16.67% of respondents reported that they are not willing to participate due to the high cost of Input-Credit of the project. In addition, 12.28% of the respondents also reported they will not participate in the project because they cannot afford to pay for the inputs credit after harvest. The rest of the responses given are illustrated in Figure 4.5.

Figure 4.5 Why some non-participants were not willing to participate in the Project

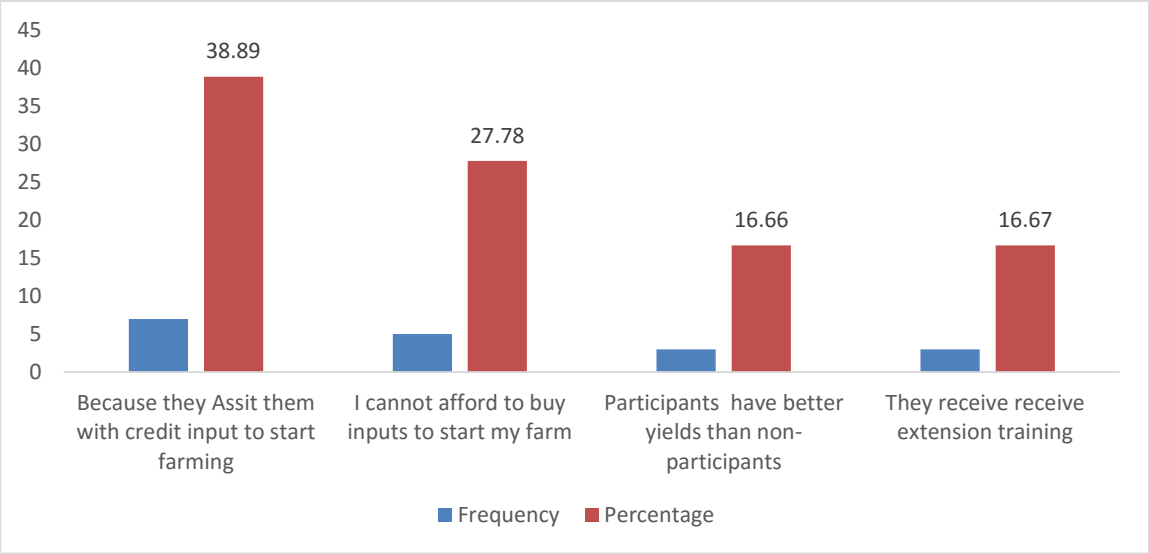


Source: Field Survey February, 2015

4.6 Why some non-participants were willing to participate in Masara Project

Some of the non-participants smallholder farmers who also expressed their interest to participate gave reasons for their decisions. Out of the 18 non-participants who expressed their interest to participate, 38.89% of respondents reported they are willing to participate because the project assists the participants' farmers with inputs to start production and 27.78% of respondents were willing to participate because they cannot afford to buy farm inputs to expand their household farm size. The rest of the reasons given by the non-participants are illustrated in Figure 4.6.

Figure 4.6 Reasons some non-participants were willing to participate in the Project



Source: Field Survey February, 2015

4.7 Factors Influencing Farmers Decision to Participate in Masra N'Arziki Project

The probit model was used to estimate the parameters of the factors that influence participation in Masara project by smallholder farmers in the study area. The significant Pseudo R^2 value of 21.14%and the correctly classified of 73.85% indicates how explanatory variables jointly influence the farmers' participation in Masara project (Table 4.5).Participation in Masara project is significantly determined by household size, years of experience of the farmer, project experience and farm size cultivated by farmers. However, the age of the farmer, education, off-farm income and marital status of the farmer do not significantly determine their participation in Masara farmer support project.

Table 4.5 Probit model results of factors influencing farmers' participation in Masara project

Dependent Variable: Participation in Masara Project				
Variable	Coefficient Estimates		Marginal Effects	
	Estimate	Standard Error	dF/dx	Standard Error
Household size	0.0915***	0.0196	0.0345***	0.0074
Education	-0.1909	0.1514	-0.0721	0.0572
Farm Experience	0.0289*	0.0128	0.0109*	0.0048
Farm Size	0.1201*	0.0582	0.4534*	0.0219
Age	-0.0136	0.0120	-0.0051	0.0045
Off farm income	-1.1191	0.2393	-0.0426	0.0917
Project Experience	0.4987*	0.2806	0.1756*	0.0908
Marital Status	-0.2442	0.5308	-0.0922	0.2003
Constant	-0.9274	0.7489	-	-
Model Diagnostics				
Number of observations = 195				
Likelihood ratio χ^2= 55.31		Prob(χ^2)= 0.000	Pseudo R^2 = 21.14%	
Log likelihood = -103.164		Correctly classified = 73.85%		

*** = Sig at 1% * = Sig at 10%

Source: Own Calculation

4.7.1 Years of Experience of Respondents in Farming

The results of the study revealed a positive significant difference in the years of experience of the participant farmers which implies that their years of experience in farming determine their probability of participation in Masara project. This is consistent with Adesiji et al. (2011), who found farmers with more years of farming experience are considered knowledgeable and are expected to be well acquainted with the use of credit facilities from support project.

4.7.2 Household Size of Respondents

The marginal effects estimated from the probit regression reveals that a unit increase in the household of farmers increased their probability of participation by 0.0345 which was significant at 1% significance level. This is consistent with Martey et al. (2014) that household size serves as a form of family labour and complements the effort of the household heads on the farm hence influences their participation in support project, also larger households spend more on food and other household needs that smaller households hence influences their decision to participate in project to earn enough to support the household food demands (Edward et al., 2013).

4.7.3 Project Experience

Smallholder farmers who had the experience of participating in other projects increase their access to information which is important to production and marketing decisions. Especially farmer groups engage in group marketing, bulk purchasing of inputs and credit provision for its members (Olwande and Mathenge, 2010). The study revealed that farmers who participated in other projects had a higher probability of participation in Masara project than those who did not. These implies that those who participated in the project had 0.1756 more probability of participating in Masara project than those who had not participated in the project. About 39.83% of the farmers in Masara project participated in farmer support project before and the remaining 60.17% never participated in farmer support project. This finding is contrary to Nokuphiwa et al. (2014), where Smallholder farmers who have worked with credit support project in groups affect their participation negatively.

4.7.4 Farm Size of Respondents

There was a positive significant relationship between farm size and farmer's decision to participate in the project. Farm size may be a proxy for level of commercialization hence farmers who decide to cultivate an additional hectare of land were determined to move away from subsistence production and were therefore more likely to participate in order to have access to inputs, technology and output market from Masara N'Arziki project. The Probit model results from Table 4.5 revealed that a unit increase in farm size of smallholder farmer increase his probability of participation by 0.4534, significant at 1% level. This is contrary to Martey et al. (2014); Mohammed (2013) and Nxumalo and Oladele (2013), who observed that farm size influenced household heads decision to participate in agricultural projects, however the study is consistent to Nokuphiwa et al. (2014) who found that farm size negatively affected farmers decision to participate in farmer support project. This finding were attributed to poor output of farmers especially larger farm size affected by unfavourable rainfall or poor germination, hence increases their cost of recovery after harvest to the project.

4.8 Econometric Analyses of the Effect of Masara Project Participation on the Output and Income of Smallholder Farmers

Using the propensity score, we were able to match participants from the treatment group with non-participants (from the control group), so that the treatment group and control group can be balanced. This approach significantly reduced bias in the study (Rosenbaum, 1987, 2004; Rosenbaum and Rubin, 1985; Rubin and Thomas, 1992).

The results of Table 4.6 below illustrate the estimated propensity score in the common support region. One of the important step in investigating the validity or performance of the propensity

score matching estimation is to verify the common support or overlap condition. This is based on the assumption that the probability of participation in Masara project, conditional on observed characteristics, is not perfectly predicted and lies between 0 and 1. After deriving the propensity score, there is the need to ensure that there is enough common support. This was done by discarding treated individuals with a propensity score lying outside the range of propensity scores for individuals in the control group. The number of blocks ensures that the mean propensity score is not different for treated and controls in each block. The balancing property is satisfied.

Table 4.6 Description of Estimated Propensity Score in the Region of Common Support

Estimated Propensity Score

	Percentiles	Smallest		
1%	1.14 e^{-07}	9.06 e^{-09}		
5%	0.0006768	1.14 e^{-07}		
10%	0.0078286	1.33 e^{-07}	Observations	195
25%	0.1257958	0.0000157	Sum of Weight.	195
50%	0.8244214		Mean	0.6029
		Largest	Std. Dev.	0.4173
75%	0.9955618	1		
90%	0.9999975	1	Variance	0.1742
95%	1	1	Skewness	-0.3954
99%	1	1	Kurtosis	1.3749

Note: Balancing property is satisfied

Source: Own Calculation

4.8.1 PSM Estimation of Maize Output Produced by Smallholder Farmers

The propensity score matching estimation of output from the survey was done using nearest neighbour and kernel based matching algorithms. Table 4.7 below illustrates details of the results from the estimation.

Table 4.7 PSM Estimates of Maize Output

Estimation	Nearest Neighbour Matching		Kernel Based Matching		Regression Adjustments	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
ATE	1735.39***	153.51	1921.79***	220.51	1589.41***	129.21
ATT	1895.35***	172.17	1808.75***	253.28	1658.59***	152.28
ATU	1490.26***	209.09	2093.51***	320.75	-	-

Number of Observations = 195 Number of Matches = 1 Minimum = 1 Maximum = 3

*** = Significant at 1%

Source: Author's Own Calculation

The average treatment effect (ATE) of maize output from the project with nearest neighbour and Kernel based matching were 1735.39kg and 1921.79kg respectively. These calculations were based on 1-to-1 matching pairs, and were all significant at 1% level; this implies that average output of maize was quite high for the participants in the project which indeed influenced many farmers to join than producing with own resources. However the impact of the project on the participant farmers (ATT) were1895.35 kg and 1808.75 kg for the nearest neighbour and kernel based matching respectively which were also all significant at 1% level. More importantly, the potential output of the non-participant farmers in the project (ATU) was lower (1490.26 kg) than the participants for nearest neighbour matching but higher (2093.51 kg) for the kernel based matching than the participants; this implies that if the non-participants had participated in the project, their potential output of maize would have been quite higher than the participants in the project. This is also attributed to the fact that they were not motivated to join and hence were risk averse.

The regression adjustment which accounts for systematic differences in baseline characteristics between treated and untreated subjects was also calculated. The essence of it was to determine

whether the propensity score model has been adequately specified. Regression adjustment results in increased precision for continuous outcomes and increased statistical power for continuous, binary, and time-to-event outcomes (Steyerberg, 2009). In addition, regression adjustment was used to reduce bias due to residual differences in observed baseline covariates between treatment groups. The results from the Table 4.7 revealed that the regression adjustments for ATE and ATT were 1589.41 kg and 1658.59 kg respectively, which were both significant at 1% level.

4.8.3 PSM Estimation of Farm Income of Respondents

The farm income that accrues from maize production was calculated in Ghana Cedis per hectare. The estimate was to evaluate the monetary value that accrue from the quantity of farm produce received by the participant after paying for the cost of credit during recovery by the project. The results of the study are highlighted in Table 4.8.

Table 4.8 PSM Estimates of Farm Income (GH¢/ha)

Estimation	Nearest Neighbour Matching		Kernel Based Matching		Regression Adjustments	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
ATE	15.95	33.53	43.58	57.74	217.68***	31.01
ATT	23.32	40.57	44.63	80.92	233.55***	40.09
ATU	4.64	34.05	41.96	39.91	-	-
Number of Observation = 195		Number of Matches = 1		Minimum = 1		Maximum = 3

*** = Significant at 1%

Source: Author's Own Calculation

The result from Table 4.8 reveal that there was no statistical significant difference between the farm income of participant (ATT) and that of the non-participants (ATU). This was attributed to the low farm output coupled with challenges such as unfavourable rainfall and the delay in ploughing farm lands due to non-availability of the tractor services. This makes it difficult for farmers to increase their output to pay for the cost of inputs received from the project. This also accounted for reasons why farmers complain of the high cost of input recovery, due to inadequate quantity of farm produce received by participants below their expectation from participating in the project. Invariably, there was a significant statistical relation between the farm incomes of the participants (ATT) with regression adjustment estimation as well the potential farm income that would been received by non-participants if they had participated at 1% significant level.

4.8.4 PSM Estimates of Maize Yield of Respondents

The maize yield of the farmers was estimated to ascertain the significant difference between the farm outputs relative to the farm size (ha) cultivated by the smallholder farmers in the study. The result from Table 4.9 shows that the average treatment effect of the maize yield (ATE) were 427.96 kg/ha and 439.02 kg/ha for both nearest neighbour and kernel based matching respectively; this was about 25% of the maize yield average (1.7 metric tonnes) in Northern Ghana (Tara, 2013). In addition the average maize yield of the participant farmers was 443.20 kg/ha and 410.40 kg/ha for the nearest neighbour and kernel based matching respectively at 1% significance level. However the potential maize yield of the non-participants farmers (ATU) if they had participated would have been 404.68 kg/ha and 482.88 kg/ha for the nearest neighbour and kernel based matching respectively, which was higher than the participants for kernel based matching at 1% significance level. In addition the ATU of maize yield for both matching

algorithms was also higher than mean yield of non-participants (400.53) of the descriptive statistics; this explains the relative difference of potential yield that would have accrued by the non-participants in the study.

Table 4.9 PSM Estimates of Maize Yield

Estimation	Nearest Neighbour Matching		Kernel Based Matching		Regression Adjustments	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
ATE	427.99***	40.29	439.02***	57.04	437.91***	35.53
ATT	443.20***	40.95	410.40***	40.10	431.64***	37.15
ATU	404.68***	59.81	482.88***	111.02	-	-
Number of Observation = 195		Number of Matches = 1		Minimum = 1		Maximum = 3
*** = Significant at 1%						

Source: Author's Own Calculation

4.8.5 PSM Estimation by Radius Matching

The radius matching algorithm was employed in order to assess the robustness of the results. The radius matching has the ability to avoid the risk of poor matches. The matching method specifies a "calliper" or maximum propensity score distance by which a match can be made. The basic idea of radius matching is that it uses not only the nearest neighbour within each calliper, but all of the comparison group members within the calliper. In other words, it uses as many comparison cases as are available within the calliper, but not those that are poor matches (based on the specified distance). The result of Table 4.10reveals the actual matches within the radius of the Masara project participants (treated group) and non-participants (control group) in the study. Out of a total of 77 non-participants, 65and 66 individuals of the control group matched within the calliper radius of the various outcomes with the participant group in the

project, representing 84.41% maize output, 85.71% of farm income and 85.71% maize yield of matching quality of the control group. The study also revealed that the average effect of the project on the participant was 1691.12kg of maize output, and 418.87 kg/ha of yield, however the average farm income of the participant farmers in the project was GH¢14.42/ha which were all significant at 5% level .

Table 4.10 Radius Matching by PSM

Variable	No. of Treated	No. of Control	ATT	Std. Err	t
Maize Output	118	65	1691.12**	174.05	9.716
Farm Income	118	66	14.42**	34.39	0.419
Maize Yield	118	66	418.87**	37.96	11.036

**= Sig at 5% Note: The numbers of treated and controls refers to the actual matches within the radius

Source: Own calculation

4.8.5 Sensitivity Analyses- Bootstrap Statistics of PSM Results

The robustness of the results proves the validity and the significance of the PSM estimate of the various matching algorithms; nearest neighbour, kernel based and radius matching. The robustness check of propensity score estimated was carried out. It involves using treated farmers (participants) with similar untreated farmers (non-participants) to evaluate the effects of Masara N'Arziki project on the participants of the different outcomes: output of maize, yield and farm income from the project. This check is also to make sure that these findings are not driven by the selection of a particular strategy; coefficients are estimated using different matching algorithms. The bootstrapping of the standard errors was done to assess the robustness of the results on the standard deviation of the estimated-effects of Masara project across replications. It is not possible to interpret the results of the impact estimation without estimating the standard

errors, which provide an indicator of the importance of sampling error in the estimates generated (Carolyn et al., 2010). The standard errors of propensity score-matching estimates were obtained by conventional method using bootstrap methods with 50 replications. In general, the bootstrap relies on sampling from the analysis with replacement, replicating the analysis multiple times. The results of Table 4.11 show the bootstrap statistics of the maize output and farm income; there was a significant statistical relation at 5% level for all the outcomes. This reaffirms the robustness of the results and the significant effects of the Masara project on the participants thus influencing their participation in the project.

Table 4.11 Bootstrap Statistics of Outcomes

Number of Observation = 195
Replications = 50

Variable	Reps	Observed	Bias	Std. Err.	[95% Conf.	Interval]	
Maize Output	50	1691.12	26.61	201.35	1286.50	2095.74	(N)
					1417.53	2157.34	(P)
					1415.44	2157.34	(BC)
Farm Income	50	14.42	-5.88	44.84	-75.69	104.53	(N)
					-94.03	82.96	(P)
					-94.03	82.96	(BC)
Maize Yield	50	418.87	8.322	42.076	334.31	503.43	(N)
					361.49	518.07	(P)
					353.01	493.26	(BC)

N= normal P= Percentile BC= Bias-corrected Note: Common Support has been selected at region of [0.000000114, 1]

Source: Own calculation

4.8.6 Sensitivity Analysis - Mantel and Haenszel (MH, 1959) test statistic for Hidden Bias

Aakvik (2001) suggested the use of Mantel and Haenszel (MH, 1959) test statistic for the detection of hidden unobservable or hidden bias. The PSM approach cannot fully be controlled

for unobservable characteristics (Tagel and Anne, 2014). The MH non-parametric test compares the successful number of individuals in the treatment group against the same expected number given the treatment effect is zero. Aakvik (2001) notes that the MH test can be used to test for no treatment effect both within different strata of the sample and as a weighted average between strata. Ichnino et al. (2006) suggested that, the presentation of matching estimates should be accompanied by sensitivity analysis. If there are unobserved variables that simultaneously affect assignment into treatment and the outcome variable, a hidden bias might arise to which matching estimators are not robust (Rosenbaum, 2002). Accordingly, we checked the sensitivity of the estimated treatment effects to selection on unobservable using the bounding approach developed by Rosenbaum (2002). We applied the procedure by Becker and Caliendo (2007) to aid in the construction of Rosenbaum bounds for sensitivity testing. This procedure uses the matching estimate to determine the confidence interval of the outcome variables for different values of Γ (gamma). Γ captures the degrees of association of unobserved characteristic with the treatment and outcome required (the unobserved characteristic) to explain the observed impact (Duvendack and Palmer-Jones, 2011). Diprete and Gangl (2004) indicated that, if the lowest, which encompasses 0, is relatively small (say > 2), then one may state that the probability of such unobserved characteristic is relatively high and the estimated impact is therefore sensitive to unobservables.

Table 4.12 reports the Mantel-Haenszel (mh) bounds results, showing that under the assumption of hidden bias when Γ = 1, the Q_{mh} test statistic indicates a highly significant treatment effect for Masara project participation on the farm income that accrues from maize output.

The two bounds in the Mantel-Haenszel output table (Table 4.12) can be interpreted in the following way; the Q_{MH+} statistic adjusts the MH statistic downwards for positive (unobserved

selection). The results from the study shows that the positive selection bias occurs when those most likely to participate then have a higher farm income that accrue from the project output even without participation in the project, and given that they have the same independent characters or covariates as individuals in the group. This effect leads to upwards bias in the estimated treatment effect. The effect is significant under $\Gamma = 1$ and becomes even more significant for increasing values of $\Gamma > 1$ if we have underestimated the true treatment effect. The Q_{MH+} reveals that the study is insensitive to hidden bias at 5% significance level. The sensitivity analysis of the study indicates that the observed results of the effects of Masara N'Arziki project on the Smallholder farmers' output and income are insensitive to selection on unobservables or hidden bias.

Table 4.12 Mantel-Haenszel bounds for outcome = Farm income of maize output

Gamma	Q_mh$^+$	Q_mh–	P_mh$^+$	P_mh–
1	3.932	3.932	0.000046	0.000042
1.05	4.043	3.850	0.000026	0.000059
1.1	4.138	3.761	0.000017	0.000084
1.15	4.281	3.678	0.000012	0.000017
1.2	4.323	3.600	7.7e - 06	0.000159
1.25	4.411	3.527	5.1e - 06	0.000211
1.3	4.498	3.457	3.4e - 06	0.00027
1.35	4.583	3.392	2.3e - 06	0.00035
1.4	4.667	3.329	1.5 e- 06	0.00044
1.45	4.749	3.270	1.0e - 06	0.00054
1.5	4.829	3.214	6.8 e - 06	0.00065

Source: MH Bounds using STATA 13. $\Gamma = 1 \approx$ no 'hidden' bias

Q_mh$^+$ = Mantel-Haenszel statistic Q_mh$^-$ = Mantel-Haenszel statistic

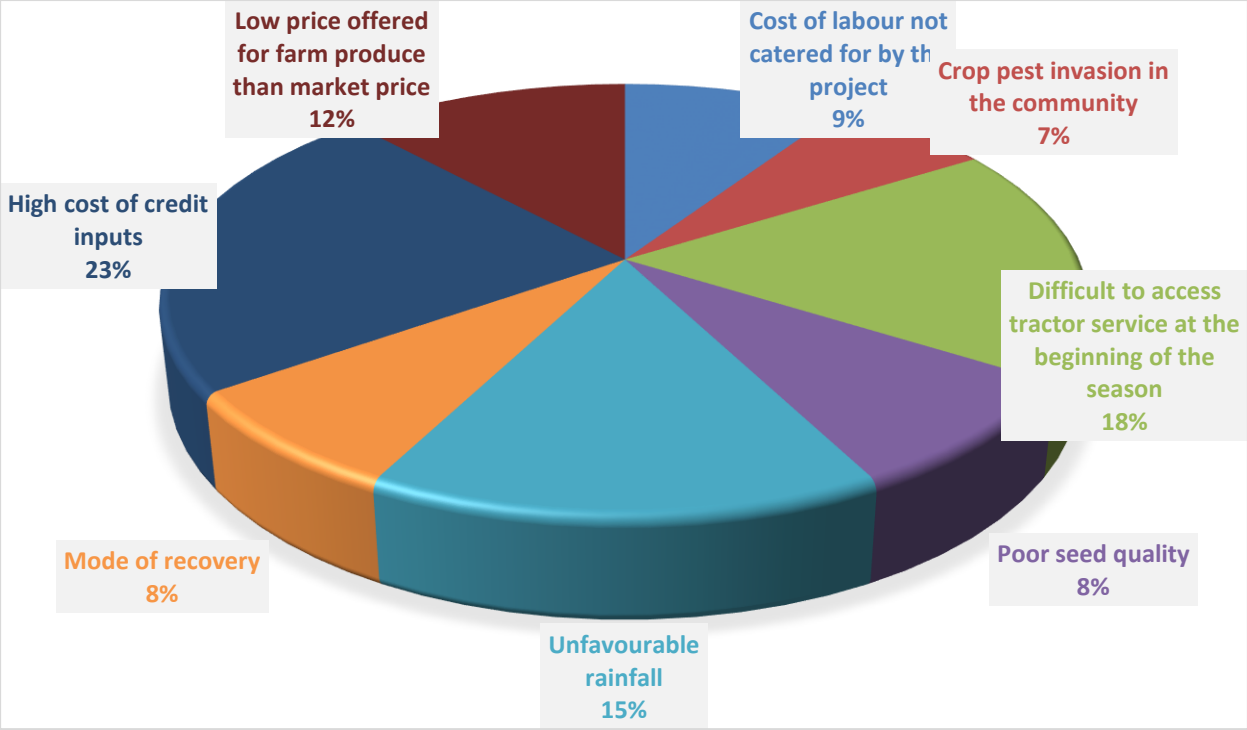
P_mh$^+$ = Significance level P_mh– = Significance level

4.9 Challenges of Smallholder Farmers in Masara Project

The study revealed a number of challenges that inhibit smallholder farmers in the project from getting the expected yield to make them profitably competitive than nonparticipant farmers. The results of the study revealed that the most pressing challenge of farmers in the project was the high cost of Input-Credit with 23% respondents reporting this problem (Figure 4.7).The price of inputs like fertilizers are very expensive therefore, many small scale farmers simply cannot afford the required quantity for a good yield. This was one of the factors beyond the ability of the farmer to control since the market price of this inputs are calculated into the cost of recovery. According to United Nations Environment Food Programme (UNEFP) (2012), there are significant social challenges confronting smallholder farmers such as limited formal education and literacy levels that can impair their ability to negotiate equitable commercial contracts with suppliers and customers and applying to benefit from governmental support programmes. This challenge rendered farmers vulnerable in negotiating with the contract agreement of Masara project model which leads to high cost of recovery after harvest.

That notwithstanding, Chianu et al. (2008) revealed that, the high prices of most agro-inputs, constrain the development of efficient farm input distribution systems and are fed into by farmers' inability to sell their farm surplus produce at high prices, especially immediately after harvest. This situation contributes to declining in Smallholder farmers' household welfare, and negatively affects farmer investments in farm inputs and returns to agricultural production (Bashaasha, 2001). Chianu et al. (2008) also report that high input price, requires a reduction in input prices (through economies of size and new institutional arrangements, etc.) at the farm-level, credit availability to farmers for the purchase of agro-inputs, and attractive prices for farm produce.

Figure 4.7 Challenges of smallholder farmers in Masara Project



Source: Field Survey, February 2015

The results of the study on the challenges of farmers in Masara project also reaffirms the findings of Celia et al. (2014) which revealed that smallholder farmers across the tropics face numerous risks to their agricultural production, including pest and disease outbreaks, extreme weather events and market shocks, which often undermine their household food and income security.

In addition, Masara project does not give tractors services to their farmers; hence the difficulty in accessing tractor to plough their fields causes delay in the time of planting, even though inputs would usually be given on time. The study revealed that 18% respondents were faced with this challenge in working with the project. In addition the tractor services providers offered different prices to farmers as a result of the high demand and pressure on their services at the

period ranging from the average amount of GH¢16/ha to GH¢25/ha. This as a result, increases the cost of production by farmers who are not able to negotiate affordable prices for ploughing their fields.

The unfavourable rainfall pattern in the study area also affected the yield of farmers in the project. Even though a farmer might acquire access to tractor services and inputs required at the right time, they do not have control of the uncertainty of the rainfall, since majority of the staple crops in the Northern region are rain-fed. According to IEA Ghana Policy Journal (2013), climate change affects food security of Smallholder farmers due to the reliance on rain-fed which will mean that output will decline resulting in lower incomes for farmers.

The results of the study also revealed that farmers who were faced with poor yield due to unfavourable rainfall were compelled to sell livestock such as sheep, goats and cattle to pay for the cost of recovery after harvest which invariably affect their vulnerability to household food insecurity.

The price offered for the farm produce after harvest was the next pressing challenge constituting 14(12.28%) respondents. The participant farmers who felt this challenge expected a relatively equal or higher price per 50kg bag at cost of GH¢34.00 than the prevailing market price of GH¢50.00. This was as a result of fluctuations of farm produce in the market and farmers inability to negotiate with the project with price offered by the project before signing on to a contractual agreement with Masara project.

However, the study also revealed that 9% respondents were not satisfied with the cost of labour not catered for by Masara project. The results of the study revealed farmers have to bear the

cost of land preparation before ploughing, which were usually done either by communal labour or hired labour especially farmers who cannot provide household labour. More so the project did not cater for the labour incurred during harvesting which was averagely done in 3 days, and the additional labour required in bagging of the maize produce after shelling by mechanical corn Sheller provided by Masara project. Farmers who could not pay for the labour incurred in this activity only resorted to in-kind barter payment with some of the maize produce harvested at a cost of 20kg/ha to the mechanical Sheller provided by Masara and any other person who assisted in the harvest in the community. This as a result reduces the quantity of maize produce required to pay for the recovery and hence inadequate quantity received by the farmers for their family. This situation worsens during poor harvest due to unfavourable rainfall distribution in the farmer's field.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

The primary objective of this research was to examine the effect of farmer support project on smallholder farmers' output and income. The survey was a case study limited to Masara N'Arziki project operating in the Northern region. The study adopted stratified and simple random sampling techniques and selected 195 respondents in the Savelugu-Nanton Municipality communities and randomly selected 195 respondents for the survey, due to the high participation and number of smallholder farmers of the project in the area. Under the objectives of the study, three research themes were examined. The first was to determine the factors that influence smallholder participation in Masara N'Arziki project in the study. The second research objective focused on the effects of the project on the smallholder farmers' output and income. The third research area aims to provide an understanding and identify challenges of smallholder farmers' on Masara N'Arziki project.

This final chapter summarizes and evaluates the research that has been carried out and presented in this study. A summary of the key findings is provided first and then the conclusions and recommendations that arise are also evaluated in the context of their implications for policy as well as future research.

5.2 Summary

The fast growing population of the rural folks in the northern region has created a burden of higher dependency ratios and household heads need to sustain food supplies to meet their household food demand from one farming season to another. This motive has influenced

smallholder farmers to participate in farmer support projects where they are assisted with farm inputs to boost their capacity and self-sufficiency in food production.

The results of the study revealed that the household size of a farmer, farm experience, farm size, and project experience were the significant factors that influence smallholder farmers' decision to participate in the project. On the contrary, the age of the farmer, educational years, off farm income and marital status were the insignificant factors that negatively affect their decision to participate in the project. Propensity score matching (PSM) was used to estimate the effect of the project on the participants farm output and income. The PSM for this study was based on comparing the project participants and non-participants within the same area, where we matched participants from the treatment group with participants from the control group, so that the treatment group and control group can be balanced.

The results from the study revealed that the mean output of the participants' farmers was 3026.69 kg against 1129.87 kg of the non-participant farmers. The t-test for these results was significant at 1% level; this explains a significant statistical relationship between the output and its influence on participation in the project. In addition, the mean farm income of maize production for participant farmers was GH¢225.72 kg/ha and that of non-participants was GH¢193.36 kg/ha; this implies that average farm income of the non-participants was less than the participant farmers. The average treatment effect (ATE) of maize output for the nearest neighbour and Kernel based matching were 1735.39 kg and 1921.79 kg respectively; this implies that average output of maize was quite high and contributed to the factors that influenced smallholder farmers' participation. However, the impact of the project on the participant farmers (ATT) was 1895.35 kg, whiles the potential output of the non-participant

farmers if they had participated was 2093.51 kg which was higher than that of the participants at 1% significance level.

However the results of the estimate of farm income that accrue from the Masara project after recovery revealed no significant statistical difference between the participant and non-participants. Which was as results of low farm output recovered from the participants to pay for the cost of the inputs received from the project.

Finally, the results of objective three revealed that the pressing challenge of farmers in the project was the high cost of Input-Credit after harvest, reported by 23% of the respondents from the survey. In addition difficulty in accessing tractor service at the beginning of the season was also reported by 18% of the respondents from the study which accounted for the low farm produce received by participants below their expectation from participating in the project.

5.3 Conclusion

Participation in farmer support project is very crucial in addressing most of the production challenges faced by smallholder farmers in Northern Ghana. The case study on Masara N'Arziki project revealed that smallholder farmers in the Northern region are influenced to participate in support project by factors such as household size of a farmer, farm experience, project experience and farm size of the farmer. However, the age of the farmer, educational years, off farm income and marital status were the factors that did not significantly influence farmers' decision to participate in Masara N'Arziki project.

The effect of participation on farm output revealed that the participant farmers had relatively high output of maize produced than the non-participants farmers producing with their own

resources. However one of the reasons which accounted for the low farm income received by participants was as a results of low output coupled with high inputs prices after recovery which reduces the quantity received by farmers after recovery.

However it is rational for the participants' farmers to continue working with project than producing with their own resources. Since participant farmers capacity are improved with the technical advisory on farm production which makes them better off than non-participants in Masara project.

The results of the study also reaffirms the findings of USAID/EAT project case study on Masara N'Arziki project in 2012, that Masara project farmers face challenges in their farm output from the project model despite the timely delivery of input-credit. The participant farmers complained of high cost of labour in production which was not catered for by the project hence results in low farm output and income received by participants after recovery. In view of these, effective implementation of the recommendations could lead to an improvement in the smallholder farmers' output and income in the Northern region.

5.4 Recommendations

The smallholder farmers in Masara N'Arziki project were better off in their farm production than non-participants, hence the project should scale up to more food insecure farming communities in the Northern region since a significant difference exists between the farm output of participants and non-participants in their current operational areas in the Northern region of Ghana.

For active participation of farmers in farmer support project, the study recommends farmer support projects that operate with in-kind credit and recovery model to target active farmers

who can provide household farm labour, and are very experienced with the business of input-credit support and repayment model of farm production.

Masara Project should also embark upon a needs analysis exercise of the smallholder farmers in all their communities. This would equip them with the right information of better targeting of smallholder farmers to enable them work toward achieving their project objectives in increasing farmers' output and income.

The study also revealed that some of the participant felt being cheated due to unfair pricing terms by Masara project. Hence the decentralised Department of Agriculture in the various districts/municipalities must intervene and assist farmers to negotiate at fair credit repayment terms before signing on to any contractual agreement with any credit support project. This would enable more farmer participation since they will be more satisfied with the risk involved even period of unfortunate climate externalities.

Finally the present study contributes to the scanty literature and hence provides the foundation for quantitative analysis of factors influencing smallholder farmer participation in support projects in Northern region. However, the current approach of the study was non-experimental; it is recommended that future researchers should undertake similar study with experimental approach like Randomised Controlled Trials (RCTs) to determine the socio-economic difference that encourage participation and its effects on smallholder farmers output and income in the various districts/municipalities of Northern Ghana. Indeed, use of RCTs is very expensive, but there is higher pay off in terms of identifying impacts of specific projects. Implementation of farmer support projects should thus build impact evaluation cost into their activities.

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APPENDIX

QUESTIONNAIRE ON THE EFFECTS OF WIENCO MASARA N'ARZIKI INPUT-CREDIT PROJECT ON OUTPUT AND INCOME OF FARMERS IN THE SAVELUGU-NANTON MUNICIPALITY OF THE NORTHERN REGION

INTRODUCTION:

Hello my Name is…… I am a student from UDS, Tamale. We are undertaking a research on the Masara Project. Our interest is to know how the project is benefiting farmers and their welfare as well as the challenges they face on the project. Your response to the interview is highly confidential and no other person will have access to it.

I therefore entreat you to respond to the questions to the best of your knowledge and interest.

Kindly note that you reserve the right to answer the questions or otherwise. You may also withdraw from answering if at any stage of the interview you do not feel like continuing. Your fullest and maximum cooperation would, however, be greatly appreciated.

Are you willing to participate in the interview? Yes [ ] No [ ]

Thank you

Questionnaire Number:……..

District:……...

Community:……...

Name of Interviewer:……...

Date:……

SECTION A: DEMOGRAPHIC CHARACTERISTICS

1. Name of farmer

   ……..

2. How old are you…….years

3. What is your religious denomination?

   a. Islam ☐ b. Christianity ☐ c. Traditionalist ☐ d. None ☐

4. Sex Male ☐ Female ☐

5. Marital status:

   a. Single ☐ b. Married ☐ c. Divorced ☐ d. Widowed ☐

6. How many people are living under your care in your household?.....

   a. Adults (above 18 yrs)……b. Children(below 18 yrs)…….

7. What is your level of education?

   a. No formal education ☐ b. Primary ☐ c. JHS/Middle School ☐

   d. SHS/Voc. ☐ e. Training College ☐ f. Tertiary ☐

8. How long have been farming…….years

9. Do you have any professional skills other than farming? Yes ☐ No ☐

10. Sate the profession if yes to question 9……

SECTION B:

FARMERS DECISION TO PARTICIPATE IN MASARA N'ARZIKI PROJECT

11. Do you know of Masara Project in your community? Yes [ ] No [ ]

12. Are you a participant/beneficiary of the Project? Yes [ ] No [ ] **if no move que 43.**

13. How long have you been working with Masara Project……Years

14. Who introduced you to the Masara Project?

a. A friend [ ] b. Project field worker [ ] c. Agric worker/MoFA [ ]

d. Self [ ] e. Family Relative [ ]

15. What motivated you to join? Please Tick the response(s)

Decision	**Response (√)**
To increase my yield/Production	
Input given on credit	
Extension training on farming	
Higher returns than other project	
Project team dedication to the project delivery	
Others Specify:…… ……	

16. How were you selected? Please Tick the right option(s)

Criteria/ Mode of selection	
Open to all interested farmers	
Based on your relationship with Agric. Volunteer of the community	
Based on your previous experience and output in Maize production	
Based on my affiliation to a group	
Based on the decision of the project team/field worker	
Based on my relation with protocol/political affiliation	
Other specify: ……	

17. Were you schooled or educated on the project objectives before joining?

Yes [ ] No [ ]

18. Were you issued a contractual agreement documents before joining? Yes [ ] No [ ]
19. Did you spent time to get detailed understanding of the terms and conditions of the project before participation? Yes [ ] No [ ]
20. Were you satisfied with their conditions before joining? Yes [ ] No [ ]
21. If no to question 20, state reasons for your decision……..

    ……

    …….....

    .....

    ……

    …….....

    .....

22. Were you given the opportunity to raise any concern on the contractual agreement?

    Yes [ ] No [ ]

23. If Yes state concern(s) raised…….

    ……

    ……

    …….....

    .....

    Did the Project team address your concern on your issue raised with the contractual agreement? Yes [ ] No [ ]

24. Are you better off joining the Project than before? Yes [ ] No [ ]
25. Give reasons for answer in question 22 if Yes……

    ……

    …

    ……

    ……

If

No……..

……

……

……

26. Do you still have interest to continue working with the project now and in the future?

Yes [ ] No [ ]

27. Give reason(s) for your answer in question 25.

If

Yes…….

……

……

……

If

No……..

……

……

……

28. Did you receive any extension services during your farm production? Yes [ ] No [ ]
29. If Yes, for how many times did you receive extension in a year…….times
30. How satisfied are you with the extension service received? a. Very Satisfied [ ] b. Satisfied [ ] c. Dissatisfied [ ] d. Very dissatisfied [ ] e. Neutral [ ]
31. Are you satisfied with your output from MasaraProject. Yes [ ] No [ ]
32. If No to question 31, state

why……..

……

……

33. Did you benefit from any project other than Masara in the previous season.

Yes [ ] No [ ]

34. If \yes to question 34 state……..NGO [ ] Govt [ ]
35. Is your output better in Masara project than other project you have participated in? Yes [ ] No [ ]
36. Are you satisfied with the price offered for your produce by Masara depending on the prevailing market price? Yes [ ] No [ ]
37. If Yes to question 37, how satisfied are you. a. very satisfied [ ] b. satisfied [ ] c. dissatisfied [ ] d. very dissatisfied [ ] e. Neutral [ ]
38. Will you be willing to participate in the Masara Project next season? Yes [ ] No [ ]
39. If no to question 39, give you reason (s)……
……
……
……
……
.....

SECTION C: MASARA PROJECT AND SMALLHOLDER FARMERS' INCOME

40. INPUT COST IN PRODUCTION : MASARA FARMERS ONLY

Crop	**Farm Size**		**Qty Of Seeds Used**		**Unit Cost Of Seed/Bag**	
	PREV(2014)	CURRENT(2015)	2014 season	2015season	2014 season	2015 season
MAIZE						

41. LABOUR COST IN PRODUCTION- MASARA MAIZE ONLY

Activity	Type of Labour		No. of Labour	Cost of Labour	No. of Days Used
	Family labour	Hired Labour			
Land clearing/preparation					
Ploughing					
Planting					
1st weeding					
2nd weeding					
Fertiliser application					
Herbicide application					
Harvesting/processing					
Bagging/Shelling					
TOTAL					

42. COST OF AGROCHEMICAL USED-MASARA MAIZED ONLY

Type	Quantity used/bag	Unit cost	Total cost
Herbicide/weedicide			
Insecticide			
Fungicide			
Fertiliser used			

43. Output/Yield Harvested : Masara farmers MAIZE ONLY

	Last yr(2014)	Current 2015
Crop		
Quantity Harvested (Bags)		
Quantity Received by Farmer		
Quantity Received by Masara Project		
Output price per bag		
Quantity sold by farmer		
Quantity consumed by household		

44. Input Cost: Other Crops Cultivated PARTICIPANT & NON-PARTICIPANTS

Crop	Farm Size	Ploughing Cost	Qty of weedicide used	Unit Cost weedicide	Qty of seed used	Unit cost	Qty of Fert. used	Unit Cost
Rice								
Groundnut								
Soyabean								
Millet								
Sorghum								
Others Specify								

45. Farm Output of Both PARTICIPANT & Non-PARTICIPANTS

Crop	Qty Harvested	Output price/BAG	Qty SOLD	QTY Consumed
Rice				
Groundnut				
Soyabean				

Millet				
Sorghum				
Others Specify				

OTHER SOURCE OF INCOME

46. Do you have alternative source(s) of income other than farm revenue? Yes [ ] No [ ]
47. If yes, to question ……state your secondary source(s) of income……
48. What is your average monthly income…….....GH¢
49. Do you rear animals? Yes [ ] No [ ]

Livestock	Number	Annual Income (GH₵)
Cattle		
Sheep		
Goat		
Pig		
Guinea fowl		
Fowls		
Ducks		
Turkey		
Others Specify…… ……..		

SECTION D: CHALLENGES OF FARMERS ON MASARA PROJECT

50. Do you have any challenges participating on the project? Yes [ ] No [ ]

51. If yes, state, by ticking the options below

Challenge/Problem	**Yes (√)**	**No (√)**
Price offered per bag		
Cost of credit /input		
Size of farm land allocated by project		
Attitude of project team/field workers		
Mode of recovery after harvest		
Land tenure problem/ land availability		
Others Specify…….. …… ……..	……. …… ……..	

52. Do you report your challenges to Masara project managers/field workers? Yes [ ] No [ ]
53. If no, state why……...
……
……
…….....
.....
54. Do the Masara project managers/field workers address your view on the challenges/problems before the next season. Yes [ ] No [ ]

CHALLENGES OF NON- PARTICIPANTS ON THEIR FARM PRODUCTION

55. Do you have any challenges on your farm production? Yes [ ] No. [ ]
56. If yes state the challenges……
……
…

……
…

57. Are you able to afford cost of input required for your farm? Yes [ ] No. [ ]
58. Do you receive a ready market for your farm produce after harvest? Yes [ ] No. [ ]
59. Are you satisfied with the price offered for your produce?
    a. Very satisfied [ ] b. Satisfied [ ] c. Dissatisfied [ ]
    d. Very dissatisfied [ ] e. Neutral [ ]
60. Do you receive any extension training on your farm production? Yes [ ] No [ ]
61. Are you satisfied with the extension received? 1. Very satisfied [ ] 2. Satisfied 3. Dissatisfied [ ] 4. Very dissatisfied [ ]
62. Do you report your challenges to the extension workers? Yes [ ] No. [ ]
63. How often do you receive training from extension workers?
    a. Weekly [ ] b. Monthly[ ] c. Yearly [ ]