EFFECT OF MiDA INTERVENTION ON PRODUCTIVITY OF MAIZE FARMERS IN THE AFRAM BASIN OF GHANA

BY

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THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PHILOSOPHY DEGREE IN AGRICULTURAL ECONOMICS

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DECLARATION

I, Afia Fosua Agyekum, author of this Thesis, "EFFECT OF MiDA INTERVENTION ON PRODUCTIVITY OF MAIZE FARMERS IN THE AFRAM BASIN OF GHANA", do hereby declare that the work presented, with the exception of various forms of literature consulted which have been duly acknowledged, was entirely done by me in the Department of Agricultural Economics and Agribusiness, University of Ghana, Legon. This work has never been presented either in whole or in part for any other degree in this University or elsewhere.

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(Student)

This thesis has been presented for examination with our approval as supervisors

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DEDICATION

This thesis is dedicated to the Almighty God, the one in whom I find my strength.

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ABSTRACT

MiDA, in March 2008, instituted a four year project in the Afram Basin with the aim of enhancing the productivity of the farmers (including maize farmers) in the basin. Although the project ended in February 2012, the question of the effect of the project on the productivity of maize farmers in the zone from the point of view of an independent body remains unknown. Therefore this study assessed the effect of MiDA intervention on the productivity of maize farmers in the Afram basin of Ghana.

Farmers' perceptions of MiDA intervention were assess using a three point likert-type scale and analyzed using percentages. A partial factor productivity index, yield, was used to estimate the level of productivity of both participant and non-participant maize farmers. The PSM method was adopted to assess the effect of MiDA intervention on the productivity of the participant maize farmers.

Purposive sampling was used to select four out of nine districts in the basin in which the intervention was carried out based on the intensity of maize production in the districts. Again, purposive sampling was used to select two communities in each district from which simple random sampling was used to select 25 participant and 50 non-participant maize farmers from each district to give a total of 300 maize farmers.

Results from the data collected indicates that majority of both participant and non-participant maize farmers (81.3%) were of the view that the intervention has helped increase the yields of participant farmers with most of them (88.3%) recommending the repetition of the intervention. The main limitation of the MiDA intervention, according to the farmers, was the late purchase of the maize grain by MiDA. The main proposal the farmers suggested should be included in the intervention, if it was to be implemented again, was to provide them with some facilities and equipment. The mean yield of the participant farmers was 1.51 Mt/ha with that of the non-participant farmers being 0.86 Mt/ha. Also, the study revealed that maize yields of farmers vary across districts but are the same across regions. There was no significant difference between the mean yields of participant males and participant females although the mean yield of non-participant males was higher than the mean yield of non-participant females. Lastly, the study revealed that participation in MiDA intervention has a positive and significant effect on the productivity of the participants with participation in the intervention increasing the yields of the participants by 0.6680 Mt/ha. The results suggest that MiDA intervention was successful from the point of view of the farmers although there were a few limitations. In addition, it can be concluded that participation in MiDA intervention enhanced the productivity of the participant maize farmers. This study thus recommends that organizations that aim at enhancing the productivity of maize farmers such as MiDA and MoFA should undertake more of such interventions.

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ACRONYMS

ADRA:	Adventist Development and Relief Agency
ATE:	Average Treatment Effect
ATT:	Average Treatment Effect on the Treated
ATU:	Average Treatment Effect on the Untreated
FBO:	Farmer Based Organization
IFPRI:	International Food Policy Research Institute
ISSER:	Institute of Statistical, Social and Economic Research
MiDA:	Millennium Development Authority
MoFA:	Ministry of Food and Agriculture
PSM:	Propensity Score Matching
SRID:	Statistics, Research and Information Directorate

CHAPTER ONE

INTRODUCTION

1.1 Background

Agriculture plays a prominent role in the economy and society of all Sub-Sahara African countries. Most countries in the region have the natural and human resources needed for strong and sustainable agricultural development. Yet agriculture is widely seen as underperforming (Dewbre and Borot de Battisti, 2008). Despite significant progress to boost the performance of the agricultural sector in many sub-Saharan African countries over the last decade, large percentages of people who depend on farming for a living are in poverty. Income gaps between farm and non-farm households are wide and a high percentage of both rural and urban populations suffer from malnutrition and food insecurity (Asenso-Okyere and Jemaneh, 2012). With rapid population growth, expanding agricultural output is essential especially because of its expected impact on food security and poverty reduction in the continent. Considering current growing concerns about climate change and deforestation in addition to scarcity of land, water, energy and other natural resources, there is the need to focus on productivity increment for output increment against area expansion which has been the norm in the continent for several decades.

In Ghana, the agricultural sector is expected to lead the growth and structural transformation of the economy and maximize the benefits of accelerated growth (National Development Planning Commission, 2010). The sector employs more than half of the country's population and contributes about 24.6% to national gross domestic product (GDP) (CIA World Factbook, 2013). If the definition of the agricultural sector is expanded to include the cocoa, forestry and logging and fishing industries, the

agricultural sector's contribution is about a third of national output (Mhango, 2010). However, Ghana's agriculture is dominated by small scale farmers with more than 70% of these farmers cultivating less than 3 hectares of farmland (Chamberlin *et al.*, 2007). This smallholder agriculture is characterized by reliance on rain fed conditions, limited use of improved seeds, fertilizer and mechanization for production. Based on these, agricultural productivities are below potential levels. Unfortunately, the poorest occupational group in Ghana is also within the agricultural sector making the sector a major target for both food security and poverty reduction in the country.

To address the poverty problems the Government of Ghana in August 2006, signed a 5-year $547 million Compact with the Millennium Challenge Corporation (MCC) of the United States of America (MiDA, 2007) with the main aim of reducing poverty through economic growth led by agricultural transformation. To oversee and manage the implement of this compact, the Millennium Development Authority (MiDA), a government corporation, was established by the Parliament of Ghana to serve as the accountable agent for the implementation of the Compact (MiDA, 2007). MiDA thus identified three zones in Ghana where poverty levels are above 40% to serve as the zones for implementing the activities spelled out in the compact. One of such zones is the Afram basin zone, where, the majority of inhabitants are poor farmer (ADRA-Ghana, 2008).

1.2 Problem Statement

Although the incidence of poverty is highest among employees in the agricultural sector, food crop farmers are the worst affected and are the poorest occupational group in Ghana with 46% of their population being poor (Republic of Ghana, 2010). These

food crop farmers produce food crops such as millet, sorghum, cassava, cocoyam, plantain, yam, rice and maize. Of these, maize (*Zea mays L.*) is the main staple crop in Ghana; it forms a major component of several domestic diets. In addition, maize is a major ingredient in livestock feed formulation, a possible substitute in the malt brewing industry, and a major source of income to most growers (Rondon and Ashitey, 2011).

Consumption of maize in the country has been rising over the years with an estimated consumption of about 1.8 million Mt in 2010 and an estimated consumption growth rate of 2.6% annually between 2010 and 2015 (MiDA, 2009). Ghana is not self-sufficient in maize production with an average shortage in domestic maize supply of about 12% in recent years (MoFA, 2011). Based on the most recent domestic production data, the shortfall between domestic production and domestic consumption is estimated to reach 267,000 metric tons by 2015 (MoFA, 2011). With about 992,000 hectares of land devoted to maize production in 2010, average maize yield was about 1.7 metric tons per hectare against a potential of 6 metric tons per hectare (MoFA, 2011).

There have been several interventions in Ghana to help promote maize production. In 2008, the Government of Ghana introduced a 50 percent subsidy for fertilizer to make it affordable to producers (including maize producers) and also increase fertilizer use. Also, the government set up the national food buffer stock company (NAFCO) to buy, preserve, store, sell and distribute excess grains (including maize) in warehouses across the country so as to reduce post-harvest losses, ensure price stability and establish emergency grain reserves (Rondon and Ashitey, 2011).

In Ghana, maize is cultivated in all the ecological zones but the highest production of maize is in the transition zones. The vegetation of the Afram Basin is predominantly that of a transition zone; thus, maize is one of the major food crops produced by most farmers in the zone. This makes the zone one of the areas targeted in attempt to increase maize production in the country.

However, land degradation, which is mainly from deforestation, overgrazing and bushfires, has resulted in declining soil fertility in the Afram basin (Pagett and Acquah, 2012). According to Pagett and Acquah (2012), the continuous use of these degrading lands results in rapid soil erosion which increases loss of soil fertility and results in low crop productivity. In addition, the Afram Basin is characterized by predominantly rural communities with most of their inhabitants being poor (Codjoe *et al.*, 2012). This high spread poverty among farmers in the zone limits their ability to purchase productivity enhancing inputs such as fertilizer, hybrid seeds and pesticides for production. Thus, most farmers in the zone rely on traditional methods, tools and inputs with little or no use of mechanization for their production activities leading to low crop (including maize) productivity. The lack of adequate collateral by the farmers also makes it difficult for the farmers to secure loans from financial institutions for investment in their farming activity. These conditions, coupled with over dependence on rain-fed conditions for production has resulted in productivity levels of maize farmers in the Afram basin of Ghana far below potential levels (MoFA, 2011).

To address some of these constraints to maize production, MiDA instituted a four year project in the Afram Basin in 2008 with the aim of enhancing productivity of farmers in the zone. The crop productivity enhancement project instituted by MiDA, and being

evaluated in this study, entailed four key training activities: 1. training on proper agronomic practices, 2. hand holding activity, 3. field days activities and 4. distribution of starter packs to the participant farmers. The training began in November 2008 and ended in January 2011 and the entire MiDA compact project ended in February 2012 (ISSER, 2012).

Although MiDA did not find any significant effect of participation in the FBO training on the yields of the participant maize farmers when they evaluated the project, the question of the effect of the project in enhancing productivity of the maize farmers and whether the maize farmers in the Afram Basin zone considered the intervention to be beneficial from the perspective of an independent body remains unknown.

This leads to the following research questions:

1. What are the perceptions of maize farmers in Afram basin about MiDA intervention?
2. What are the levels of productivity of MiDA intervention participants and non-participants in the Afram Basin?
3. Has the MiDA intervention improved productivity of the target group?

1.3 Objectives of the Study

The main objective of the study is to analyze the effect of MiDA intervention on the productivity of maize farmers in the Afram basin. Specifically, the study seeks to:

1. Describe the perceptions of maize farmers in Afram basin about MiDA intervention.

2. Estimate the level of productivity of both participant and non-participant maize farmers in the study area.
3. Estimate the effect of the MiDA intervention on productivity of the target group.

1.4 Relevance of Study

The purpose of undertaking crop productivity enhancing interventions is to increase the productivity or yields of the target crop farmers; which are expected to translate into increase income, food security and eventually, poverty reduction. Therefore, assessing the effect of MiDA intervention on productivity of maize farmers in the Afram basin will provide information on the extent to which the intervention was able to improve the yields of the participant farmers. The results of this research will guide MiDA and governmental research organizations such as Ministry of Food and Agriculture (MoFA) and International Food Policy Research Institute (IFPRI) to assess how well the project was able to achieve its expected objective and also serve as a justification for the continuation or termination of similar interventions aimed at increasing the productivity of maize farmers in Ghana.

Knowledge of the level of productivity of both participant and non-participant maize farmers in the zone will inform researchers and policy makers on the current level of productivity of maize farmers in the zone so that policies aimed at enhancing productivity will target increasing the productivity levels from the current levels. Also, knowledge of the perceptions of farmers about the project, its constraints and effectiveness will serve as a guide to other organizations who wish to undertake similar interventions. It will also guide researchers, extension agents, policy makers and organizations on how to design such interventions to meet the needs of their target

groups for effective participation. Finally, assessing the effect of MiDA intervention on productivity of the maize farmers will serve as a justification for the budget allocated to the project by helping the investors decide whether or not the budget was for a good course.

1.5 Organization of the Report

This report is organized into 6 chapters. Chapter Two is discusses reviews the relevant literature on the study. It entails a description of the key concepts in the study as well as a review of empirical studies related to the key concepts. The chapter is organized into three main sections. Overview of the activities undertaken by MiDA is presented in Chapter Three. It begins with a brief history about MiDA, continues with a description of the compact project undertaken by MiDA and concludes with the specific intervention introduced to the maize farmers by MiDA. Chapter Four presents the methodology and begins with a description of the study area, continues with a discussion of the conceptual, theoretical and analytical frameworks underpinning the study as well as the methods used to achieve the specific objectives and conclude with the methods of data collection. Chapter Five presents the details of the analysis and a discussion of the results. Summary, conclusions and recommendations of the study are presented in Chapter Six.

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CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature related to the study. It begins with the meaning and measurement of productivity as well as project evaluation and ends with a review of empirical studies on productivity and project evaluation.

2.2 Concepts: Meaning and Measurement

This section discusses the meaning and methods of measurement of the two key concepts in the study namely productivity and project evaluation.

2.2.1: Productivity

Productivity is generally defined as a measure of the rate at which outputs of goods and services are produced per unit of inputs (Tatom, 1979; Newton and Yee, 1997; OECD, 2001; Diewert and Nakamura, 2002; CSLS, 2003). Commonly, it is defined as a ratio of a volume measure of output to a volume measure of input use (OECD 2001) and conventionally defined simply as the ratio of output to input (Diewert and Nakamura 2002). According to Parham (n.d), conceptually, productivity is a supply side measure that captures technical production relationships between inputs and outputs although implicitly, it is also about the production of goods and services that are desired, valued and demanded. Productivity contributes to growth in output, income and living standards.

There are several ways of measuring productivity and the choice of which measure to use depends on the purpose of the productivity measurement and to a small extent, the

nature or type of the data available (OECD, 2001). Broadly, there are two measures of productivity which are Single factor productivity measure (or partial factor productivity) and multifactor productivity measure (or total factor productivity).

Single factor productivity measure (or partial factor productivity) (PFP) is a productivity measure which relates a measure of output to a single measure of input. Examples of PFP measures are labour productivity (ratio of output to labour input), capital productivity (ratio of output to capital input) and land productivity (ratio of output to land input). This measure of productivity is frequently used to measure productivity in literature and according to OECD (2001) it is mainly because of the ease of computation and readability. However, the major drawback to the use of single factor productivity measures in measuring productivity is that it does not account for the joint influence of the other factors used in production.

Multifactor productivity measure (or total factor productivity) (TFP) is a productivity measure that relates output to a bundle of inputs (OECD, 2001; Newton and Yee, 1997). This measure is often used in cases where industrial or enterprise level and sectoral technical change analysis are required. According to OECD (2001), TFP is the most appropriate tool to measure productivity because it incorporates the joint effect of all intermediate inputs used. However, the main drawback associated with this productivity measure is difficulty in obtaining accurate data for the analysis. Due to this major drawback, only few studies employ this measure in measuring productivity with most of these studies being macro level studies (regional and national).

Generally, productivity measures can be expressed as a physical measure (for example, number of cars produced per employee), a monetary measure (for example, thousands of dollars of output per hour worked) or an index (for example, output per unit of labour = 100) (Parham, n.d).

2.2.2 Project Evaluation

According to Preskill and Russ-Eft (2005), several definitions of evaluation have been offered over the years with the definition by Michael Scriven being one of the earliest definitions. Michael Scriven defined evaluation as the process of determining the merit, worth or value of something or the product of that process (Preskill and Russ-Eft, 2005). Rossi *et al.* (2004) define project evaluation as systematically investigating the effectiveness of social interventions. This definition draws on the techniques and concepts of social science disciplines and is intended to be useful for improving projects and informing social actions aimed at ameliorating social projects (Preskill and Russ-Eft, 2005). Generally, such evaluations involve comparing the outcome variables of beneficiaries of the intervention with that of non-intervention group members (control group) (African Impact Evaluation Initiative (AIEI), 2011 and Baker, 2000). Kirkpatrick and Kirkpatrick (2009) identified three reasons for evaluating training programs which are: (1) to justify the existence and budget of training department in organizations, (2) to decide whether to continue or discontinue a training program and (3) to gain information on how to improve future training programs.

There are two broad types of project evaluations namely *ex ante* and *ex post* evaluations. *Ex ante* evaluations are conducted in situations where expected potential outcomes are necessary for the planning, design and approval of the intervention or project and are

thus conducted before implementation of the project (Staronova *et al*., 2007). An example of *ex ante* evaluations is formative evaluations. Formative evaluations deal with evaluations that seek to identify the gap between project activities and the needs of the communities in which the project is to be implemented (Staronova *et al*., 2007). It is mostly undertaken before implementing the project and helps test the logic used in the project planning. *Ex post* evaluations on the other hand are used to identify the actual effects of an intervention either during the implementation of the intervention to allow for corrective action to be taken if necessary or after implementation of the intervention to provide information for improving the design for future similar interventions (Staronova *et al*., 2007). Examples of *ex post* evaluations are process evaluation, outcome evaluation and impact evaluation. Process evaluation is an evaluation that examines the actual activities used in a project and compare it to what was planned and it is mostly carried out during project implementation (Blackstock *et al*., 2007). Outcome evaluations are evaluations that sort to assess actual project outcomes and are often undertaken immediately after the project or intervention has ended to determine the projects short term effects whereas impact evaluations are evaluations that assess the net effect of a project in the long term (Blackstock *et al*., 2007). Impact evaluations are often carried out after a project has concluded (at least a year after project activities have ended). However, these types of evaluations can all be carried out either quantitatively or qualitatively although each type of evaluation technique (whether qualitative or quantitative) has its own advantages and limitations. The choice of which technique to adopt usually depends on the type of information desired and also its ability to produce change in the discipline or field where it is being applied (Young and Hagerty, 2007). Generally, *ex post* quantitative evaluations can be carried out in two ways: “before and after” and “with and without” evaluations.

"Before and after" evaluation compares the performance of key variables during and after an intervention with those before the implementation of the intervention. With this evaluation technique, the key outcome variables for both intervention and non-intervention members are measured both before and after the intervention (Schwarz, 2012). The effect of the intervention is generated by comparing the difference in outcome variables before and after the intervention for intervention members with the difference in outcome variables before and after the intervention for non-intervention members (Schwarz, 2012). With both "before and after" data available, this estimation technique is easier to compute and has a smaller chance of encountering biases compared to the "with and without" evaluation technique. However, the main drawback to the use of this technique is availability of the required "before" the intervention data. Once data before the intervention is not available, this estimation technique cannot be employed and this leads to the use of the "with" and "without" estimation technique to assess an intervention effect.

"With and without" evaluation however compares changes in key outcome variables of intervention beneficiaries with changes in these key variables of non-intervention comparison group (Wainaina *et al*., 2012). "With and without" approach uses a comparison group as a proxy for what would have happened to beneficiaries of the intervention in the absence of the project (Wainaina *et al*., 2012). According to Baker (2000), this "what would have happened to beneficiaries in the absence of the intervention" is called the counterfactual outcome with the estimation of the counterfactual outcome being the main challenge in "with and without" project evaluation. Based on the fact that the counterfactual outcome is never observed, it has to be estimated using statistical methods. There are three main types of evaluation

designs used to obtain estimates for the counterfactual outcome and these are: experimental (control group), quasi-experimental (comparison group) and non-experimental (non-participant) designs.

In Experimental (also referred to as randomized) evaluation designs, selection into treatment and control group (or comparison group) is random with the only differentiating factor between the two groups being the chance to participate in the intervention (Heinrich *et al.*, 2010). The treatment group receives the intervention services whiles the control group does not. The control group is thus used to assess what would have happened to the treatment group in the absence of the intervention (counterfactual outcome) because they are very similar to the intervention group. The effect of the intervention is measured simply by the difference between the means of the samples of the treatment group and the control group. The main advantage associated with the use of this evaluation design is the simplicity of the measurement of the intervention effect. Despite this advantage, there are several limitations to the use of this technique according to Baker (2000). Some of these limitations are; difficulty in ensuring that assignment into treatment and control groups are truly random, willingness of individuals in the treatment and control groups to stay in their respective groups without changing groups or dropping out of their groups and the expensiveness and time consuming nature of experimental designs especially during data collection. With good management of these short comings, experimental designs are generally the most robust evaluation technique and are considered the optimum approach to estimating intervention effects (Baker, 2000).

Quasi-Experimental designs, according to Wainaina *et al.* (2012), are used to evaluate projects that do not permit the treatment and control groups to be generated through experimental designs or randomization. This implies that selection into either treatment or comparison group under this evaluation design is not random. Based on this, two common sources of bias are associated with this type of evaluation design; (1) project placement or targeting bias, which refers to the non-randomness of the location or target population of the intervention and (2) self-selection bias, in which members of the intervention choose whether or not to participant in the project or intervention (Davis *et al.*, 2010).

To deal with these biases, quasi-experimental designs generate a comparison group that resembles the intervention group in at least observable characteristics, and uses the comparison group to estimate what would have happened to the intervention group members in the absence of the intervention. The effect of the intervention is generated by comparing the difference between the mean outcome variables of the intervention members and the comparison group members. Several econometric methods can be employed to link an intervention member to a comparison group member, who is very similar to the intervention member, to allow for proper assessment of intervention effects. Common econometric methodologies employed include matching methods, double difference methods, instrumental variables methods and reflexive comparisons. According to Baker (2000) matching methods of quasi-experimental designs are generally considered second-best alternatives to experimental designs with majority of literature on program evaluation centered on the use of this type of evaluation design. One common matching method used is propensity score matching developed by Rosenbaum and Rubin (Rosenbaum and Rubin, 1983). The main advantage associated

with quasi-experimental designs is that they can be applied to already existing data and they can be performed after a program has been implemented. However, the principal disadvantages of quasi-experimental techniques are that the reliability of the results are often reduced as the methodology is less robust statistically, the method can be statistically complex and the problem of selection bias associated with this evaluation design (Baker, 2000).

Non-experimental evaluation designs, according to Berg *et al.* (2009), deals with before and after comparison of pre and post treatment variables. Here, there are participants who receive the intervention and non-participants who do not receive the intervention. Selection to be a participant or not may not be random but the idea is to quantify the difference over time (before and after) between outcome levels of participants and non-participants of the project to assess project effects (Berg *et al.*, 2009).

Aside these quantitative methods of evaluating *ex-post* programs, qualitative methods can also be used to assess project effects. The focus for most qualitative project evaluations is to understand the processes, behaviours and conditions as perceived by the groups being studied (Baker, 2000). Due to the fact that measurement of the counterfactual is essential in project evaluation, most qualitative designs are used in conjunction with other quantitative evaluation designs. According to Baker (2000), common methodologies used in evaluating projects qualitatively are the rapid rural assessment evaluation technique which relies on participants' knowledge of the conditions surrounding the intervention being evaluated and participatory evaluation technique which involves stakeholders in all stages of the evaluation. The benefits of qualitative impact assessment are: they are flexible, can be carried out quickly and

provide a better understanding of the conditions and processes that may affect the intervention effects (Baker, 2000). Among the main drawbacks are the subjectivity involved in data collection, the lack of a comparison group, and the lack of statistical robustness which makes validity and reliability of qualitative project evaluation techniques highly dependent on the methodological skills employed as well as the sensitivity and training of the evaluator (Baker, 2000).

2.3 Empirical Studies on Productivity

Studies on agricultural productivity can be classified broadly into two groups: theoretical and empirical. Theoretical studies define productivity and its determinants more rigorously and set precise relationships for estimation. They also suggest hypotheses that can be tested empirically. Empirical studies on the other hand examine trends over time and quantify the contributions of specific inputs, policies, technologies and other productivity-enhancing factors. In the realm of empirical studies, Kelly *et al.* (1995) identified three categories of productivity measures in agriculture. These are "macro", "meso" and "micro" studies. Macro studies use time series data reported at the national level, while meso studies use national data disaggregated into farm types (large or small), agro-ecological zones, or administrative regions. Micro studies however use cross-sectional data, which permit comparison across different sub-groups at a particular point in time.

Reardon *et al*. (1997) and Thirtle *et al.* (2001) are examples of macro studies on productivity whiles some micro studies on productivity include Akinbile (2007), Okoye *et al*. (2008), Ukoha *et al.* (2010) and Mbam and Edeh (2011). The macro studies employed panel data (Reardon *et al*., 1997 and Thirtle *et al.*, 2001) whiles the micro

studies used cross-sectional data (Akinbile, 2007; Okoye *et al*., 2008 Ukoha *et al.*, 2010; & Mbam and Edeh, 2011). Whiles Mbam and Edeh (2011), Ukoha *et al.* (2010), Thirtle *et al.* (2001) and Akinbile (2007) measured productivity using total factor productivity index, Okoye *et al.* (2008) and Reardon *et al*. (1997) employed partial factor productivity indicators; specifically crop and land productivity indexes.

Mbam and Edeh (2011) and Akinbile (2007) focused on identifying the factors that affect the productivity of rice farmers in Nigeria and found that education was a common determinant of productivity. In addition, Mbam and Edeh (2011) identified fertilizer use and use of improved variety as key determinants of productivity whiles Akinbile (2007) identified farm size, and quantity of labour employed to be the determinants of productivity. Also, Reardon *et al.* (1997) identified land degradation to limit land productivity whiles land conservation and investment in soil conservation enhance land productivity.

A review of these studies indicates that the method of analysis adopted as well as the factors that affect productivity varies based on the type of productivity analysis being conducted.

2.4 Empirical Studies on Project Evaluation

Most project evaluation studies employ quantitative methods with majority adopting quasi-experimental designs to estimate project effects (Mendola, 2007; Pufahl and Weiss, 2008; Becerril and Abdulai, 2009; Dontsop Nquezet *et al.*, 2011; Doyle 2011; Owusu *et al*., 2011b; Wainaina *et al.*, 2012, ISSER, 2012 and Zick *et al.*, 2013) while few studies adopted experimental designs (Newman *et al.*, 2002) and non-experimental

designs (Maluccio and Flores, 2004). Davis *et al.* (2010) however combined both quantitative and qualitative estimation methods to assess the impact of farmer field schools on agricultural productivity and poverty in East Africa. Most project evaluation studies are conducted at a micro or household level (Mendola, 2007; Pufahl and Weiss, 2008; Dontsop Nquezet *et al.*, 2011; Doyle 2011; Wainaina *et al.*, 2012; ISSER, 2012 and Zick *et al.*, 2013). Whiles studies by Mendola (2007), Dontsop Nquezet *et al.* (2011), Wainaina *et al.* (2012), Owusu *et al*. (2011a), Owusu *et al.* (2011b), ISSER (2012) and Zick *et al.* (2013) employed cross-sectional data; Newman *et al.* (2002), Maluccio and Flores (2004) and Davis *et al.* (2010) used panel data. The type of data employed in program evaluation analysis is mainly dependent on the type of evaluation technique being adopted.

Some program evaluation studies include studies by Maluccio and Flores (2004) Dinar *et al.* (2007), Pufahl and Weiss (2008), Liane and Awudu (2008), Becerril and Abdulai (2009), Davis *et al.* (2010), Owusu *et al.* (2011b), Dontsop Nguezet *et al.* (2011), Doyle (2011) and ISSER (2012). Most of these studies assessed the effect of several agricultural programs such as extension services programs (Dinar *et al*., 2007), irrigation programs (Owusu *et al.* 2011b) and adoption programs (Mendola, 2007; Liane and Awudu, 2008; Dontsop Nguezet *et al.*, 2011) on incomes and poverty status of the target group (Maluccio and Flores, 2004; Mendola, 2007; Liane and Awudu, 2008; Becerril and Abdulai, 2009; Owusu *et al.*, 2011b and Dontsop Nguezet *et al.*, 2011). In addition, Doyle (2011) estimated the causal effects of foster care on long-term and short-term outcomes variables such as delinquency and emergency healthcare episodes whiles Pufahl and Weiss (2008) evaluated the effects of two types of farm programs on input use and farm output of individual farms in Germany. Studies that

focused on productivity were Davis *et al.* (2010) and ISSER (2012) who assessed the effect of Farmer field Schools and MiDA FBO training, respectively on the productivity and incomes of their target groups.

Whiles Mendola (2007), Pufahl and Weiss (2008), Liane and Awudu (2008), Becerril and Abdulai (2009) and Owusu *et al*. (2011b) used propensity score matching, Dontsop Nguezet *et al.* (2011) and Doyle (2011) employed instrumental variable approach with Davis *et al*. (2010) and ISSER (2012) employing the double differencing method to evaluate the effect (estimating ATT, ATU and ATE) of the various programs on the various outcome variables.

Generally, most studies found a positive and significant effect of participation in the various programs on their outcome variables except for ISSER (2012), which found no significant effect of participation in an agricultural productivity enhancing program (MiDA FBO Training) on productivity of the participant groups. These findings are however consistent with World Bank (2011), a study that analysed several studies evaluating agricultural programs and concluded that more than half of all the evaluation studies analysed had positive effects on their various agricultural outcome variables with a few not finding any significant effect.

Largely, most of the literature on project evaluation used quasi-experimental designs and employed propensity score matching (a type of matching method) to assess intervention or project effects and this is due mainly to its ease of applicability compared to the other approaches (double differencing and instrumental variable approach) and will thus be adopted for this study as used by Mendola (2007), Pufahl

and Weiss (2008), Liane and Awudu (2008) Becerril and Abdulai (2009) and Owusu *et al*. (2011b).

CHAPTER THREE

OVERVIEW OF THE ACTIVITIES OF MIDA

3.1 Introduction

This chapter explains the project undertaken by MiDA. It begins with a brief history of MiDA followed by the goal of the Compact implemented by MiDA. Next, the details of the compact projects undertaken by MiDA are discussed with the chapter concluding with the specific intervention for maize farmers in the Afram Basin.

3.2 Brief History of MiDA

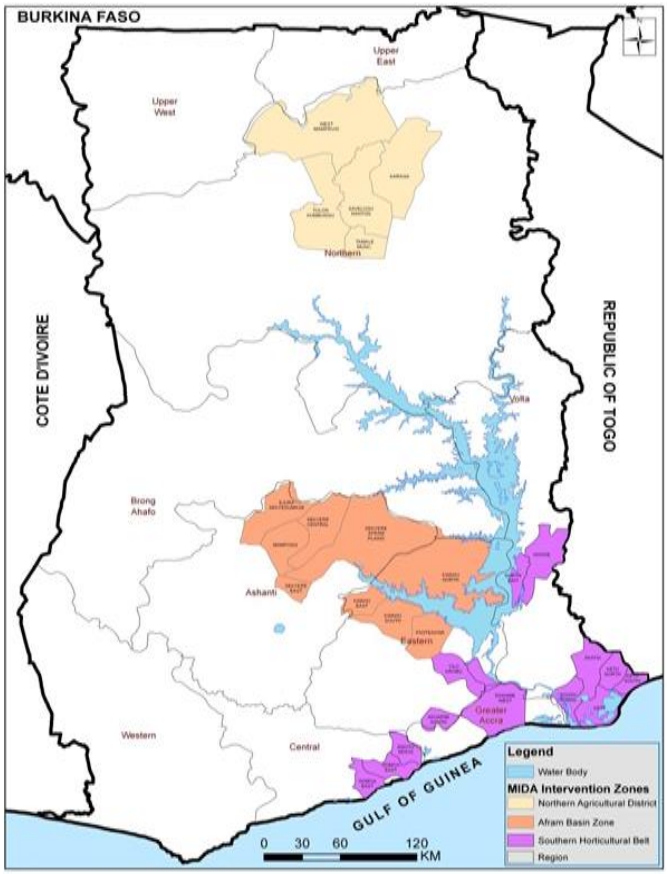
Millennium Development Authority (MiDA) is a public entity established by the Government of Ghana through the Parliament of Ghana based on act 702 and 709 on 23rd March, 2006. This was after the signing of a 5-year $547 million Compact with the Millennium Challenge Corporation (MCC) of the United States of America (MiDA, 2007). The objectives for setting up MiDA were: 1. to oversee and manage the implementation of the Ghana Program under the Millennium Challenge Account of the United States Government, 2. secure the proper and effective utilization of the Millennium Development Fund granted to Ghana under the Compact, and 3. to oversee and manage other national development programs of similar nature funded by the Government of Ghana, Development Partners or by both.

3.3 Goal of the MCA Compact

The goal of the compact was to reduce poverty through economic growth led by agricultural transformation. This goal resulted in two main objectives: 1. to increase the production and productivity of high-value cash and food staple crops and secondly, to enhance the competitiveness of Ghana's high-value cash and food crops in both local

and international markets (MiDA, 2007). The Compact Program focused on three Intervention Zones where poverty rates were above 40%. These were the Northern Agricultural zone (Northern Region), the Central Afram Basin area (Ashanti and Eastern Regions) and the Southern Horticultural Belt area (South-East Coastal Plains). Figure 3.1 shows the map of Ghana with the MiDA Intervention zones.

Figure 3. 1: Map of Ghana Showing MiDA Intervention Zones



Source: Geography Department, University of Ghana, 2013.

Thirty districts were considered for the project (MiDA, 2006). MiDA identified and focused on three main sectors important in achieving the goals of the compact. These were the agriculture sector, transportation sector and finally rural development. The Compact entered into force on 15th February 2007 and ended on 16th February 2012 (MiDA, 2006).

3.4 Compact Projects Undertaken by MiDA

MiDA identified three main project areas namely the Agricultural sector project, Transportation project and Rural Development project which were undertaken in all the three selected intervention zones. The details of each of these projects are described below and in summary from the Ghana compact by MiDA (2010).

3.4.1 Agricultural Sector Project

The aim of the agricultural sector project was to enhance the profitability of staple foods such as maize, rice, yam and high value horticultural crops. The project also focused on improving the delivery of business and technical services to support the expansion of commercial agriculture and farmer-based organizations (FBOs). In totality, a budget of about US$ 208.8 million representing 38.8% of the total compact budget was allocated to the agricultural sector project. To be able to achieve the objectives of this project, six activities were identified and implemented. These activities are described below.

The first activity was the farmer and enterprise training in commercial agriculture. This activity focused on accelerating the development of commercial skills and capacity building among Farmer-Based Organizations (FBO). It comprised of training the farmers on how to prepare a business plan and the distribution of production Starter Packs (SPs) worth $230 for a 1-acre (equivalent to 0.4 Ha) farm to the trained farmers. The second activity was the Irrigation Development Activity. The aim of this activity was to establish a limited number of retention ponds and weirs requested by FBOs and FBO partnerships with water being critical to the success of their businesses. The third activity was the land tenure facilitation activity which aimed at improving the tenure

security for existing land users and facilitating access to land for higher value agricultural crops. The program comprised of the construction of 3 new land title registry offices, developing a more efficient way for land title registration and organizing specific ICT, Land Law and alternative dispute resolution training for Judges who handle land cases in courts.

Next was the improvement of post-harvest handling and agricultural value chain services activity. The focus of this activity was to facilitate strategic investments by FBOs and FBO partnerships in post-harvest infrastructure improvements and also to build the capacity of the public sector to introduce and monitor compliance with international plant protection standards. The activities, including, the construction of a modern 1000 tons privately managed perishable cargo centre with storage and cold rooms, the construction of 10 Agriculture Business Centres (ABCs) and the construction of 3 public pack houses to serve as storage, aggregation and buying centres for selected horticultural and food crops across all the three intervention zones.

It is also important to consider credit services for On-Farm and agricultural value chain investments. The objective of this activity was to augment the supply of and access to credit provided by financial institutions operating in the intervention zones to provide seasonal credit to FBOs through commercial and rural banks, as well as through non-traditional channels such as input suppliers and medium-term credit through banks to finance capital goods such as irrigation, post-harvest processing and storage facilities.

The last activity undertaken under the agricultural sector project was the rehabilitation of feeder roads activity. The aim of this activity was to reduce transportation costs and

time, to increase access to major domestic and international markets, and to facilitate transportation linkages from rural areas to social service networks (including for instance, hospitals, clinics and schools).

3.4.2 Transportation Project

The purpose of the transportation project was to support the agricultural sector by reducing the transportation cost affecting agricultural commerce at the sub-regional and regional levels of Ghana. A total of US$ 218.37 million representing 40% of the compact budget was allocated to this project. In view of this, three main transportation activities were carried out and these were;

The N.1 Highway activity which involved the construction of 2 grade separation interchanges, 6 footbridges, 13 bus bays, 23 minor junctions, bicycle lanes and 2 transport terminals so as to reduce the bottleneck in accessing International Airport and the Tema Port and also to support the expansion of Ghana's export-directed horticultural base beyond current production levels.

The Trunk Road Activity which aimed at rehabilitating or/and constructing of up to two hundred and thirty (230) kilometers of trunk roads in the Afram Basin area to facilitate the growth of agriculture and access to social services in the area.

The Lake Volta Ferry Activity which was aimed at improving the reliability of ferry services in the busiest crossing points on the Volta River and in the Afram Basin. Specifically, this involved the rehabilitation and modernization of the 43 years old floating dock at Akosombo, the construction of new landing stages at both ends of the

lake and the upgrading of the passenger terminals at Adawso and Ekye Amanfrom.

3.4.3 Rural Development Project

The total budget allocated to this project was about US$ 77.72 million representing 14% of the total compact budget. The Rural Development Project was aimed at improving rural livelihoods in general through the provision of basic services. Specifically, there were three sub-activities and these are described below.

The Procurement Capacity Activity which was to support the development of procurement professionals and reinforce the capabilities of the Government to procure goods and services. This was basically through the provision of curricula and training modules for procurement majors, diploma etcetera, training of 20 lecturers in the use of the curricula and training modules and the placement of 1600 tertiary students in procurement-related internships with public institutions.

Community Services Activity which was to complement the Agricultural Project by funding the construction and rehabilitation of educational facilities, construction and rehabilitation of water and sanitation facilities, electrification of rural areas and by providing capacity-building support to local government institutions.

Financial Services Activity which aimed at extending the depth and value of financial services provided to rural populations and to reinforce their integration into the cash economy and provide access to savings, credits and transfer services.

MiDA hoped to achieve the goal of the compact by implementing these activities in all the three intervention zones. The crops primarily focused on were the horticultural crops such as mango and pineapple and food crops such as legumes, plantain, yam, vegetables, cassava and maize.

3.5 Specific Intervention for Maize Farmers in the Afram Basin

MiDA entered into a contract with Adventist Development and Relief Agency- Ghana (ADRA-Ghana) to serve as the Regional Implementation Consultant (RIC) responsible for the implementation of the compact in the Afram Basin Intervention Zone (ADRA-Ghana, 2010). ADRA-Ghana was expected to promote commercial development of farmer organizations in the Afram Basin through partnerships and to assist farmers to increase their yields and incomes. The Afram Basin zone had 600 FBOs, comprising of about 30,000 farmers (ADRA-Ghana, 2010). Two training cohorts were set up and each farmer group assigned to a training cohort. Two training sections were organized with one training cohort preceding the other training cohort. As a result, all the groups were not trained at once, but by the end of the training section, all the groups had been trained. The training section lasted from November 2008 to January 2011 (ISSER, 2012). This intervention was carried out in nine districts in the Afram Basin; Kwahu South, Kwahu North, Kwahu East, Fanteakwa, Sekyere Central, Mampong Municipal, Sekyere East, Sekyere Afram Plains and Ejura-Sekyedumase. Maize farmers in the basin received training in four broad areas; business development /commercialization, marketing, group formation and crop productivity enhancing activities.

3.5.1 Business Development /Commercialization

The farmers were trained to treat farming as a business and not a subsistence activity. Treating farming as a business entails understanding the market demands, such as what variety of maize is being demanded on the market, the quantities demanded and the characteristics of consumers. In addition, the farmers were also trained on the maize value chain (from production to final consumer as well as the various actors along the chain) to help them identify different actors to focus on for produce marketing aside selling to final consumers. The farmers were also taught how to develop business plans. At the end of the training, the maize farmers were able to develop their own business plan with assistance from the training personnel to help them acquire loan from banks.

3.5.2 Marketing

Maize farmers received training on the various marketing channels and options available to them aside selling on the market. This included building the confidence of farmers to enable them approach heads of institutions particularly senior high schools and other interested parties for negotiations on supplying them with maize. Fortunately, some groups of farmers were able to contact heads of schools like St. Peters High School and Mpreaso High School to supply them with maize.

3.5.3 Group Formation

Maize farmers in the zone were educated on the importance and the need for them to operate as members of a group rather than as individual farmers. This was because of the advantages farmers enjoy when they operate as members of a group; are able to more easily access credit, buy inputs in bulk at lower prices, and able to negotiate for good prices for their produce.

3.5.4 Crop Productivity Enhancing Activities

The crop productivity enhancing activity involved training farmers on new agricultural methods such as pre-planting, post-planting and post-harvest technologies. The training lasted for 6 weeks after which 3 weeks practical hand holding activity on the practices taught was carried out. The training was done three days in a week. The hand holding activity was led by the training personnel, who held the hands of the farmers to teach them how the practices taught were actually carried out on the field. Also, demonstration plots were established with field days during which the training personnel together with the farmers carried out some of the practices taught during the training. Some of these practices included how to conduct seed germination test, establishing planting distances and depth, number of seeds per hole, accurate time for pruning and fertilizer application, how to apply fertilizers, weeding practices etcetera. Farmers also had the chance to observe and compare the growth performance of maize crops on the demonstration plots to other farms to better understand the importance of complying with the practices taught. Finally, each maize farmer was given a starter pack worth GHC230 for the cultivation of 1 hectare of land. The starter pack contained 2 bags of NPK fertilizer, 1 bag of sulphate of ammonia, 9 kilos of improved seed (obatampa) maize, pair of field boots, nose mask, hermetic sacks for storing the maize and GHC30 to pay for land preparation. The purpose of giving the farmers starter packs was to assist them undertake the practices they were trained in (ISSER, 2012). MiDA hoped that these activities will collectively help the maize farmers to enhance their productivity and hence, increase their incomes. This study thus focuses on analyzing how this crop productivity enhancing activity has helped enhance the productivity of the participant maize farmers.

CHAPTER FOUR

METHODOLOGY

4.1 Introduction

Chapter four is divided into six sections. The first and second sections deal with the description of the study area and the conceptual framework for the study. This is followed by the theoretical and analytical frameworks used in the study and the method of analysis for each specific objective. The last section deals with the method of data collection, sample size and sampling technique.

4.2 Description of Study Area

The Afram Basin zone covers nine districts namely: Kwahu South, Kwahu North, Kwahu East and Fanteakwa in the Eastern region of Ghana and Sekyere Central, Mampong Municipal, Sekyere East, Sekyere Afram Plains and Ejura-Sekyedumase in the Ashanti of Ghana. Of these, four districts with maize cultivation as their primary farming activity were selected in consultation with ADRA, the Regional Implementation Consultant (RIC) for the Afram Basin project. These four districts were Kwahu North, Kwahu East, Sekyere Central and Ejura-Sekyeredumase.

Kwahu North and Kwahu East are both located in the northern part of Eastern region and share boundaries with each other. The district capital of Kwahu North and Kwahu East are Donkorkrom and Abetifi, with each having nine and eight towns, respectively. Kwahu North, which is the largest district in the region in terms of land size, has a total land size of 5,040 square kilometers with that of Kwahu East being 860 square kilometers (Kwahu North District Assembly, 2012; Kwahu East District Assembly, 2012).

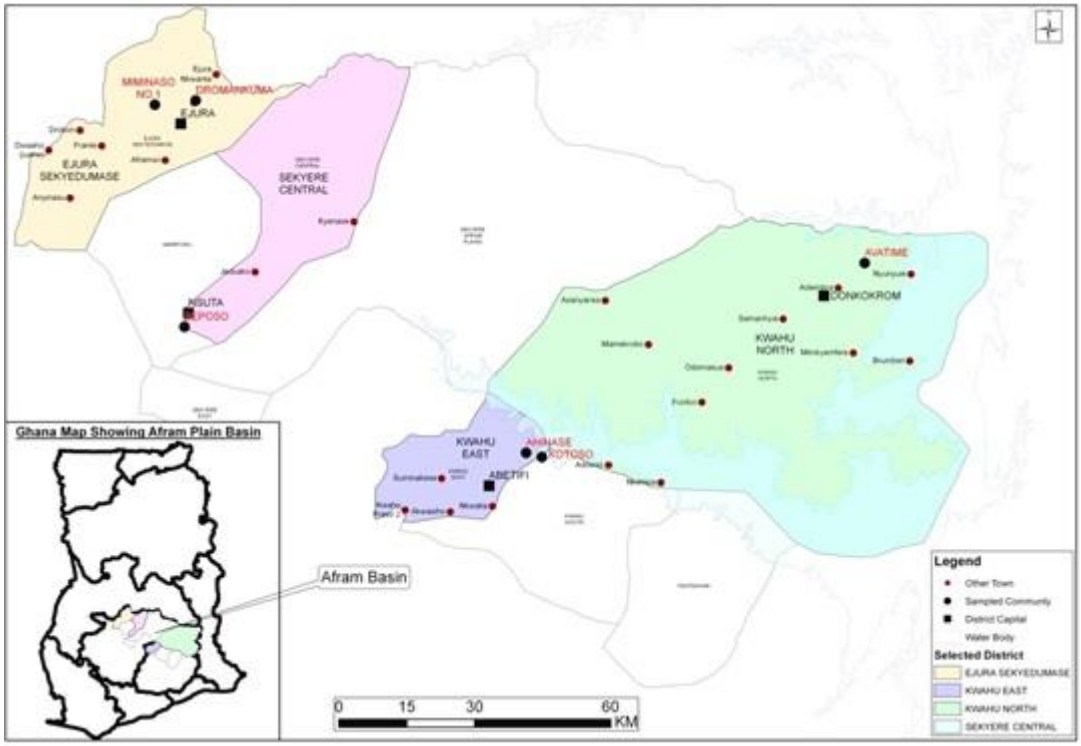
The population of Kwahu North district and Kwahu East district as at 2010 was estimated at 218,235 and 77,125 respectively (GSS, 2012). Agriculture employs majority (80% and 75% respectively) of the labour force in these districts. The main agricultural activities engaged in are food crop farming, livestock farming and cash crop farming with more than 78% of the farmers predominantly into food crop farming (Kwahu North District Assembly, 2012; Kwahu East District Assembly, 2012). Common food crops farmed in the two districts include maize, yam, plantain, cocoyam and cassava. Kwahu North has majority of about 39% of land under food crop farming devoted to maize production alone in the district (MoFA, 2013).

Sekyere Central and Ejura-Sekyeredumase are located at the northern part of Ashanti region with Nsuta and Ejura as their district capital, respectively. Sekyere Central district has 120 settlements and covers a total land area of 1,564 square kilometers representing about 3.28% of the regions total land size (Sekyere Central District Assembly, 2012). Ejura-Sekyeredumase district has 130 settlements and covers a total land area of 1782.25 square kilometers representing about 7.3% of the regions land area (Ejura-Sekyeredumase District Assembly, 2012).

The population of Sekyere Central district as at 2010 was estimated at 71,232 with that of Ejura-Sekyeredumase estimated at 85,446 (GSS, 2012). Majority of the labour force in each of these districts are employed by the Agricultural sector. Agricultural activities undertaken in these districts include food and cash crop farming, animal rearing and others. The major crop cultivated in the district is maize. However, maize farming in both districts is dominated by small-scale subsistence farmers who depend on rain-fed conditions for production. Ejura-Sekyeredumase district remains the leading producer

of maize in Ashanti region with about 13,486 Ha of land in the district under maize production in 2007 (DADU-SRID, 2007). The district produced about 28,861 metric tons of maize in 2007(DADU-SRID, 2007). Figure 3.3 presents the Map of Afram Basin highlighting the four districts in which this study was conducted.

Figure 4.1: Map of Afram Basin Showing Sampled Districts



Source: Geography Department-University of Ghana, 2013.

4.3 Conceptual Framework

Figure 4.2 illustrates the conceptual framework on how participation in MiDA intervention is expected to enhance the productivity of the participant farmers. Small scale maize farmers in Ghana use traditional agronomic practices leading to low productivity. To enhance the productivity of these farmers, MiDA carried out a crop productivity enhancing project in the Afram Basin zone of Ghana. Although the requirement for participation in the intervention was membership of an FBO, field observations revealed that most of the farmers were not members of FBOs before the

start of the intervention but formed their various FBOs to be able to participate in the intervention. This study thus ignores the requirement of being an FBO member for participation in MiDA intervention in this analysis.

Participation in the intervention was by self-selection (i.e. the decision to participate in the intervention or not was strictly based on the farmer's personal desire). Therefore, participation in the intervention was dependent on each farmer's specific characteristics such as the farmer's educational level, experience, age, total plot size and many others.

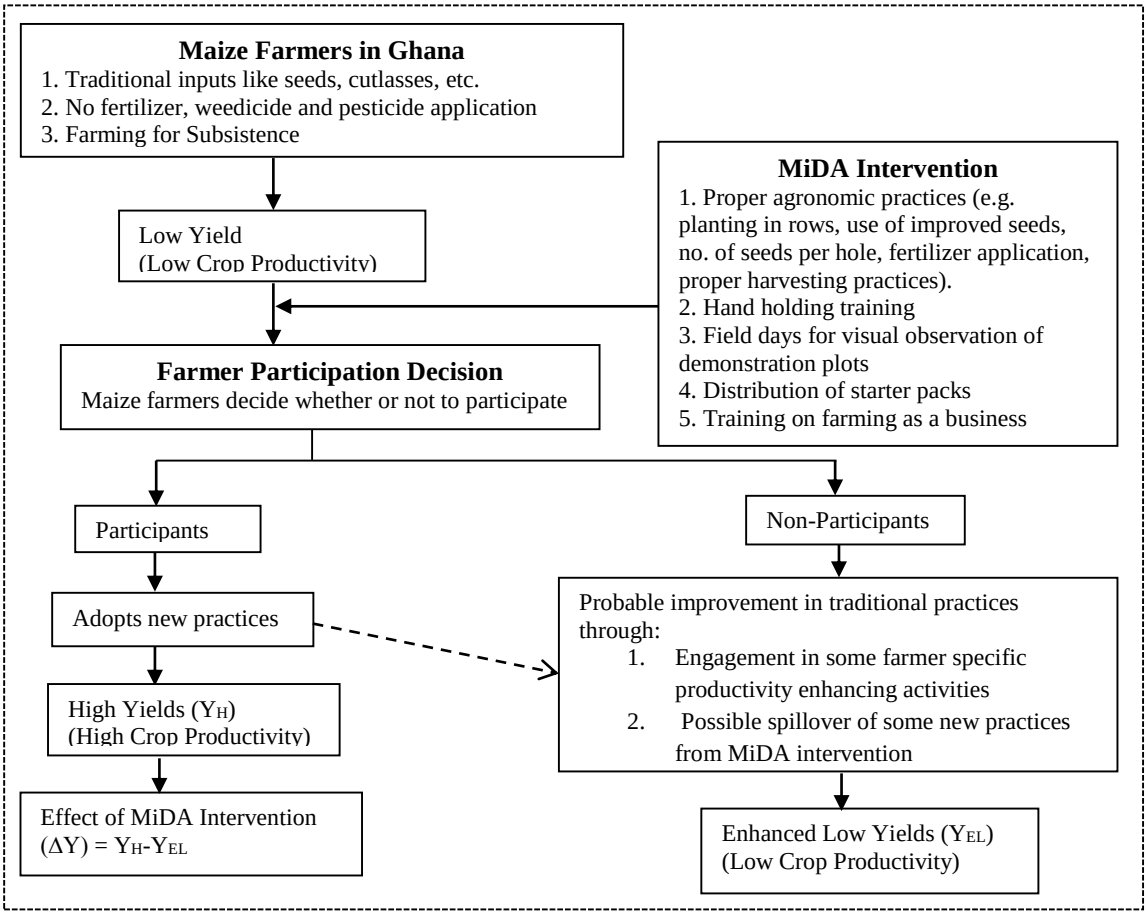
The participant farmers were trained broadly in four areas; training on proper agronomic practices from land preparation to harvesting, "hand holding" training to help the farmers properly undertake the skills taught, field days for farmers to visit demonstration plots and observe the farms and appreciate the effect of adopting the practices and finally, the provision of starter packs to the participants to encourage them practice the acquired skills on their individual farms.

It is expected that farmers who did not receive the training (non-participants) will undertake some farmer specific crop productivity enhancing activities, adopt some of the improved practices taught by MiDA from their neighbouring participant farmers (spillover) as well as contact extension agents for their services to enhance their production activity. However, their knowledge about crop productivity is not expected to be as high as participants of the intervention. Therefore, this study assumes that farmers who received the training will be more knowledgeable in all their production activities, employ more productive inputs and adopt more appropriate agronomic

practices in their farming activities and thus, are expected to be more productive *ceteris peribus* than farmers who did not participate in the intervention.

This study estimates the difference between the level of productivity of participant maize farmers and non-participant maize farmers to assess the extent to which the intervention enhanced the productivity of the participant maize farmers.

Figure 4.2: Conceptual Framework for MiDA Intervention on Productivity Enhancement



Source: Author's Compilation, 2013.

4.4 Theoretical Framework

The theory underpinning this study is the theory of production. The theory of production refers to the economic process of converting inputs into output. With output

being the outcome variable of interest (Y) and participation in MiDA intervention as one of the inputs (D) employed, together with some other inputs (Z_i), the production function for the outcome variable (Y) according to Flux (1894) is specified as:

$$Y_i = f(Z_i, D) \quad (4.1)$$

where:

D is a dummy, equal to 1 for participants and 0 for non-participants.

Z is a set of other observed inputs employed by the farmers which can be farmer characteristic variables, production variables and/or institutional variables.

A problem arises with the estimation of equation 4.1 using ordinary least squares (OLS) when there is project placement or targeting bias and self-selection bias in the design of the project. Project placement bias occurs in projects where the location or target population of the project is not random whiles self-selection bias exists in projects where the participant groups choose whether or not to participate in the project (Davis *et al.*, 2010). This implies that the participants and the non-participants (comparison group) may differ not only in their participation status but also, in other characteristics that affect both participation (D) and the outcome variable of the project (Y). These characteristics may be observable (e.g. educational level, level of experience, land size etcetera), unobservable and/or a combination of both. Observable characteristics can be measured while unobserved characteristics cannot be measured. Therefore, if unobserved factors influence a farmer's decision to participate in the intervention (or receive the training), then the error term in estimating equation 4.1, which measures the unobserved characteristics, will contain variables that are also correlated with the

participation variable (D). This leads to unobserved selection bias, thus, the covariance between the participation variable (D) and the error term (ε) will not be equal to zero i.e. cov (D, ε) ≠ 0 as expected. This then violates one of the key assumptions of ordinary least squares in obtaining unbiased estimates and in addition biases the other estimates in the equation including estimates of the intervention effect, which is the coefficient of the participation variable (D). Another method that can be used to estimate this production function is stochastic frontier model but according to Cerdan-Infantes *et al.* (2008), stochastic frontier models suffer from the same identification problem if participation in the intervention is not random and includes unobserved characteristics. This leads to the use of an evaluation method, "With" and "Without" evaluation method, to estimate the effect of participation in the intervention on the outcome variable. Discussion of how the "with and without" evaluation method solves the problem of selection bias in estimating the participation effect is presented in the analytical framework.

4.5 Analytical Framework

"With and without" approach to estimating participation effect uses a comparison group as a proxy for what would have happened to participants of the project in the absence of the project (counterfactual outcome) (Wainaina *et al*., 2012). Considering the fact that the counterfactual outcome is never observed, quasi-experimental design is used to obtain estimates for the counterfactual outcomes. Quasi-experimental designs, according to Wainaina *et al.* (2012), are used for evaluating interventions for which it is not possible to construct participant and non-participant groups through experimental designs. However, this evaluation design has two common sources of bias which are: the targeting bias and self-selection bias (Davis *et al.*, 2010).

To evaluate the effect of participation in the intervention on the outcome variable (Y) of the treated group using the quasi-experimental design, the expected effect of participation or the expected average treatment effect on the treated (ATT') which is the difference between the outcome variable level of the participants and what would have been their outcome variable level if they had not participated in the intervention needs to be calculated. This is given as:

$$ATT' = E(Y_{1i} - Y_{0i}/D_i = 1) \quad (4.2)$$

where Y_{1i} denotes outcome variable of the ith individual who participated and Y_{0i} denotes what the outcome variable of the ith individual who participated would have been if the individual had not participated (the counterfactual) and thus, cannot be measured. However, the outcome variable (Y) of the non-participant group can be measured. If the outcome variable of the non-participant group is given as:

$$E(Y_{0i}/D_i = 0) \quad (4.3)$$

Then, adding and subtracting equation 4.3 from equation 4.2 and simplifying gives:

$$ATT' = E(Y_{1i} - Y_{0i}/D_i = 1) + E(Y_{0i}/D_i = 0) - E(Y_{0i}/D_i = 0)$$

$$ATT' = E(Y_{1i}/D_i = 1) - E(Y_{0i}/D_i = 1) + E(Y_{0i}/D_i = 0) - E(Y_{0i}/D_i = 0)$$

$$ATT' = E(Y_{1i}/D_i = 1) - E(Y_{0i}/D_i = 0) + E(Y_{0i}/D_i = 1) - E(Y_{0i}/D_i = 0) \quad (4.4)$$

Substituting ATT for $E(Y_{1i}/D_i = 1) - E(Y_{0i}/D_i = 0)$ in equation 4.4 gives:

$$ATT' = ATT + E(Y_{0i}/D_i = 1) - E(Y_{0i}/D_i = 0) \quad (4.5)$$

$$ATT' = ATT + B \quad (4.6)$$

where B is the error term, given as: $E(Y_{0i}/D_i = 1) - E(Y_{0i}/D_i = 0)$.

It is observed that the expected ATT (i.e. ATT') is only equal to the estimated ATT if the error term (B) is equal to zero. Unfortunately, the magnitude of the error term cannot be estimated because $E(Y_{0i}/D_i = 1)$ portion of the error term cannot be measured and thus, one may never know the exact difference in outcomes between the treated and the untreated groups. It is important to minimize this error term (bias) to the barest minimum for consistent and accurate treatment effects.

To be able to reduce this selection and placement bias (B), Khandker *et al.* (2010) proposed picking a comparison group (or non-participant group) that is very similar in characteristics to the participant group, such that participants of the intervention would have had outcomes similar to those in the untreated group in the absence of the treatment. In addition to this, several approaches/methods have been developed to deal with this bias and these methods vary by their underlying assumptions regarding how to resolve the selection bias in estimating intervention participation effect (Khandker *et al*., 2010).

One of these approaches is the matching method, specifically propensity score matching (PSM). PSM addresses this issue of selection bias by assuming: (a) conditional independence which states that selection into intervention is based only on observable characteristics of the target units and that after conditioning on the

observable characteristics influencing participation, the expected outcome in the absence of treatment does not depend on treatment status (Khandker *et al*., 2010) and (b) a sizable common support or overlap in the propensity scores across treated and untreated groups to allow for possible matching of the treated group members to closely related untreated group members. Once these conditions are met and the biases have been corrected, then, the effect of participation in the intervention on the outcome variable can be estimated.

4.6 Describing the Perceptions of Maize Farmers in Afram Basin about MiDA Intervention

The first objective of the study is to describe the perceptions of both participant and non-participant maize farmers in the zone about MiDA intervention. The participant maize farmers expressed their opinions on statements such as: "knowledge and skills taught were easy to understand; I can practice the skills taught effectively on my field," while both participant and non-participant maize farmers expressed their opinions on statements such as: "practices adopted from the training have enhanced output per unit area of participants; I recommend the repetition of this intervention because it was very helpful"; etcetera using a three point Likert-type scale. The three point Likert-type scale employed was scored 3 for "agree", 2 for "indifferent" and 1 for "disagree". The total number of farmers who agreed, were indifferent and disagreed to each statement was estimated using percentages. The differences among the proportions observed for each of the statements were tested using a chi-square test to conclude on the perceptions of the farmers about each of the statements.

In addition, the participant farmers were asked to state whether they encountered any challenges when implementing the skills taught by MiDA on their individual farms and

what those challenges were as well as their opinions on what did not go on well with the implementation of the MiDA intervention. These were analysed using frequencies and presented using percentages. Finally the farmers were asked to list three things they thought should be included in the intervention package in order of priority if it should be implemented again. The proposed things listed in order of priority were weighted as "First proposal listed" =3, "Second proposal listed" =2, and "last proposal listed" = 1. The total scores for each "proposal" was estimated and used to rank the "proposals" to identify the key things the farmers thought should be included in the intervention package if it was to be implemented again.

4.7 Estimating the Level of Productivity of both Participant and Non-Participant Maize Farmers in the Study Area

Productivity of farmers can be computed using a total factor productivity index or a partial factor productivity index. Total factor productivity is often estimated from time series data whereas partial factor productivity is estimated using cross-sectional data. Since the data collected is cross-sectional, a partial factor productivity index was estimated. Following Fermont and Benson (2011), crop productivity, specifically yield (output per unit area) which is a partial factor productivity index was used to measure the productivity levels of both participant and non-participant maize farmers.

4.7.1 Crop Productivity

Crop productivity, identified as one of the essential indicators for agricultural development (Fermont and Benson, 2011), is defined as the ratio of the amount of harvested product to total area harvested. It is also referred to as crop yield. There are different ways of measuring the components of the yield index (amount of harvested product and area harvested) and this is because different academic disciplines have

different concepts with regards to what crop yield refers to. Generally, in economics, there are three types of crop yield, namely: potential yield, economic yield and actual yield. Potential yield refers to the fullest expression of a specific crop genotype for a particular climatic environment in terms of ambient temperature and solar radiation. Economic yield is the yield level that provides the highest financial returns to investment considering all possible biotic and a-biotic constraints to production, whiles actual yield refers to yield obtained due to the use of available technologies (Fermont and Benson, 2011).

Therefore, this study estimates the actual yields of the farmers which will give an indication of how the technologies the farmers were trained on actually affected their output. Empirically, the actual crop productivity or yield is given as:

$$CP_i = \frac{Y_i}{A_i} \tag{4.7}$$

where:

CP_i refers to maize productivity of the i^{-th} farmer.

Y_i is the total maize output produced (measured in Mt) by farmer i.

A_i is the total land area harvested (measured in Ha) by farmer i.

The mean productivity levels for participant and non-participant maize farmers were computed. Also, the mean productivity levels of participants across different districts and regions were computed and a test of difference between means conducted. This was also repeated for male participants and female participants as well as male non-participants and female non-participants.

4.7.2 Test of Difference in Productivity

Based on the sample size of the participant farmers across the different groups (district, region or gender) whose means were being tested, i.e. whether the sample size is less than 30 or greater than 30, the student t-test or the Z test, respectively was conducted. The student t-test or Z-test is estimated as:

$$\text{Z or t} = \frac{\bar{X}_1 - \bar{X}_2}{S_{\bar{X}_1 - \bar{X}_2}} \quad (4.8)$$

where:

$\overline{X_1}$ refers to the mean productivity level of participants or non-participants in group 1 in metric tons per hectare.

$\overline{X_2}$ refers to the mean productivity level of participants or non-participants in group 2 in metric tons per hectare.

$S_{X1\text{-}X2}$ is the standard error of the difference between the two means and it is estimated as:

$$S_{\bar{X}_1 - \bar{X}_2} = \sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}} \quad (4.9)$$

where:

S_1^2 is the unbiased estimate of the variance of the participant or non-participant farmers in group 1.

S_2^2 is the unbiased estimate of the variance of the participant or non-participant farmers in group 2.

n_1 and n_2 are the sample sizes for the participants or non-participants in group 1 and 2,

respectively.

Statement of Hypothesis

For Ashanti region, it is expected that participant farmers in Ejura-Sekyeredumase district will have a higher productivity level compared to participant farmers in Sekyere Central district mainly because Ejura-Sekyeredumase district is the main maize producing district in the country. Based on this, the hypothesis test for difference in means of participant farmers in Ejura-Sekyeredumase district and participant farmers in Sekyere Central district is set out mathematically as shown below:

H_o: $\bar{X}_1 = \bar{X}_2$: there is no significant difference between the mean productivity levels of participant maize farmers in Ejura-Sekyeredumase district and participant maize farmers in Sekyere Central district.

H_1: $\bar{X}_1 > \bar{X}_2$: the mean productivity level of participant maize farmers in Ejura-Sekyeredumase district is significantly higher than the mean productivity level of participant farmers in Sekyere Central district

Similarly, for Eastern region, the hypothesis test for the difference in means of participant farmers in Kwahu East district and participant farmers in Kwahu North district is set out mathematically as:

H_o: $\bar{X}_1 = \bar{X}_2$: there is no significant difference between the mean productivity levels of participant maize farmers in Kwahu East district and participant farmers in Kwahu North district.

H_1: $\bar{X}_1 > \bar{X}_2$: the mean productivity level of participant maize farmers in Kwahu East district is significantly higher than the mean productivity level of participant farmers in Kwahu North district.

Across regions, it is expected that participant farmers in Ashanti region will be more productive compared to participant farmers in Eastern region and are thus expected to have a higher crop productivity level. The hypothesis test for the difference between the mean productivity levels of participant maize farmers in Ashanti region and participant maize farmers in Eastern region is stated mathematically as:

H_o: $\bar{X}_1 = \bar{X}_2$: there is no significant difference between the mean productivity levels of participant maize farmers in Ashanti region and participant farmers in Eastern region.

H_1: $\bar{X}_1 > \bar{X}_2$: the mean productivity level of participant maize farmers in Ashanti region is significantly higher than the mean productivity level of participant maize farmers in Eastern region.

Across gender, this study hypothesizes that the mean productivity level of male participants or male non-participants will be higher than the mean productivity level of female participants or female non-participants respectively. This hypothesis is stated mathematically as:

H_o: $\bar{X}_1 = \bar{X}_2$: there is no significant difference between the mean productivity levels of participant males or non-participant males and participant females or non-participant females respectively.

H_1: $\bar{X}_1 > \bar{X}_2$: the mean productivity level of participant males or non-participant males is significantly higher than the mean productivity level of participant females or non-participant females respectively The decision rule is to reject the null hypothesis (H_0) if the t calculated or Z calculated is greater than the t critical or Z critical, respectively.

4.8 Estimating the Effect of MiDA Intervention on Productivity of Maize Farmers in Afram Basin

There is no single method for the estimation of the effect of an intervention on its participants. However, propensity score matching (PSM) proposed by Rosenbaum and Rubin (1983) has been widely used to assess project effects because of the assumption of conditional independence and common support region used to resolve the problem of program placement and selection biases. PSM is thus adopted to evaluate the impact of the MiDA intervention on productivity of maize farmers in the study area.

4.8.1 Propensity Score Matching

Propensity score matching (PSM), according to Wainaina *et al.* (2012) is a quasi-experimental method for estimating the effect of social projects. This method basically uses information from non-participants of the project (as control group) to identify what would have happened to participants (treatment group) in the absence of the project. PSM assumes very close and similar characteristics between the treatment and control group prior to the start of the intervention so that differences in outcomes after the intervention can solely be attributed to the intervention. This is because the propensity score is a balancing score for some given characteristics assuring that for a given value of the propensity score, the distribution of the given characteristics will be the same for the treated and comparison groups (Heinrich *et al.*, 2010).

It is, therefore, very essential that the control group closely resembles the treatment group for the chosen characteristics. By comparing the average outcomes of participants and non-participants, PSM estimates the effect of a project or an intervention. This is done by matching the average outcomes of participants (treatment group) and non-participants (control group) using the propensity scores (p-score);

where, the closer the P-Score for the treated (participants) and control group (non-participants), the better the match (Baker, 2000).

Basically, there are about three steps in estimating the effect of an intervention using PSM. The first step is the estimation of the propensity score. These scores are obtained using either a logit or a probit model and this is because the treatment is dichotomous (i.e. 1 for participants or treated group and 0 for non-participants or untreated group). While Heinrich *et al.* (2010) argue that there is no strong advantage to using a logit or probit model, Wianaina *et al.* (2012) and Baker (2000) argue for the logit model against the probit on the basis of consistency of parameter estimates because of the assumption of the error term having a logistic distribution. However, other authors (Owusu *et al.*, 2011a) have used the probit regression model to estimate the propensity scores but this study employs the logit model as used by Wianaina *et al.* (2012) to estimate the propensity scores. The empirical logistic regression model is stated as:

$$In\left(\frac{Pr(D_i=1/Z_i)}{1-Pr(D_i=1/Z_i)}\right) = \beta_0 + \beta_i Z_i \qquad (4.10)$$

Where:

β_0 is the intercept, β_i are the regression coefficients.

D_i is binary dependent variable where $D_i = 1$ is the value for participants of MiDA intervention and $D_i = 0$ is the value for non-participants of MiDA intervention.

Z_i denotes a set of pre-participation farmer characteristics.

By running the logit model, β_0 and β_i are estimated and the significant variables that influence participation in MiDA intervention identified. The estimated coefficients (β_0

and β_i) are used to estimate the propensity scores for each farmer.

The pre-participation farmer characteristics used for the propensity score estimation and their mode of measurement are presented in Table 4.1.

Table 4.1: Farmer Characteristics Used in Estimation of Propensity Scores

Variable	Meaning	Mode of Measurement
FBO	Whether member of FBO	1=FBO member, 0 = 0therwise
Age	Age of farmer	Years
Agesq	Square term for age	Years
Gend	Gender of farmer	1=Male, 0= Female
Edu	Educational level of farmer	0=None, 1=Basic school, 2= Secondary school, 3 = Tertiary
Masta	Marital status of farmer	1=Married, 0 = Single
Hhsize	Household size of farmer	Number of persons
Resta	Residential status of farmer	1= Native, 0=Settler
Exp	Farmer's level of experience	Years
MInc	Main source of income	1= Maize farming, 0= Otherwise
Ldown	Land ownership	1= Owner, 0 = Otherwise
Ptsize	Total plot size	Hectares
Fert	Fertilizer application	1= Yes, 0 = No
Seed	Type of seed cultivated	1= Improved seed, 0 = Otherwise
Cred	Access to credit	1 = Receive credit, 0 = Otherwise
Ext	Access to extension services	1=Access, 0=Otherwise
Mktdis	Distance to nearest market	Kilometers
Road	Road accessibility	1= Access, 0= Otherwise
Reg	Region of Farmer	1=Ashanti 0= Eastern
Dist	District of farmer	1= Ejura- Sekyeredumase or Kwahu East, 0= Sekyere Central or Kwahu North

Source: Author's Definition, 2013.

The propensity score $P(Z_i)$, according to Owusu *et al.* (2011a), can be defined as the conditional probability of participating in the MiDA intervention given pre-participation characteristics (Z_i) and it is stated as:

$$P(Z_i) \equiv P\{D_i = 1/Z_i\} = E\{D_i/Z_i\} \quad (4.11)$$

Specifically, the propensity score for each farmer is given as:

$$P(Z_i) = \frac{1}{1+e^{-(\hat{\beta}_0+\hat{\beta}_i Z_i)}} \quad (4.12)$$

where:

$\hat{\beta}_0$ and $\hat{\beta}_1$ are the estimated values of β_0 and β_i.

Z_i are the characteristics of maize farmer i.

P (Z_i) is the propensity scores for maize farmer i.

After estimation of the propensity scores for each farmer, the second step in PSM analysis is to select a matching algorithm that will use the estimated propensity scores to match participant farmers to non-participant farmers. The purpose of matching is to reduce the level of bias between the two groups of farmers by matching participant farmers to non-participant farmers who closely resemble them in the measured characteristics. The appropriate matching algorithm to use is dependent on the type of data available and the quality of the matching test. However, a number of matching algorithms have been suggested in the literature to match participants and non-participants of similar propensity scores. The commonest matching algorithms include the nearest neighbour matching, radius matching and the kernel matching methods. Nearest neighbour matching involves matching a non-participant farmer to a participant farmer in terms of closest propensity scores. This can be done with or without replacement. Matching with replacement involves using a non-participant farmer more than once as a match while matching without replacement is when a non-participant farmer is used only once in the matching process. However, according to Heinrich *et al.* (2010), matching without replacement can lead to poor performance when there is

little overlap of the propensity scores or when the control group is small since participants are matched to observations that are not necessarily similar. In view of this, most studies resort to the use of matching with replacement as against matching without replacement.

Radius matching involves specifying a maximum propensity score distance (caliper) by which a matching is done. It matches as many non-participant farmers within the caliper, but not those that are poor matches, to participant farmers. This matching type can also be done "with" or "without" replacement. Kernel matching, however, matches the participants to the non-participants using the weighted average of the outcome variable (productivity) of all the non-participants with the highest weights being placed on those with scores closest to the participants (Heinrich *et al.*, 2010). This matching method has an advantage of low variance due to the use of more information in its estimation (Heinrich *et al.*, 2010). This shows why the kernel matching is known to give the best impact estimation. A common weakness in all these matching algorithms is that some observations used may be poor matches, hence the need for proper imposition of the common-support condition to limit the use of poor matches. There is, however, no clear rule for determining which algorithm is more appropriate. This study proposes the use of nearest neighbour matching to match participants and non-participants.

The matching can be done in a one-to-one match manner where each participant is matched to only one closely related non-participant farmer based on their propensity scores or in a one-to-many match manner where each participant farmer is matched to

more than one closely related non-participant farmer based on their propensity scores. Table 4.2 presents an example of both matching types.

Table 4. 2: Matching Methods Using Propensity Scores

Participants	Productivity level	1.12	1.49	1.87	
	Propensity scores	0.49	**0.28**	**0.83**	
	Farmers Identity	**A**	**B**	**C**	
Non-participants	Farmers Identity	**1**	**2**	**3**	**4**
	Propensity Scores	**0.28**	0.35	**0.80**	**0.85**
	Productivity Level	0.98	1.08	1.14	1.36

Source: Author's Computation, 2013.

In table 4.2, the matching of participant farmer B to non-participant farmer 1 is an example of a one-to-one matching method whiles the matching of participant farmer C to non-participant farmer 3 and 4 is an example of a one-to-many matching method. In each of the matching methods, the participant farmers are matched to the non-participant farmers based on their propensity scores. That is, a participant farmer is matched to a non-participant farmer that has the same or very close propensity score as that of the participant farmer.

After matching of the participants and the non-participants of the intervention, the last step in PSM analysis is to estimate the effect of participation in the intervention and conduct the sensitivity analysis. The most common participation effects in project evaluation include the Average Treatment Effect (ATE), Average Treatment Effect on the Treated (ATT) or the participation effect and the Average Treatment Effect on the Untreated (ATU) (Owusu *et al.*, 2011a). ATE measures the effect of the intervention on the productivity of all the farmers (both participants and non-participants). It

accounts for the average effect of the intervention on the sampled population of maize farmers. ATT measures the effect of the intervention on participants of the intervention whiles ATU captures what the effect of the intervention would have been for the non-participants if they had participated. Wainaina *et al.* (2012) stated that the parameter of interest in the estimation of intervention effect is the ATE. However, they also found that an appropriate approach of evaluating policy-relevant outcomes in a counterfactual outcome is to examine also, the ATU in addition to the ATT since it captures the effect of treatment on individuals who did not participate in the intervention. This study estimates these three effects as:

$$ATE = E[E\{Y_{1i}/D_i = 1, p(Z_i)\} - E\{Y_{0i}/D_i = 0, p(Z_i)\}] \quad (4.13)$$

$$ATT = E[E\{Y_{1i}/D_i = 1, p(Z_i)\} - E\{Y_{0i}/D_i = 0, p(Z_i)\}/D_i = 1] \quad (4.14)$$

$$ATU = E[E\{Y_{1i}/D_i = 1, p(Z_i)\} - E\{Y_{0i}/D_i = 0, p(Z_i)\}/D_i = 0] \quad (4.15)$$

where:

Y_{1i} and Y_{0i} are the two counterfactual outcomes of participants and non-participants in the MiDA intervention.

Positive ATE, ATT and ATU implies that the intervention has enhanced the productivity of the maize farmers' while their magnitudes indicate the extent to which the intervention has enhanced the productivity of the maize farmers.

Considering Table 4.2, the effect of the intervention on the participants (ATT) is estimated by finding the differences between the value of the outcome variable (productivity) for the matched participant and non-participant farmers and estimating

the average of the differences for all the matched participants. For one-to-one matching method, the average of the difference between the productivity levels of the participant farmer and non-participant farmer matched is taken as the impact of the intervention. However, for one-to-many matches, the average productivity level for all the non-participants matched to that participant is used to compare with the productivity level of the particular participant farmer in assessing the effect of the intervention. In this example, the effect of the intervention is calculated as below:

The effect of the intervention on the productivity of farmer B = (1.49-0.98) = 0.51

The effect of the intervention on the productivity of farmer C = [1.87- (1.14+1.36)/2] = 0.62

The overall effect of the intervention on the productivity of the participant farmers (ATT) is given as (0.51+0.62)/2 = 0.565.

All the unmatched subjects are discarded from the analysis after the matching has been done.

Once the effect of the intervention has been measured, the sensitivity analysis is conducted. The purpose of conducting the sensitivity analysis is to determine the effect of hidden biases on the estimated treatment effects. Hidden biases occur when there are unobserved variables or characteristics that simultaneously influence the participation decision and the outcome variable (productivity) of the farmers. Once hidden bias exists, then, if those variables causing the hidden bias are measured and used in the matching, the treatment effects calculated can either increase or decrease and their significance may also change making the estimated results not robust. To account for the robustness of the treatment effects calculated, Becker and Marco (2007) citing Rosenbaum (2002), proposed the use of the bounding approach specifically, the

Rosenbaum bounds (rbounds) test and it was adopted by this study for the sensitivity analysis. The rbounds, according to Wainaina *et al.* (2012), tests the null hypothesis that there is no change on the treatment effect for different values of unobserved selection bias. Thus, it does not conclude on whether or not hidden biases exist as well as the magnitude of the biases but ask whether the treatment effects may be altered by factors not observed in the data set. According to Kirchweger and Kantelhardt (2012), higher sensitive to hidden bias exist when the calculated participation effects change for r-bound (γ) values just slightly higher than one and low sensitivity to hidden biases exist if the calculated treatment effects change at large r-bound (γ) values.

4.9 Data Collection

This section presents the type and sources of data, the sample size and sampling technique as well as the survey instrument used in the study.

4.9.1 Type and Sources of Data

Primary data on demographic variables such as age, gender, level of education, household size, marital status and farming experience were collected from sampled maize farmers in the study area. In addition, output variables such as total maize output produced in the growing season, total land area devoted to the production of the output, types of input used by each farmer were also obtained from the farmers. Data on farmers' perceptions of the MiDA intervention were also obtained. The data for the study were taken from maize farmers who participated in the MiDA intervention as well as maize farmers who did not participate in the intervention.

4.9.2 Sample Size and Sampling Technique

A total of 300 maize farmers were sampled. Of the 300 maize farmers, 100 were participants of the MiDA intervention while the remaining 200 were non-participants. This is to provide adequate common support region so most of the participant farmers can be matched to a closely related non-participant farmer. A multi-stage sampling technique was used to select the maize farmers. The first stage of the sampling was the selection of the districts and the communities to be included in the sample. Purposive sampling was used to select four out of the nine districts in which the intervention took place based on the intensity of maize production in those districts. Purposive sampling was used again to select two communities from each of the selected districts based on the intensity of maize production in those communities.

A list of FBO groupings of the participant farmers by MiDA specification for each of the communities was obtained from the district MoFA office. Based on the number of FBOs in the list, 25 participant farmers were randomly selected to ensure each FBO group was represented. In addition, a list of non-participant maize farmers in each of the selected communities was also obtained from the district MoFA office. The farmers were serially numbered and the first fifty farmers in each serially generated list selected to form the sample of non-participant farmers. In totality, 75 maize farmers consisting of 25 participant farmers and 50 non-participant farmers were selected from each of the four districts to give a total of 300 farmers. Table 4.3 presents the distribution of the sampled participant and non-participant farmers across the various communities and districts.

Table 4.3: Distribution of Sampled Participant and Non-participant Farmers across Sampled Communities and Districts.

District	Communities	Number of Maize Farmers Selected			
		MiDA Trained Farmers (Participants)	Non-MiDA Farmers (Non-participants)	Total	
Kwahu North	Kubease	-	50	50	75
	Avertimer	25	-	25	
Kwahu East	Ahinaase	-	50	50	75
	Kotosu	25		25	
Sekyere central	Jetiase	-	50	50	75
	Beposo	25	-	25	
Ejura-Sekyeredumase	Block Factory	-	25	25	75
	Miminaso No. 1	-	25	25	
	Dromankomah	25	-	25	
	Total	100	200	300	

From Field Data, 2013.

4.9.3 Survey Instrument

A well-structured questionnaire was administered to obtain the primary data required for the study. Guided by the method of analysis, the data or information needed to achieve each specific objective was identified. A provisional set of questions were developed and pretested in the study area in November 2012 to identify ambiguities and omissions. The information gathered was then used to modify the questions to obtain the formal set of questions that was used to develop the questionnaire administered to the respondents.

CHAPTER FIVE

RESULTS AND DISCUSSION

5.1 Introduction

This chapter presents and discusses the results of the study. It begins with the distribution of the respondents and continues with the description of some socio-demographic, production and institutional variables of the maize farmers. Perceptions of the maize farmers about MiDA intervention, their productivity levels and the effect of MiDA intervention on productivity of the farmers are also presented in this chapter.

5.2 Distribution of the Respondents

Table 5.1 presents the distribution of the sampled maize farmers. A total of 300 maize farmers from four districts in the Afram Basin of Ghana were used for the study. Two districts were in Ashanti region namely Ejura Sekyeredumase and Sekyere Central districts whilst two districts, Kwahu North and Kwahu East, were in Eastern region. About 33% of the maize farmers were participants of the MiDA intervention and about 67% were non-participants of the intervention. Seventy five farmers consisting of about 33% participant and 67% non-participant maize farmers were selected from each of the districts to give a total of 150 farmers for each region.

Table 5.1: Distribution of Respondents

Region	District	Participant		Non-participant		Overall	
		Freq.	%age	Freq.	%age	Freq.	%age
Ashanti	Sekyere Central	25	33.33	50	66.67	75	25
	Ejura Sekyere Dumase	25	33.33	50	66.67	75	25
Eastern	Kwahu North	25	33.33	50	66.67	75	25
	Kwahu East	25	33.33	50	66.67	75	25
Overall		100	33.33	200	66.67	300	100

Source: Author's Computation, 2013.

5.3 Socio-Demographic Characteristics of Respondents

This section provides a description of some socio-demographic characteristics of the maize farmers. The characteristics considered include: age, gender, educational level, household size, marital status and farmer's main source of income and are presented in Table 5.2.

Majority of the participant (82%) and non-participant maize farmers (88.5%) were within the economic active age of 19 years to 60 years with the mean age of the participant and non-participant maize farmers being 46.50 years and 42.08 years, respectively.

Overall, the mean household size for the farmers was 6 with the mean of the participants and non-participants being 7 and 6, respectively. The minimum household size for both participants and non-participants was 1 with a maximum of 23 for participants and 20 for non-participants.

Generally, males constituted about 51% of the sampled maize farmers with the remaining 49% being Females. About 52% of the participant farmers were males and 48% females. The gender distribution of the non-participant farmers was the same for males and females with each forming 50% of the sampled non-participant farmers.

Also, majority of the participant farmers (78%) were married with the remaining being single (i.e.12% widowed, 9% unmarried and 1% divorced). Similarly, most of the non-participant farmers (about 80%) were married with the remaining being single (i.e. 11% unmarried, 6% widowed and 3.5% divorced)

Table 5. 2: Distribution of Farmers across some Socio-demographic Variables

Variable	Category	Participants	Non-Participants	Overall
Age	Mean	46.5	42.08	43.6
	Minimum	23.0	19.0	19.0
	Maximum	87.0	80.0	87.0
Household Size	Mean	7.2	5.8	6.3
	Minimum	1.0	1.0	1.0
	Maximum	23.0	20.0	23.0
		(%)	(%)	(%)
Age Grouped (Years)	19-30 years	13.0	27.0	22.3
	31-40	25.0	24.5	24.7
	41-50	28.0	23.0	24.7
	51-60	16.0	14.0	14.7
	Above 60	18.0	11.5	13.7
Gender	Males	52.0	50.0	50.7
	Females	48.0	50.0	49.3
Marital Status	Unmarried	9.0	11.0	10.3
	Married	78.0	79.5	79.0
	Separated/ Divorced	1.0	3.5	2.7
	Widowed	12.0	6.0	8.0
Educational level	None	25.0	26.5	26.0
	Primary	27.0	30.0	29.0
	JHS/ Middle School	40.0	32.0	34.7
	SHS/O/A Level	4.0	8.5	7.0
	Vocational /Technical	4.0	1.0	2.0
	Tertiary	-	2.0	1.3
Source of Income	Maize Farming	82.0	68.5	73.0
	Otherwise	18.0	31.5	27.0
	Total	100	100	100

Source: Author's Computation, 2013.

Majority of the participant (40%) and non-participant (32%) maize farmers had completed Junior High School (JHS) or Middle school. In addition, about 27% of the participant farmers had acquired primary education with about 25% not having any formal education. Similarly, about 30% of the non-participant farmers had acquired primary education with about 27% not having any formal education. Overall, about

35% of the farmers had completed JHS/ Middle school while about 26% had no formal education.

Most of the participant (82%) and non-participant (69%) maize farmers had maize farming as their main source of income with the rest (participants = 18% and non-participants = 31.5%) having different occupations as their main source of income which were either on-farm, off- farm or non-farm activities.

5.4 Production Characteristics of Respondents

Characteristics of farmers in relation to their production activities are presented in this section. Some of the characteristics considered include years of experience in maize farming, total plot size cultivated, membership of an FBO, type of land ownership, type of maize seed cultivated and fertilizer use. Table 5.3 presents the production characteristics of the respondents.

Overall, the mean years of experience were 17.19 years with a minimum of 1 year and a maximum of 60 years. The mean years of experience for the participant and non-participant maize farmers were 19.39 years and 16.09 years, respectively.

The minimum, maximum and mean plot sizes cultivated by the farmers were 0.20 of a hectare, 11.60 hectares and 1.33 hectares, respectively with majority of them (93%) cultivating total plot sizes between 0.01 to 3.00 hectares. The mean plot size cultivated by the participant and non-participant farmers were 1.50 hectares and 1.24 hectares, respectively.

Majority of the sampled participant farmers (66%) were members of FBOs before the start of MiDA's intervention while about 11% of the sampled non-participant farmers were members of FBOs. Overall, about 30% of the farmers were members of FBOs while about 70% were not members of FBOs.

About 51% of the participant farmers owned all their lands while about 49% did not own all or any of their lands but acquired them either through rent, contracts *et cetera*. Similarly, about 55% of the non-participant farmers owned all their lands with the remaining 45% not owning their lands.

Table 5.3: Distribution of Farmers across Some Production Variables

Variable	Category	Participant	Non-participants	Overall
Experience (Years)	Mean	19.39	16.09	17.19
	Minimum	2	1	1
	Maximum	60	55	60
Total Plot Size (Ha)	Mean	1.50	1.24	1.33
	Minimum	0.25	0.20	0.20
	Maximum	8.20	11.60	11.60
		(%)	(%)	(%)
Total Plot Size in groupings (Ha)	0.01 – 3.00	88	95.5	93
	3.01 – 6.00	11	4	6.33
	6.01 – 9.00	1	0	0.33
	9.01 – 12.00	0	0.5	0.33
FBO Member	Yes	66	11.5	29.67
	No	34	88.5	70.33
Type of land Ownership	Owner	51	55	53.67
	Otherwise	49	45	46.33
Type of Seed Cultivated	Traditional Seed	18	52.5	41
	Improved Seed	82	47.5	59
Applied Fertilizer	Yes	80	34.5	49.67
	No	20	65.5	50.33

Source: Author's Computation, 2013.

Majority of the participant farmers (82%) cultivated improved maize seeds (eg. Obatampa and Dobidi) while more than half (about 53%) of the non-participant farmers cultivated traditional maize seeds (e.g. Abrowhoma). Overall, about 41% of the farmers' cultivated traditional maize seeds while about 59% cultivated improved maize seeds.

With regards to fertilizer application, a high proportion of the participant farmers (80%) and about 34% of the non-participant farmers applied fertilizer. Overall, about 50% of the farmers applied fertilizer on their farms with the remaining 50% not applying fertilizer.

5.5 Institutional Factors of Respondents

This section presents the distribution of the respondents across three institutional factors, namely: access to credit, access to extension services and availability of access road to farm and is presented in Table 5.4.

Majority of the participant (88%), non-participant (99%) and overall population (95.33%) did not receive credit from any financial institution for their farming activity while the remaining 12%, 1% and 4.67% of the participant, non-participant and overall population, respectively received credit from financial institutions for their farming business.

Similarly, about 74%, 33% and 47% of the population of participants, non-participants and overall sample respectively had access to extension contacts during the production period while about 26%, 67% and 53% of the participant,

non-participant and overall sample populations did not have access to extension contacts.

Lastly, about 76%, 68% and 70% of the population of participants, non-participants and overall sample, respectively had access road to their farms while the remaining 24%, 32% and 30% of the population of participants, non-participants and overall sample did not have access roads to their farms.

Table 5.4: Distribution of farmers based on Access to Institutional Factors

Variable	Category	Participants (%)	Non-Participant (%)	Overall (%)
Access to Credit	Yes	12	1	4.67
	No	88	99	95.33
Access to Extension Services	Yes	74	33	46.67
	No	26	67	53.33
Access Road to Farm	Yes	76	67.5	70.33
	No	24	32.5	29.67

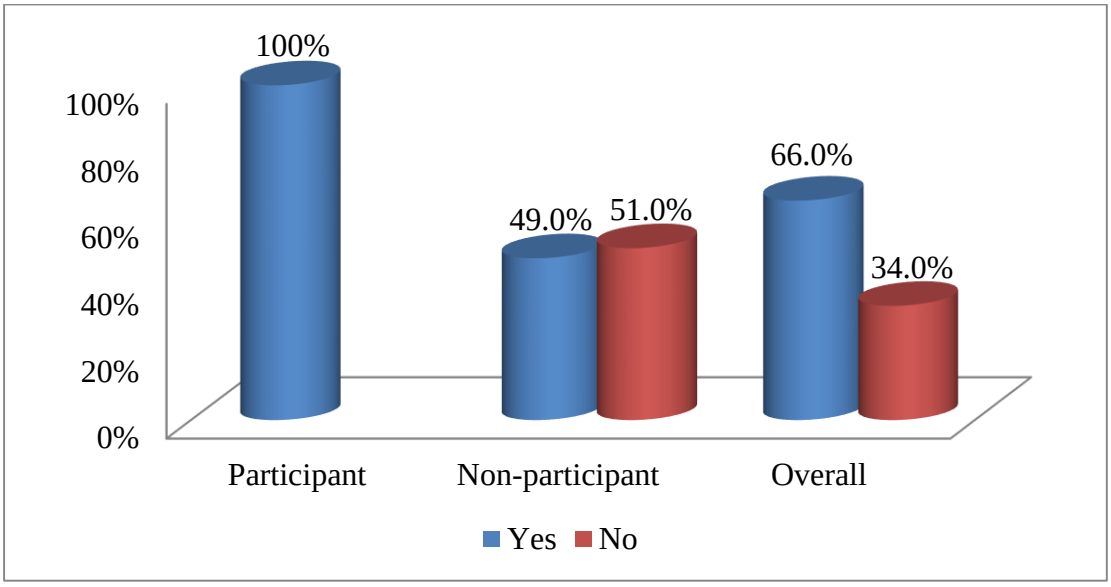
Source: Author's Computation, 2013.

5.6 Perceptions of Farmers on MiDA Intervention

5.6.1 Proportion of Farmers who heard about MiDA Intervention

Figure 5.1 presents the proportion of farmers who heard about the MiDA intervention. All the participant maize farmers heard about MiDA intervention. About 49% of the non-participant farmers heard about MiDA intervention while about 51% did not hear about the intervention. Overall, about 66% of the farmers heard about MiDA intervention while about 34% did not hear about the intervention.

Figure 5. 1: Proportion of Farmers who heard about MiDA Intervention



Source: Author's Computation, 2013.

5.6.2 Means by which Farmers heard about MiDA Intervention

About 58% of the participant farmers heard about MiDA intervention through extension agents' while about 39% of the non-participant farmers heard about MiDA intervention through announcement. Generally, the three common means through which the farmers heard about MiDA intervention were through extension agents, announcement and FBO leader with about 45%, 22% and 12% of the farmers hearing through these sources, respectively as presented in Table 5.5.

Table 5.5: Means by which Farmers Heard about MiDA Intervention

Means of Knowing about MiDA Intervention	Participant (%)	Non-participant (%)	Overall (%)
Extension Agent	58	30.93	44.67
Announcement	5	39.18	21.83
Family	10	9.28	9.64
FBO Leader	23	-	11.68
Friend	4	12.37	8.12
Personal Observation	-	4.12	2.03
Radio	-	4.12	2.03
Total	100	100	100

Source: Author's computation, 2013.

5.6.3 Reasons for not participating in MiDA Intervention

About 49% of the non-participant farmers heard about MiDA intervention but did not participate. Some of the reasons they attributed to their non-participation include: not being interested in the training (about 33%), restrained by personal issues such as travelling, illness, pregnancy and schooling (about 24%) and not being a member of an FBO (about 10%), among other reasons. About 10% of the non-participant farmers who heard about MiDA intervention had no reason for not participating in the intervention. These are presented in Table 5.6.

Table 5.6: Reasons for not participating in MiDA Intervention

Reasons	Percentage (N=98)
No reason	10.20
Was not interested	32.65
Personal issues e.g. travelling, illness, pregnancy etc.	24.49
Was not an FBO member	10.20
Heard about the Intervention too late	10.20
Training time was not suitable	5.11
Did not trust MiDA	5.11
Not interested in group work	2.04
Total	100

Source: Author's Computation, 2013.

5.6.4 Perceptions of farmers on MiDA Training

The farmers expressed their opinions on some statements related to the training (on proper agronomic practices) they received from MiDA by either agreeing, being indifferent or disagreeing to the statements. A chi-squared test, significant at 1 percent for each of the statements, implies that the proportion of farmers that agreed, were indifferent or disagreed to each of the statements is statistically significant. The results of the perceptions of the farmers about the MiDA training are presented in Table 5.7.

Of the 100 participant farmers interviewed, 99% expressed their opinions on whether or not MiDA training covered all they were told it would cover. Of this, about 89% agreed the training covered all areas expected, about 7% unable to decide whether or not the training covered all the areas expected while about 4% disagreed to the statement that the training covered all areas expected. Again, about 90% out of 95 participant farmers agreed that the knowledge and skills taught were easy to understand with about 8% being indifferent while about 2% were of the view that the skills taught were difficult to understand.

Also, of 98 participant farmers, about 91% agreed the skills taught were easy to undertake on the field, about 3% were of the opinion that the skills taught were difficult to undertake on the field while about 6% were indifferent. Similarly, of 91 participant farmers, about 76% agreed some of the skills taught were new, about 9% were of the opinion that none of the skills taught was new while about 15% could not indicate whether some of the skills taught were new or not.

Again, of 93 participant farmers, about 72% agreed the inputs required for the new skills taught were readily available and accessible while of 96 participant farmers, about 89% agreed that they can apply the skills they were taught effectively on their own. Lastly, of the 100 participant farmers interviewed, about 97% agreed that the training provided by MiDA has helped increase their output per unit area with the remaining 3% being indifferent. Similarly, about 97% of the 100 participant farmers agreed that the starter packs provided by MiDA encouraged them to practice what MiDA taught them on their farms.

Table 5. 7: Perceptions of Farmers on MiDA Training

Statement	No. of Resp.	Agree (%)	Indifferent (%)	Disagree (%)	Chi^2 Value	Prob. Value
Participants only						
MiDA training covered all you were told it will cover	99	88.9	7.1	4.0	212.40	0.00
Knowledge and skills taught were easy to understand	95	89.5	8.4	2.1	135.31	0.00
Skills taught were easy to undertake on the field	98	90.8	6.1	3.1	145.86	0.00
Some of the practices taught were new	91	75.8	15.4	8.8	74.53	0.00
Inputs required for the new practices taught are readily available and accessible	93	72	17.2	10.8	63.29	0.00
I can apply the practices taught effectively on my own	96	88.5	11.5	-	57.04	0.00
MiDA training has helped increase my output per unit area	100	97	3	-	88.36	0.00
Starter packs encouraged me to practice what I was taught	100	97	3	-	88.36	0.00
Both Participants and Non-participants						
In totality, MiDA intervention has increased the yields of participants	284	81.3	17.6	1.1	306.18	0.00
I recommend the repetition of similar training/ projects	288	88.2	11.8	-	168.06	0.00

Source: Author's Computation, 2013.

For both participant and non-participant farmers, out of 284 farmers, about 81% were of the view that the training provided by MiDA has helped increase the yield of the participant farmers, about 18% were of the view that the training provided by MiDA did not have any effect on the yields of the participant farmers with about 1% disagreeing to the statement that the training helped increase the yield of the participant

farmers. Also, about 88% of 288 farmers (both participants and non-participants) recommended the repetition of the intervention because they perceived it to have been helpful in enhancing the productivity of the participant farmers with the remaining 11.8% being indifferent to the repetition of the intervention. It can be observed that most of the farmers generally had a positive opinion about all the statements.

5.6.5 Challenges Encountered during Implementation of Skills Taught

The challenges encountered by the participant farmers during the implementation of the skills taught by MiDA and the number of farmers that encountered each of the challenges are presented in Table 5.8. Of the 100 participant farmers interviewed, only 3% encountered some challenges with the remaining 97% not encountering any challenges. The challenges encountered were: "difficulty in knowing the appropriate time for fertilizer application" and "the number of seeds to put per hole", both encountered by one farmer, "difficulty in understanding some of what were taught" encountered by another farmer and "difficulty in getting access to tractors for ploughing" also encountered by the one farmer.

Table 5.8: Challenges Encountered when Implementing Skills taught by MiDA

Challenges	Percentage (%)
None	97
Difficulty in:	
Knowing time for fertilizer application and the number of seeds to put per hole	1
Understanding some of what were taught	1
Getting access to tractors for ploughing	1
Total	100

Source: Author's Computation, 2013.

5.6.6 Limitations of MiDA Intervention

Of the 100 participant farmers interviewed, about 32% raised concerns on things they thought did not go well with the implementation of MiDA intervention. Out of the 32%, about 38% complained about the late purchase of the maize grains by MiDA. This was a peculiar case at Ejura-Sekyeredumase where MiDA arranged with the farmers to buy their grains and sell to World Food Program. Unfortunately, the purchase of the grains by MiDA has not been timely as arranged causing a major problem for the farmers who do not have adequate storage facilities to keep the grains as they await MiDA to purchase the grains. Next, about 31% of the 32% complained about the late arrival of the starter packs. This resulted in most farmers not using the fertilizer, seeds and other inputs provided for the season it was intended for.

Also, about 19% of the 32% complained about promises made by MiDA which were not fulfilled such as: promise to provide financial support, irrigation and storage facilities, and free inputs to the farmers to enhance their production activity. The last two categories of limitations which are unsuitability of the training time and others such as: lessons taught were easily forgotten and difficulty in planting in rows had equal proportion of the farmers (6.3%) complaining about each of them. Table 5.9 presents the limitations encountered by the farmers.

Table 5. 9: Limitations of MiDA Intervention

Limitations	Percentage (N= 32)
Late purchase of maize at Ejura-Sekyeredumase	37.5
Late arrival of Starter packs	31.3
Unfulfilled promises	18.8
Training times not suitable	6.3
Others	6.3

Source: Author's Computation, 2013.

5.6.7 Suggestions from Farmers on Things to be Included in the Intervention

Table 5.10 illustrates the "proposals" suggested by the farmers for inclusion in the intervention package if it is to be implemented again. Overall, the first "proposal" was the provision of some facilities such as irrigation facilities, storage facilities, tractors and spraying machines. The second "proposal" was for the intervention to help them acquire loans or give them credit to enable them expand their farming business. This is followed by provision of inputs such as: cutlasses, fertilizers, improved seeds and weedicides.

Table 5.10: Suggestions from Farmers on Things to Include in the Intervention Package

	Frequency			Total Score	
Things to Include	1st Response (F_1) (W_1=3)	2nd Response (F_2) (W_2=2)	3rd Response (F_3) (W_3=1)	$F_1W_1+F_2W_2+F_3W_3$	Rank
Machinery or other facilities	28	17	8	126	1st
Assistance on loan/ credit acquisition	33	10	4	123	2nd
Tools or inputs	14	9	3	63	3rd
Provision of starter packs	2	2	3	13	4th
Training on better farming practices and fertilizer application.	4	0	0	12	5th
Provision of available market	1	1	-	5	6th
Provision of access road	-	1	1	3	7th
Purchasing of maize on time	1	-	-	3	7th
Inclusion of more crops	1	-	-	3	7th
Extension of program time to ten years	1	-	-	3	7th
Total	85	40	19		

Source: Author's Computation, 2013.

Provision of more starter packs and training of the farmers on better agronomic practices were the fourth and fifth proposals, among others, suggested by the farmers for inclusion in the intervention package if it was to be implemented again.

5.7 Productivity Levels of the Farmers

The productivity levels of the farmers are presented in Table 5.11. The mean productivity level (yield) of the participants of MiDA intervention is 1.51 Mt/ha and it is significantly higher than the mean productivity level of the non-participants (0.86 Mt/ha) by 0.65 Mt/ha. Overall, the mean productivity level of the farmers is 1.07 Mt/ha. Unfortunately, the mean productivity level of both participants and non-participants are less than the national mean maize productivity level (yield), which as at 2010, was 1.89 Mt/ha (MoFA, 2011) although the mean productivity level of the participants (1.51 Mt/ha) is closer to the national mean maize productivity level (1.89 Mt/ha) than the mean productivity of the non-participants (0.86 Mt/ha). The minimum productivity level of the participants is 0.50 Mt/ha and the maximum is 2.25 Mt/ha. Similarly, the minimum and maximum productivity levels of the non-participant farmers are 0.31 Mt/ha and 2.19 Mt/ha, respectively.

Table 5.11: Productivity Levels of the Farmers

Type of Farmer	Obs.	Mini. Yield (Mt/ha)	Maxi. Yield (Mt/ha)	Mean Yield (Mt/ha)	Mean Diff. (Mt/ha)	Z- Score
Participant	100	0.5	2.25	1.51	0.65***	12.54
Non-participant	200	0.31	2.19	0.86		
Overall	300	0.31	2.25	1.07		

*** implies significant at 1%
Source: Author's Computation, 2013.

5.7.1 Comparison of the Mean Productivity Levels of Participants across Districts and Regions

The mean productivity level of participants in Ejura-Sekyeredumase district (1.75 Mt/ha) is statistically higher than the mean productivity level of participants in Sekyere Central (1.34 Mt/ha) by 0.41 Mt/ha. This can be attributed to the fact that Ejura-Sekyeredumase district is one of the main maize growing districts in the country thus; farmers in the district are expected to be more knowledgeable in maize farming and hence be better able to understand and undertake the practices taught by MiDA as compared to maize farmers in Sekyere Central.

Similarly, the mean productivity level of participant farmers in Kwahu East district (1.64 Mt/ha) is higher than the mean productivity level of participant farmers in Kwahu North district (1.29 Mt/ha) with a mean difference of 0.36 Mt/ha which is statistically significant at 1 percent.

Across regions, there is no significant difference between the mean productivity level of participant farmers in Ashanti region, which is 1.55 Mt/ha, and the mean productivity level of participant farmers in Eastern region, which is 1.46 Mt/ha. However, these mean productivity levels are still below the mean productivity levels for the two regions which are 1.65 Mt/ha and 2.20 Mt/ha, respectively as recorded by MoFA in 2010 (MoFA, 2011).

The mean difference in productivity levels of participants across districts and regions are presented in Table 5.12.

Table 5.12: Difference in Means Yields of Participants across District and Region

District/ Region	Observations	Mean Yield (Mt/ha)	Mean Diff. (Mt/ha)	T-value
District				
Ejura-Sekyeredumase	25	1.75	0.41***	3.74
Sekyere Central	25	1.34		
Kwahu East	25	1.64	0.36***	2.71
Kwahu North	25	1.29		
Region				
Ashanti	50	1.55	0.08	0.87
Eastern	50	1.46		

*** implies significant at 1%
Source: Author's Computation, 2013.

5.7.2 Comparison of the Mean Productivity Levels of Participants and Non-participants by Gender

The mean productivity level of participant males is 1.52 Mt/ha and is statistically not different from the mean productivity level of participant females which is 1.49 Mt/ha. However, the mean productivity level of non-participant male farmers (0.94 Mt/ha) is significantly higher (at 1%) than the mean productivity level of non-participant female farmers (0.78 Mt/ha) by 0.16Mt/ha as shown in Table 5.13. This implies that MiDA intervention has helped reduce the gap between the yields of participant males and participant females. This also means that female participants were more sensitive, i.e. positively, to the intervention than the male participants since productivity increment is more pronounce in the female participants than in the males participants.

Table 5.13: Difference in Mean Productivity Levels of Participants and Non-Participants based on Gender

Category	**Participants**		**Non-participants**	
	Males	Females	Males	Females
Number of Observations	52	48	100	100
Mean Yield (Mt/Ha)	1.52	1.49	0.94	0.78
Mean Difference (Mt/Ha)	0.03		0.16***	

*** implies significant at 1%
Source: Author's Computation, 2013.

5.8 Effect of MiDA Intervention on Productivity of Maize Farmers

This section begins by comparing the difference between means and proportions of some characteristics of the participant and non-participant farmers and continues with the results of the logistic regression models used to generate the propensity scores. The results of the quality of matching, the treatment effects and the sensitivity analysis are presented last.

5.8.1 Comparison of Differences between Means and Proportions of some Characteristics of Participant and Non-participant Farmers

Table 5.14 presents the difference between means and proportions of some socioeconomic, institutional and production characteristics of the participant and non-participant farmers. The mean difference between age, household size and experience for participants and non-participants (42.2, 1.34 and 3.31, respectively) are all statistically significant indicating that on average, the participants are older, have larger household sizes and are more experience in maize farming than the non-participants. Conversely, there is no difference between the mean plot size (0.26 ha) and mean distance from farm to nearest market centre (0.05 km) of participants and non-participants. The mean plot size being equal across both groups conforms to findings by Mendola (2007) who found no significant difference in the average land owned by adopters and non-adopters and thus concluded that adoption is unbiased by farm size.

Similarly, the proportion of participant farmers who were members of FBOs is significantly higher than the proportion of non-participant farmers who were members of FBOs. Again, the proportion of participant farmers who have maize farming as their main source of income as well as the proportion of participant farmers who applied fertilizer in their production activity is significantly higher than their non-participant

counterparts. Also, the proportion of participant farmers who cultivated improved seeds, had access to credit facilities and had access to extension services are all significantly higher than their non-participant counterparts. However, there is no statistical difference between the proportion of participant and non-participant farmers who are married as well as those who have access roads to their farms. Generally, it can be observed that participants of the intervention significantly differ from non-participants with respect to nearly all the characteristics as shown in Table 5.14.

Table 5.14: Test of Difference between Means and Proportions for selected Variables

Variable	Participants	Non-participants	Mean Difference	t-value
	Mean	Mean		
Age (years)	46.50	42.08	4.42**	2.49
Household Size	7.16	5.83	1.34***	2.99
Experience (years)	19.39	16.09	3.31*	1.94
Plot Size (ha)	1.50	1.24	0.26	1.55
Distance to nearest market center (km)	7.60	7.55	0.05	0.07
Proportion of farmers who:				
Are Married	0.78	0.80	0.15	0.30
Are FBO Members	0.66	0.12	0.545***	9.74
Have maize farming as main income source	0.82	0.69	0.135**	2.48
Applied fertilizer	0.80	0.35	0.455***	7.43
Cultivated improved seeds	0.82	0.48	0.345***	5.73
Received Credit	0.12	0.01	0.11***	4.26
Received extension services	0.74	0.33	0.41***	6.71
Have access road	0.76	0.68	0.085	1.52

*, ** and *** implies significant at 10%, 5% and 1% respectively
Source: Author's computation, 2013.

5.8.2 Results of Logistic Regression Model used for Estimating Propensity Scores

Table 5.15 presents the results of the logistic regression models employed in the computation of the propensity scores. The probability values (Prob> Chi^2) indicate the significance of the models. A probability value of 0.000 implies the model is significant

at 1 percent. The pseudo R^2 indicates the extent to which the explanatory variables together explain the variations in the dependent variable. A pseudo R^2 value of 0.4892 for the overall model implies that about 49% of the variations in the dependent variable are explained by the independent variables in the overall model. The significant variables are the variables that influence participation in the MiDA intervention. Overall, the factors identified to influence participation in the MiDA intervention programme positively are FBO membership, use of fertilizer, access to extension services, access to credit, household size of farmer and region of farmer (specifically farmers in Eastern region). Household size influencing participation positively is consistent with findings by Botlhoko and Oladele (2013) who also found household size to positively influence farmers' participation in Agricultural projects.

Across regions, the factors identified to positively influence participation in MiDA intervention for maize farmers in Ashanti region are FBO membership, educational level, household size, residential status, farmer's experience level, form of land ownership and fertilizer use while gender of farmer and age of farmer influences participation negatively. Age and gender influencing participation negatively means that female maize farmers in Ashanti region are more likely to participate in the intervention compared to male maize farmers in the region. Also, younger farmers in the region are likely to participate in the intervention compared to older farmers.

The factors identified to positively influence participation in MiDA intervention for maize farmers in Eastern region are FBO membership, plot size, fertilizer application, access to credit and access to extension contacts while experience level of farmer, form of land ownership, distance from farm to market centre, availability of access road to

farm and district of farmer were identified to influence participation in MiDA intervention negatively.

Table 5.15: Results of Logistic Regression Models

Variable		Region		Gender	
	Overall	Ashanti	Eastern	Males	Females
			Coefficients		
FBO	3.0491***	6.4703***	2.5747***	3.7880***	2.7629***
Age	-0.0568	-0.2130***	0.2337	-0.0716	-0.0417
Agesq	0.0007	-	-0.0014	0.0009	0.0000
Gend	-0.3366	-2.9641**	-0.1321	-	-
Edu	0.1435	1.5829**	-0.8388	-0.2115	0.9165
Masta	-0.2926	0.1269	0.4820	0.2071	-1.2162
Hhsize	0.1295*	0.4504*	-0.0399	0.2068*	0.1054
Resta	0.2292	3.9839***	-1.3519	1.9065***	-1.0957*
Exp	-0.0226	0.1220**	-0.0984**	-0.0332	0.0149
MInc	0.4962	0.5428	0.2917	0.5523	0.8815
Ldown	-0.3542	2.3149**	-1.4052**	-0.1212	-0.8023
Ptsize	0.1431	-0.1686	0.6474*	0.0923	0.4169
Fert	2.2642***	4.8462**	3.0114***	2.6416**	2.5496***
Seed	0.4867	0.9718	0.8725	-0.0649	1.5462*
Cred	2.2503*	1.1795	2.9734***	2.6777	1.9892*
Ext	1.0484**	0.6311	2.3649***	0.4296	1.8363***
Mktdis	-0.0326	0.0652	-0.6790***	-0.0676	0.0057
Road	0.6367	1.5163	1.6249**	1.3871*	0.1185
Reg	-0.9730*	-	-	-1.2506	-0.4607
Dist	-	1.6783	-9.3352***	-	-
_Cons	-3.6771	-9.6583	0.4675	-5.4283	-4.2086
No. of Obs.	300	150	150	152	148
Pseudo R^2	0.4892	0.7563	0.6031	0.5342	0.5760
Prob. > Chi^2	0.0000	0.0001	0.0000	0.0000	0.0000

*, ** and *** implies significant at 10%, 5% and 1% respectively
Source: Author's Computation, 2013

Across gender, the factors identified to positively influence male maize farmers' participation in MiDA intervention are FBO membership, household size of farmer, residential status of farmer, fertilizer application and availability of access road to farm. Also, the factors identified to positively influence female maize farmers participation in MiDA intervention are FBO membership, fertilizer application, cultivation of

improved seeds, access to credit and access to extension services while residential status negatively influence their participation in the MiDA intervention.

Generally, across all the categories (overall, region and gender), the factors identified to positively influence participation in MiDA intervention are FBO membership and fertilizer application. This means farmers who are members of FBOs and farmers who apply fertilizer on their farms are more likely to participate in the MiDA intervention.

With the logistic model results presented in Table 5.15, the propensity scores were estimated for each farmer. The invocation of the common support option resulted in an ideal set of participants and non-participants with propensity scores bounded within 0.03701916 and 0.99433999. Across regions, the common support resulted in propensity scores bounded within 0.0776 and 0.9999 for participant and non-participant farmers in Ashanti region and propensity scores bounded within 0.0471 and 0.9992 for participant and non-participant farmers in Eastern region. Similarly, across gender, the imposition of the common support resulted in propensity scores bounded within 0.1302 and 0.9988 for participant and non-participant male maize farmers and propensity scores bounded within 0.0333 and 0.9985 for participant and non-participant female maize farmers.

5.8.3: Indicators of Matching Quality Before and After Matching

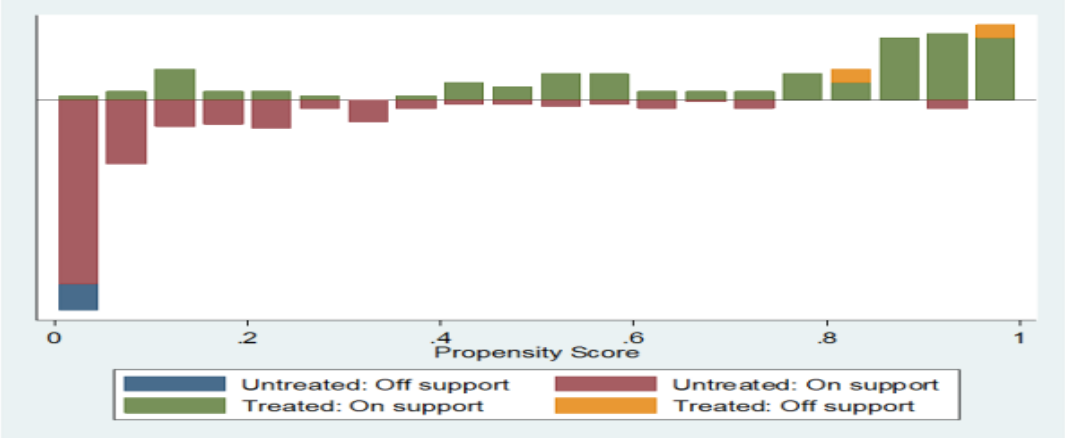
The distribution of the propensity scores before and after matching for all the categories are shown in Figure 5.2. It can be observed that before matching, the propensity scores were widely and unevenly distributed indicating the vast variation between the propensity scores of the participants and non-participants which were due to the

presence of biases. However, the after matching graphs show an evenly narrowly distributed propensity scores across the participant and non-participant maize farmers, demonstrating the removal of the biases by imposing the common support leading to the exemption of farmers who were not best matches and thus, not within the common support region. This shows that the estimation of the propensity scores balances the participant and non-participant groups quite well and justifies the need for estimating the propensity scores.

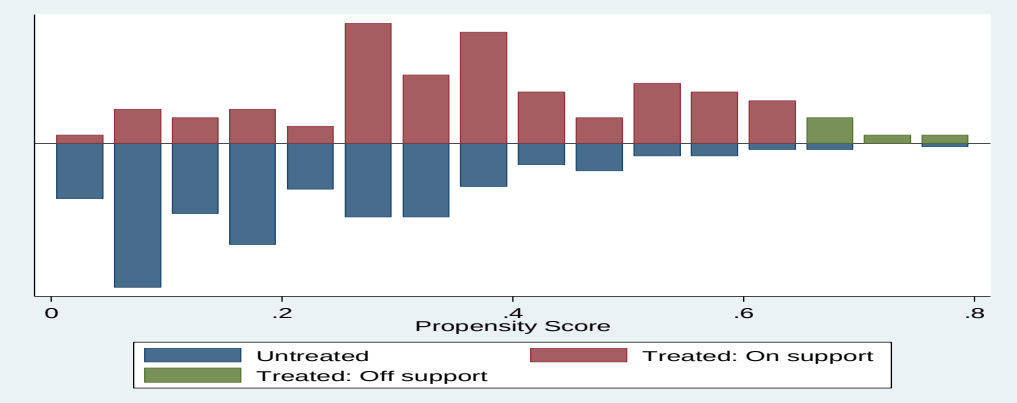
Figure 5.2: Distribution of Propensity Scores Graphs Before and After Matching for all the Models

1. Propensity Scores Graph for Overall Model

Before Matching

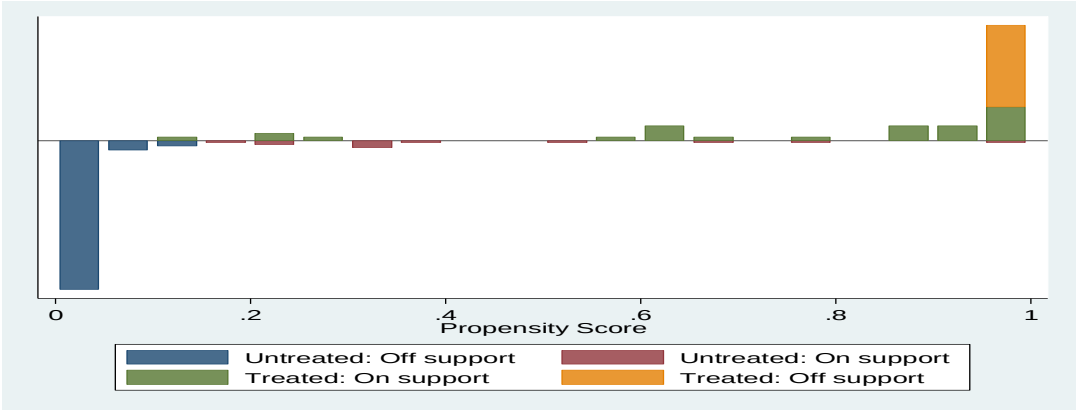


After Matching

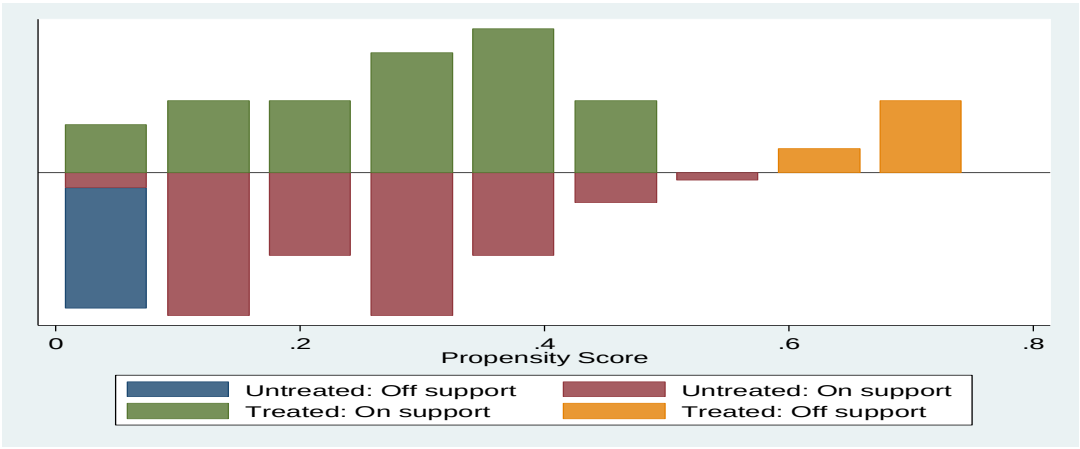


2. Propensity Scores Graph for Ashanti Region

Before Matching

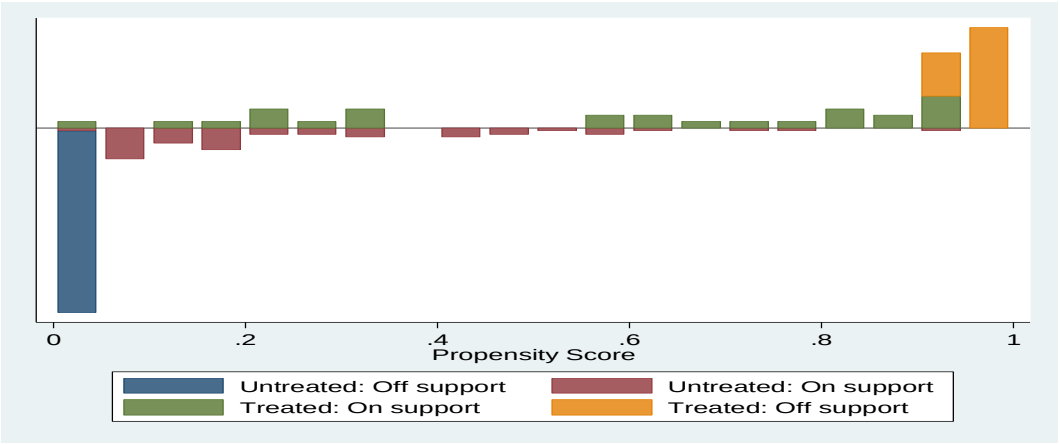


After Matching

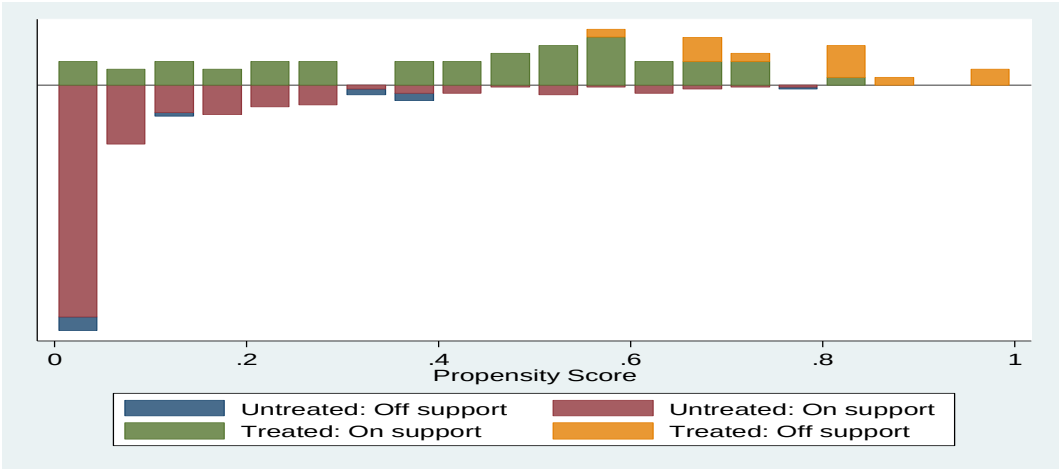


3. Propensity Scores Graph for Eastern Region

Before Matching

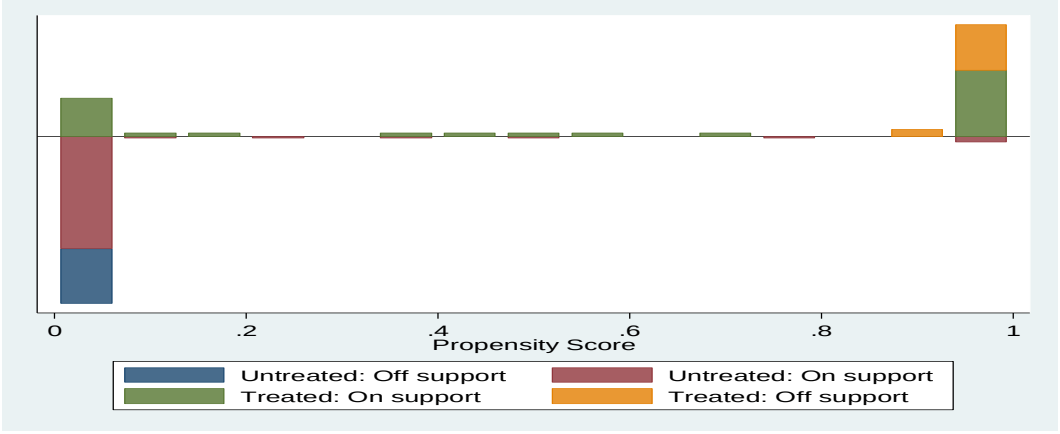


After Matching

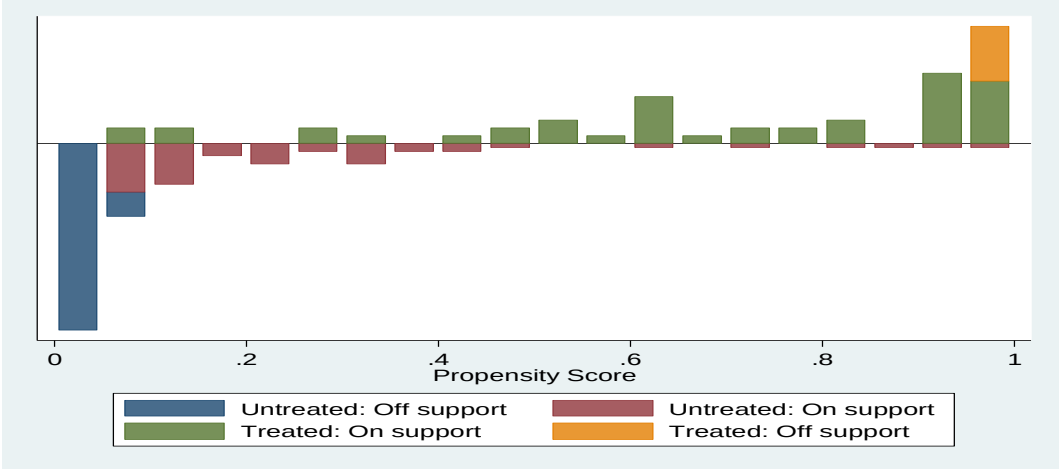


4. Propensity Scores Graph for Males

Before Matching

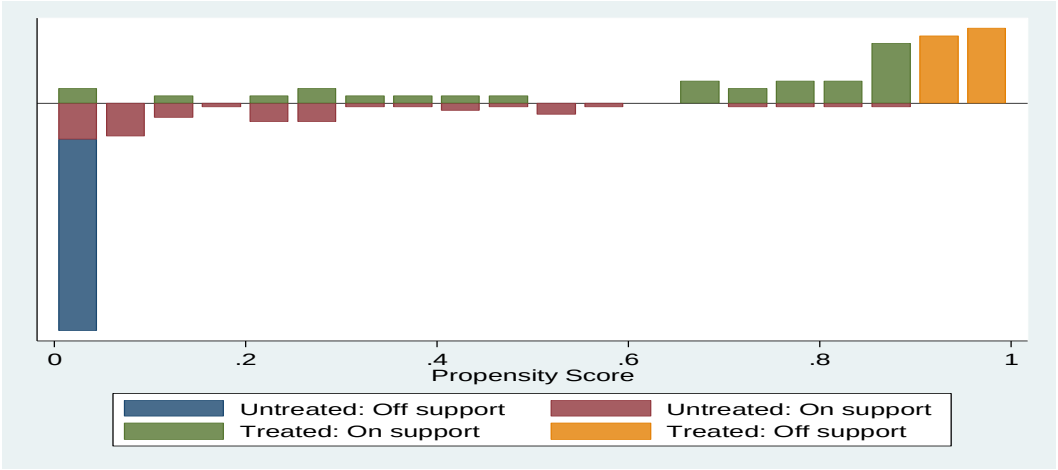


After Matching

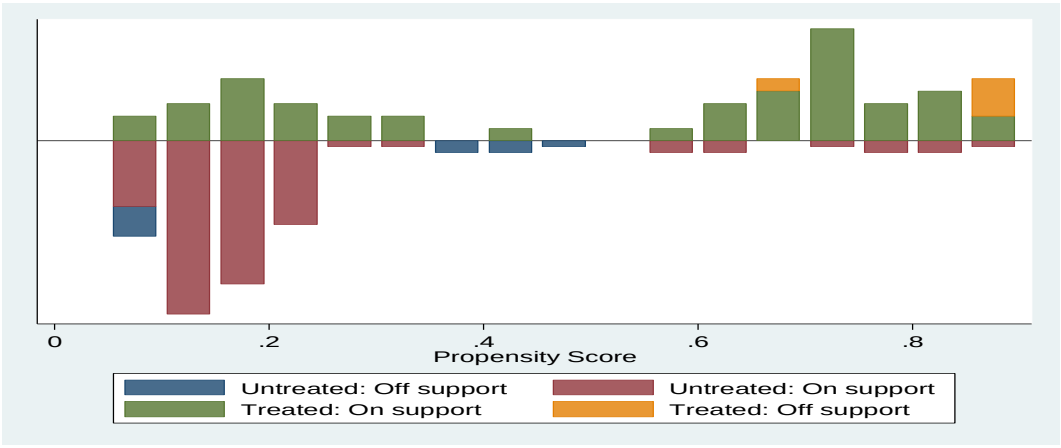


5. Propensity Scores Graph for Females

Before Matching



After Matching



Source: Author's Computation, 2013.

Also, Table 5.16 presents other covariate balancing indicators before and after matching. Generally, before matching, the pseudo R^2 and the likelihood ratio test are high and highly significant with a higher mean bias level. However, after matching, the pseudo R^2 are very low and the likelihood ratio test insignificant with the mean bias level greatly reduced. The low pseudo R^2 and the insignificant likelihood ratio test after matching support the hypothesis that both participants and non-participants have the same distribution in covariates after matching. This shows that the matching procedure is able to greatly reduce the level of bias across the characteristics of participants and non-participants and thus balances the characteristics across the participant and non-

participant farmers. The matching was thus used to estimate the effect of participation in MiDA intervention on productivity of the maize farmers.

Table 5.16: Other Covariate Balance Indicators Before and After Matching

Model Type		Pseudo R^2	LR Chi^2	P> Chi^2	Mean Bias	% Bias Reduction
Overall	Before Matching	0.490	187.30	0.000	35.40	55.65%
	After Matching	0.029	15.73	0.675	15.70	
Ashanti Region	Before Matching	0.753	143.73	0.000	48.90	44.38%
	After Matching	0.062	8.17	0.963	27.20	
Eastern Region	Before Matching	0.607	115.91	0.000	40.20	66.42%
	After Matching	0.057	11.30	0.913	13.50	
Males	Before Matching	0.535	104.46	0.000	40.20	55.22%
	After Matching	0.044	9.32	0.952	18.00	
Females	Before Matching	0.577	107.66	0.000	45.10	61.86%
	After Matching	0.038	7.47	0.986	17.20	

Source: Author's Computation, 2013.

5.8.4: Participation Effects and Sensitivity Analysis

The effect of MiDA intervention on productivity of the farmers computed using the nearest neighbour matching with replacement method is shown in Table 5.17. The outcome variable is productivity (yield) in metric tons per hectare. The effect of the intervention on the productivity of the participant farmers is shown by the ATT index. The results show that participation in MiDA intervention has a positive and significant effect (at 1 percent) on participants of the intervention. Participation in MiDA intervention increased the productivity of the participant maize farmers by 0.6680 Mt/ha. This is consistent with findings by Owusu *et al.* (2011a) and Owusu *et al.* (2011b) who found a positive and significant effect of participation in non-farm income and access to irrigation, respectively on household income. However, this finding contradicts findings by ISSER (2012) who did not find any significant effect of the

MiDA FBO training on the yields of the participant maize farmers. One reason attributed to their observed results was the short duration between the completion of the training and the start of their evaluation which did not allow for significant impacts to be observed. It is, therefore, very understandable that approximately two years after the training, significant effects of the intervention on the yields of the participant maize farmers have been observed.

Table 5.17: Treatment Effects and Sensitivity Analysis

Outcome Variable	Category	Treatment Effects			Gamma Level (γ)	Common Support (No. On Support)	
		ATT	ATU	ATE		Treated	Control
Yield (Mt/ha)	Overall	0.6680*** (7.20)	0.3803*** (3.11)	0.4988*** (5.09)	12.32-12.33	82	117
	Region						
	Ashanti	0.8895*** (6.42)	0.3394 (1.15)	0.6603*** (3.76)	8.56-8.57	28	20
	Eastern	0.4790*** (3.90)	0.3139 (1.53)	0.3813** (2.37)	3.0-3.5	29	42
	Gender						
	Males	0.6147*** (4.09)	0.3539** (2.04)	0.5118*** (3.59)	6.5-7.0	46	30
	Females	0.6176*** (3.76)	0.4049** (2.53)	0.4798*** (3.32)	7.0-7.5	25	46

Values in parenthesis are t-values
** and *** implies significant at 5% and 1% respectively
ATT= the effect of the intervention on Participants
ATU= the effect of the intervention on non-participants
ATE= the average effect of the intervention on the sampled population
Source: Author's Computation

Also, participation in the MiDA intervention had a positive and significant effect on the non-participants as reported by the ATU. An ATU value of 0.3803 implies that the productivity of the non-participant farmers would have increased by 0.3803 Mt/ha if they had participated in the MiDA Intervention. Lastly, an ATE of 0.4988 Mt/ha (significant at 1 percent) implies that the productivity of the sample population of maize farmers in the MiDA intervention increased by 0.4988 on the average.

Across regions, participation in MiDA intervention had a positive and significant effect on participant maize farmers; increasing the productivity of participant maize farmer in Ashanti region by 0.8895Mt/ha (significant at 1%) and that of participant maize farmers in Eastern region by 0.4790 Mt/ha (significant at 1%).

Across gender, participation in MiDA intervention positively enhanced the productivity of participant and non-participant males. Participation increased the productivity of male participants by 0.6147 Mt/ha whiles the productivity of male non-participant farmers would have increased by 0.3539 Mt/ha if they had participated in the intervention. Similarly, participation in MiDA intervention positively enhanced the productivity of participant and non-participant females. Participation increased the productivity of female participants by 0.6176 Mt/ha while the productivity of female non-participants would have increased by 0.4049 Mt/ha. On average, the productivity of the sampled population of male maize farmers in the MiDA intervention increased by 0.4118 Mt/ha whiles the productivity of the sampled population of female maize farmers in the MiDA intervention increased by 0.4798 Mt/ha.

It can be observed that the magnitude of ATT is higher than the magnitude of ATE which is also higher than the magnitude of ATU in all the categories demonstrating that farmers with higher probability of participating in the MiDA intervention are able to obtain higher productivity levels compared to those that are less inclined to participating in the MiDA intervention. The magnitude of ATT being higher than ATU implies farmers who did not participate in the intervention would have had their productivity levels, on average, being lower than participants of the intervention even if they had participated in the intervention. This means that productivity levels gained

from participating in the intervention are higher for farmers with higher probability of participation than for farmers with slightly lower chances of participation.

Sensitivity Analysis for Hidden Bias

According to Wainaina *et al.* (2012), the gamma level is the odd ratio of differential treatment assignment owing to an unobserved covariate. Table 5.17 shows the gamma levels for the matching algorithm. A gamma value of 3.0-3.5 implies that if farmers who have the same characteristics differ in their odds ratio of participation by a factor of 200-250 percent, then the significance of the estimated participation effects on productivity may be questionable. The highest gamma level is 12.32-12.33 and the lowest is 3.0- 3.5 indicating that large amounts of unobserved heterogeneity will not alter the inference about the estimated treatment effects, suggesting that the findings are generally insensitive to hidden biases.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the summary, conclusions and policy recommendations based on the findings of the study.

6.2 Summary of the Study

The primary objective of the study was to analyze the effect of MiDA intervention on the productivity of maize farmers in the Afram basin of Ghana. This was achieved by first ascertaining the perceptions of participant and non-participant maize farmers in the Afram basin about MiDA intervention with the help of a three point likert-type scale. Proportions, weighted scores and chi-square test were used to analyze the results. Next, the level of productivity of both participant and non-participant maize farmers were estimated using crop productivity index, yield, estimated as the total quantity of maize harvested divided by the total area harvested. Lastly, the effect of the intervention on productivity of the participant farmers was estimated using propensity score matching (PSM) approach and the nearest neighbour matching approach used in the matching.

Stratified sampling technique was employed in selecting four out of nine districts in which the intervention was carried out based on the intensity of maize farming in those districts. The districts that were purposely sampled were Ejura Sekyeredumase and Sekyere Central districts, both in Ashanti region and Kwahu North and Kwahu East districts in Eastern region. Similarly, purposive sampling was employed to sample two communities from each district from which simple random sampling was used to select a total of 25 participant maize farmers and 50 non-participant maize farmers from each

district to give a total of 300 respondents. A well-structured questionnaire was administered to the 300 respondents to obtain data for the analysis of the objectives.

The results indicated that majority of the participant farmers (97%) were of the view that the intervention has helped increase their output per unit area and that the starter packs encouraged them to practice what they were taught on their individual farms. Likewise, majority of both participant and non-participant farmers (81.3%) were of the view that the intervention has helped increase the yields of the participant farmers with most of them (88.3%) recommending the repetition of the intervention. The main limitation of the MiDA intervention was the late purchase of the maize grain by MiDA particularly at Ejura-Sekyeredumase district, which was followed by the late arrival of the starter packs. In addition, key proposals by farmers for inclusion in future similar interventions included: provision of machinery, assistance in acquiring loans or credit and provision of tools and inputs, among others.

Also, the mean productivity level of the participant farmers was 1.51 Mt/ha and that of the non-participant farmers was 0.86 Mt/ha with a mean difference of 0.65 Mt/ha significant at 1%. In addition, the study found that the mean productivity level of participant farmers in Ejura –Sekyereduamse (1.75 Mt/ha) was statistically higher than the mean productivity level of participant farmers in Sekyere Central (1.34 Mt/ha). Similarly, the mean productivity level of participant farmers in Kwahu East (1.64 Mt/ha) was significantly higher than the mean productivity level of participant farmers in Kwahu North (1.29 Mt/ha). However, there was no statistical difference between the mean productivity level of participant farmers in Ashanti region (1.55 Mt/ha) and that of participant farmers in Eastern region (1.46 Mt/ha). Although the difference between

the mean productivity level of non-participant males and non-participant females which was 0.16 Mt/ha was statistically significant at 1 percent, there was no statistical difference between the mean productivity level of participant males (1.52 Mt/ha) and the mean productivity level of participant females (1.49 Mt/ha).

Lastly, the study revealed that participation in MiDA intervention has a positive and significant effect on the productivity of the participants. Participation in the intervention increased the yields of the participants by 0.6680 Mt/ha. The effect of the intervention on the yields of participant farmers in Ashanti region was 0.8895 Mt/ha with the effect of the intervention on the yields of participant farmers in Eastern Region being 0.4790 Mt/ha. Similarly, the effect of the intervention on male participant maize farmers was 0.6177 Mt/ha whiles the effect on female maize participant farmers was 0.6176 Mt/ha.

6.3 Conclusions of the Study

Empirical results from the study indicate that most of the participant and non-participant farmers had a positive perception about MiDA intervention and thus, recommended the repetition of the intervention. This shows that the MiDA intervention was successful from the point of view of the farmers although there were a few limitations. These limitations are the late purchase of the maize grain by MiDA and the late arrival of the starter packs. From the point of view of the farmers, access to machinery for production, availability of tools and inputs and access to credit facilities are some of the factors that positively enhance their productivity. In addition, the mean productivity level of participant farmers was higher than the mean productivity level of non-participant farmers. Also, productivity levels of the maize farmers vary widely across different districts but are the same across different regions implying the need to

focus on increasing the yields of all districts to an equal level so that some districts are not more productive than others. Again, it can be concluded that MiDA intervention has helped reduce the gap between the productivity levels of male and female participants in the study area.

Lastly, participation in MiDA intervention enhanced the productivity of the participant maize farmers. The effect of the intervention on the productivity of the participant maize farmers is higher than the effect of the intervention on the productivity of the non-participant maize farmers.

6.4 Policy Recommendations

MiDA is advised to buy the grains from the farmers on time since most of the farmers do not have storage facilities to keep the maize grains as they wait for purchases to be made. This will help the farmers continue to keep the arrangements they made with MiDA and thus, produce more bearing in mind that they have a ready market that also buys their grains on time.

MiDA, MoFA and Non-Governmental Organizations (NGOs) that aim at enhancing the productivity of maize farmers in Ghana should undertake more of such interventions because they help increase the productivity of the farmers. In addition, they should assist the farmers with facilities such as irrigation facilities, storage facilities and tractors and provide loans or assist the farmers acquire loans from financial institutions, among others since access to these facilities aid in enhancing the productivities of the farmers.

Organizations that undertake similar interventions should focus on enhancing district level productivity rather than national level productivity since productivity levels vary across districts (including districts in the same region) whiles the regional productivity levels are the same.

Lastly, Farmers should be encouraged by extension agents, fellow farmers and concerned organizations to participate in such productivity enhancing interventions because they are very helpful.

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APPENDICES

APPENDIX I

Logistic Regression Results Using STATA

Logistic Regression Results for Overall Data

Logistic regression — Number of obs = 300
Wald chi2(19) = 108.17
Prob > chi2 = 0.0000
Log pseudolikelihood = -97.544921 — Pseudo R2 = 0.4892

Farmertype	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
FBO	3.049089	.438337	6.96	0.000	2.189964	3.908213
Age	-.0568332	.0794817	-0.72	0.475	-.2126144	.098948
Agesq	.0007358	.000793	0.93	0.353	-.0008184	.0022899
Gend	-.3365805	.4202528	-0.80	0.423	-1.160261	.4870998
Edu	.143506	.2950531	0.49	0.627	-.4347875	.7217994
Masta	-.2925669	.4038015	-0.72	0.469	-1.084003	.4988695
Hhsiz	.1294828	.0784776	1.65	0.099	-.0243305	.2832962
Resta	.229188	.4349584	0.53	0.598	-.6233148	1.081691
Exp	-.022586	.0236761	-0.95	0.340	-.0689903	.0238183
MInc	.4962076	.4115353	1.21	0.228	-.3103868	1.302802
Ldown	-.3541646	.4214705	-0.84	0.401	-1.180232	.4719024
Ptsize	.1430693	.1341654	1.07	0.286	-.1198901	.4060287
Fert	2.264165	.5210425	4.35	0.000	1.242941	3.28539
Seed	.4866582	.4414621	1.10	0.270	-.3785915	1.351908
Cred	2.250298	1.206181	1.87	0.062	-.1137721	4.614369
Ext	1.048376	.4170949	2.51	0.012	.2308852	1.865867
Mktdis	-.0326073	.0348504	-0.94	0.349	-.1009128	.0356982
Road	.6366874	.5028008	1.27	0.205	-.3487841	1.622159
Reg	-.973024	.5421403	-1.79	0.073	-2.0356	.0895515
_cons	-3.677076	1.999906	-1.84	0.066	-7.59682	.2426675

.

Logistic Regression Results for Ashanti Region

Logistic regression — Number of obs = 150
Wald chi2(18) = 50.17
Prob > chi2 = 0.0001
Log pseudolikelihood = -23.266503 — Pseudo R2 = 0.7563

Farmertype	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
FBO	6.470349	1.710337	3.78	0.000	3.118149	9.822548
Age	-.2130022	.0607453	-3.51	0.000	-.3320609	-.0939436
Gend	-2.964085	1.482071	-2.00	0.046	-5.868891	-.0592794
Edu	1.582878	.6379215	2.48	0.013	.3325752	2.833182
Masta	.126932	1.187194	0.11	0.915	-2.199927	2.45379
Hhsiz	.4503852	.2611976	1.72	0.085	-.0615527	.9623231
Resta	3.983947	1.362792	2.92	0.003	1.312923	6.654971
Exp	.1219752	.0488755	2.50	0.013	.026181	.2177693
MInc	.5428475	.9800423	0.55	0.580	-1.378	2.463695
Ldown	2.314895	1.152422	2.01	0.045	.0561888	4.5736
Ptsize	-.1685635	.4372567	-0.39	0.700	-1.025571	.6884439
Fert	4.846155	2.125896	2.28	0.023	.6794742	9.012835
Seed	.9717533	.8900792	1.09	0.275	-.7727699	2.716276
Cred	1.179514	1.696005	0.70	0.487	-2.144594	4.503621
Ext	.6310682	.8629597	0.73	0.465	-1.060302	2.322438
Mktdis	.0651503	.0841303	0.77	0.439	-.0997421	.2300427
Road	1.516289	1.489227	1.02	0.309	-1.402543	4.435121
DES	1.678308	1.569141	1.07	0.285	-1.397151	4.753767
_cons	-9.658328	5.092317	-1.90	0.058	-19.63909	.3224307

Logistic Regression Results for Eastern Region

Logistic regression — Number of obs = 150
Wald chi2(19) = 60.18
Prob > chi2 = 0.0000
Log pseudolikelihood = -37.891669 — Pseudo R2 = 0.6031

Farmertype	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
FBO	2.574685	.8898765	2.89	0.004	.8305587	4.318811
Age	.2336758	.2057994	1.14	0.256	-.1696837	.6370353
Agesq	-.0014397	.0019694	-0.73	0.465	-.0052996	.0024203
Gend	-.1321001	.7750819	-0.17	0.865	-1.651233	1.387032
Edu	-.8387861	.6908239	-1.21	0.225	-2.192776	.5152037
Masta	.4820057	.7920989	0.61	0.543	-1.07048	2.034491
Hhsiz	-.039869	.1388126	-0.29	0.774	-.3119367	.2321988
Resta	-1.351857	.9403103	-1.44	0.151	-3.194831	.4911179
Exp	-.0983952	.0392631	-2.51	0.012	-.1753495	-.0214408
MInc	.2916846	.7738321	0.38	0.706	-1.224998	1.808368
Ldown	-1.405206	.6481466	-2.17	0.030	-2.67555	-.134862
Ptsize	.647389	.3835116	1.69	0.091	-.10428	1.399058
Fert	3.011402	.8836331	3.41	0.001	1.279513	4.743291
Seed	.8724527	.7244555	1.20	0.228	-.5474539	2.292359
Cred	2.973366	.9528801	3.12	0.002	1.105755	4.840976
Ext	2.364866	.6271837	3.77	0.000	1.135608	3.594123
Mktdis	-.67897	.2148963	-3.16	0.002	-1.100159	-.257781
Road	1.624899	.8034786	2.02	0.043	.0501094	3.199688
DKE	-9.335194	3.156499	-2.96	0.003	-15.52182	-3.148569
_cons	.4675371	3.770287	0.12	0.901	-6.92209	7.857164

Logistic Regression Results for Males

Logistic regression — Number of obs = 152
Wald chi2(18) = 54.94
Prob > chi2 = 0.0000
Log pseudolikelihood = -45.482638 — Pseudo R2 = 0.5342

Farmertype	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
FBO	3.788008	.7033387	5.39	0.000	2.40949	5.166527
Age	-.071567	.1215032	-0.59	0.556	-.3097088	.1665748
Agesq	.0009456	.0011841	0.80	0.425	-.0013752	.0032663
Edu	-.2115004	.4173793	-0.51	0.612	-1.029549	.606548
Masta	.2070824	.8264246	0.25	0.802	-1.41268	1.826845
Hhsiz	.206829	.1180296	1.75	0.080	-.0245049	.4381628
Resta	1.906459	.7234297	2.64	0.008	.4885633	3.324356
Exp	-.0331812	.0330372	-1.00	0.315	-.0979329	.0315705
MInc	.5522615	.6236462	0.89	0.376	-.6700626	1.774586
Ldown	-.1212466	.5881018	-0.21	0.837	-1.273905	1.031412
Ptsize	.0923249	.1356641	0.68	0.496	-.1735719	.3582216
Fert	2.641648	1.020861	2.59	0.010	.6407964	4.6425
Seed	-.0649156	.6182718	-0.10	0.916	-1.276706	1.146875
Cred	2.677723	2.120042	1.26	0.207	-1.477484	6.83293
Ext	.4296148	.6616404	0.65	0.516	-.8671765	1.726406
Mktdis	-.0675836	.0592533	-1.14	0.254	-.1837181	.0485508
Road	1.387115	.7888508	1.76	0.079	-.1590045	2.933234
Reg	-1.250584	.8611028	-1.45	0.146	-2.938315	.4371462
_cons	-5.428254	2.849737	-1.90	0.057	-11.01364	.1571267

Logistic Regression Results for Females

Logistic regression — Number of obs = 148
Wald chi2(18) = 61.25
Prob > chi2 = 0.0000
Log pseudolikelihood = -39.537735 — Pseudo R2 = 0.5760

Farmertype	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
FBO	2.762854	.6971564	3.96	0.000	1.396452	4.129255
Age	-.0417366	.1474688	-0.28	0.777	-.3307702	.247297
Agesq	.0000208	.0016511	0.01	0.990	-.0032153	.0032569
Edu	.9165339	.7119732	1.29	0.198	-.478908	2.311976
Masta	-1.216229	.749185	-1.62	0.105	-2.684605	.2521462
Hhsize	.105412	.1222229	0.86	0.388	-.1341405	.3449645
Resta	-1.095685	.6277719	-1.75	0.081	-2.326095	.1347255
Exp	.0148799	.0554034	0.27	0.788	-.0937087	.1234685
MInc	.8814617	.8562111	1.03	0.303	-.7966812	2.559605
Ldown	-.8022704	.6107854	-1.31	0.189	-1.999388	.3948471
Ptsize	.4169098	.452055	0.92	0.356	-.4691017	1.302921
Fert	2.549582	.7140933	3.57	0.000	1.149985	3.949179
Seed	1.54624	.8099939	1.91	0.056	-.0413192	3.133799
Cred	1.98918	1.142436	1.74	0.082	-.2499531	4.228312
Ext	1.836329	.6524271	2.81	0.005	.5575959	3.115063
Mktdis	.0056198	.058723	0.10	0.924	-.1094753	.1207148
Road	.1184544	.7464763	0.16	0.874	-1.344612	1.581521
Reg	-.4606776	.7122596	-0.65	0.518	-1.856681	.9353256
_cons	-4.208626	3.387579	-1.24	0.214	-10.84816	2.430907

APPENDIX II

Results of Estimated Treated Effects Using STATA

Overall

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
CPtonsHa	Unmatched	1.50501705	.85637193	.648645123	.045859892	14.14
	ATT	1.49057825	.822618269	.667959984	.092746465	7.20
	ATU	.906626315	1.28694508	.380318764	.122444133	3.11
	ATE			.498844292	.0980825	5.09

Ashanti Region

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
CPtonsHa	Unmatched	1.54554601	.888761641	.656784371	.067624988	9.71
	ATT	1.67057526	.781119228	.88945603	.138545843	6.42
	ATU	.804447601	1.14385684	.339409237	.294934421	1.15
	ATE			.660269866	.175762324	3.76

Eastern region

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
CPtonsHa	Unmatched	1.4644881	.823982219	.640505876	.061809339	10.36
	ATT	1.4248358	.945864034	.478971763	.12268976	3.90
	ATU	.922710623	1.23658037	.31386975	.205510585	1.53
	ATE			.381305783	.160859115	2.37

Males

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
CPtonsHa	Unmatched	1.51704995	.936819618	.580230327	.070494788	8.23
	ATT	1.51746226	.902744609	.614717648	.150367309	4.09
	ATU	.910069779	1.26396964	.353899866	.173059815	2.04
	ATE			.51176326	.142659198	3.59

Females

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
CPtonsHa	Unmatched	1.49198142	.775924242	.716057179	.056228223	12.73
	ATT	1.42169524	.804056061	.617639177	.16438178	3.76
	ATU	.835931324	1.24082091	.404889587	.160345097	2.53
	ATE			.479801415	.144354789	3.32

APPENDIX III

Results of Covariate Balancing Before and After Matching

Overall Model

Variable		Mean Treated	Mean Control	%bias	%reduct |bias|	t-test t	t-test p>|t|
FBO	Unmatched	.66	.115	134.4		11.74	0.000
	Matched	.58537	.32563	64.0	52.3	1.62	0.107
Age	Unmatched	46.5	42.08	30.8		2.49	0.013
	Matched	45.585	44.123	10.2	66.9	0.38	0.702
Agesq	Unmatched	2354.8	1987.5	26.2		2.15	0.032
	Matched	2267.5	2156.5	7.9	69.8	0.30	0.763
Gend	Unmatched	.52	.5	4.0		0.33	0.745
	Matched	.4878	.51608	-5.6	-41.4	0.96	0.336
Edu	Unmatched	.83	.87	-6.6		-0.53	0.599
	Matched	.79268	.82563	-5.5	17.6	1.26	0.210
Masta	Unmatched	.78	.795	-3.7		-0.30	0.765
	Matched	.82927	.87236	-10.5	-187.3	0.12	0.904
Hhsiz	Unmatched	7.16	5.825	35.7		2.99	0.003
	Matched	6.5976	7.0131	-11.1	68.9	-0.70	0.485
Resta	Unmatched	.68	.62	12.6		1.02	0.309
	Matched	.64634	.61055	7.5	40.4	0.34	0.734
Exp	Unmatched	19.39	16.085	23.9		1.94	0.053
	Matched	18.951	16.343	18.9	21.1	0.33	0.740
MInc	Unmatched	.82	.685	31.6		2.50	0.013
	Matched	.81707	.83317	-3.8	88.1	-0.97	0.335
Ldown	Unmatched	.51	.55	-8.0		-0.65	0.514
	Matched	.5122	.55427	-8.4	-5.2	1.59	0.112
Ptsize	Unmatched	1.4995	1.2403	19.9		1.70	0.091
	Matched	1.4945	1.3847	8.4	57.6	0.86	0.388
Fert	Unmatched	.8	.345	103.2		8.20	0.000
	Matched	.76829	.64472	28.0	72.8	-0.16	0.876
Seed	Unmatched	.82	.475	77.2		6.05	0.000
	Matched	.79268	.63317	35.7	53.8	-0.04	0.967
Cred	Unmatched	.12	.01	45.6		4.38	0.000
	Matched	.09756	.08945	3.4	92.6	-1.60	0.110
Ext	Unmatched	.74	.33	89.8		7.25	0.000
	Matched	.70732	.50603	44.1	50.9	0.93	0.352
Mktdis	Unmatched	7.5978	7.5505	0.8		0.06	0.949
	Matched	7.9538	8.2852	-5.6	-600.8	0.69	0.489
Road	Unmatched	.76	.675	18.9		1.52	0.130
	Matched	.78049	.73668	9.7	48.5	0.02	0.982
Reg	Unmatched	.5	.5	0.0		0.00	1.000
	Matched	.5	.44724	10.5	.	1.20	0.230

Sample	Pseudo R2	LR chi2	p>chi2	MeanBias	MedBias
Raw	0.490	187.30	0.000	35.4	23.9
Matched	0.029	15.73	0.675	15.7	9.7

Ashanti Region

Variable		Mean Treated	Mean Control	%bias	%reduct |bias|	t-test t	t-test p>|t|
FBO	Unmatched	.82	.04	253.5		16.36	0.000
	Matched	.67857	.36111	103.2	59.3	0.79	0.430
Age	Unmatched	46.22	43.14	22.5		1.26	0.210
	Matched	46.964	44.465	18.2	18.9	0.54	0.591
Gend	Unmatched	.46	.56	-20.0		-1.15	0.250
	Matched	.53571	.45139	16.8	15.7	0.57	0.568
Edu	Unmatched	.84	.8	6.4		0.35	0.723
	Matched	.89286	.98958	-15.4	-141.8	-0.26	0.795
Masta	Unmatched	.66	.82	-36.8		-2.20	0.029
	Matched	.71429	.71875	-1.0	97.2	0.04	0.970
Hhsiz	Unmatched	8.52	6.23	54.5		3.32	0.001
	Matched	6.8929	7.6944	-19.1	65.0	0.32	0.751
Resta	Unmatched	.68	.52	32.9		1.88	0.062
	Matched	.60714	.54861	12.0	63.4	0.14	0.893
Exp	Unmatched	20.78	14.87	43.6		2.48	0.014
	Matched	20.286	19.389	6.6	84.8	0.45	0.653
MInc	Unmatched	.84	.55	65.9		3.63	0.000
	Matched	.78571	.84375	-13.2	80.0	-0.53	0.597
Ldown	Unmatched	.62	.52	20.2		1.16	0.248
	Matched	.42857	.70486	-55.7	-176.3	-1.00	0.321
Ptsize	Unmatched	1.507	1.489	1.3		0.07	0.940
	Matched	1.3804	1.7288	-24.6	-1835.9	-0.58	0.566
Fert	Unmatched	.96	.54	110.3		5.70	0.000
	Matched	.92857	.88542	11.3	89.7	-0.73	0.468
Seed	Unmatched	.74	.33	89.5		5.11	0.000
	Matched	.71429	.5	46.8	47.7	0.85	0.399
Cred	Unmatched	.04	.01	19.1		1.24	0.219
	Matched	.03571	0	22.8	-19.0	1.23	0.221
Ext	Unmatched	.72	.37	74.5		4.25	0.000
	Matched	.60714	.39931	44.3	40.6	0.44	0.658
Mktdis	Unmatched	6.0078	5.4119	19.4		1.09	0.277
	Matched	6.0421	6.7242	-22.2	-14.5	-0.15	0.878
Road	Unmatched	.56	.61	-10.1		-0.58	0.560
	Matched	.67857	.46181	43.7	-333.5	1.65	0.103
DES	Unmatched	.5	.5	0.0		0.00	1.000
	Matched	.57143	.51042	12.1	.	0.75	0.457

Sample	Pseudo R2	LR chi2	p>chi2	MeanBias	MedBias
Raw	0.753	143.73	0.000	48.9	27.7
Matched	0.062	8.17	0.963	27.2	18.7

Eastern Region

Variable		Mean Treated	Mean Control	%bias	%reduct |bias|	t-test t	t-test p>|t|
FBO	Unmatched	.5	.19	68.4		4.12	0.000
	Matched	.41379	.38576	6.2	91.0	0.59	0.554
Age	Unmatched	46.78	41.02	38.3		2.23	0.027
	Matched	45.759	45.461	2.0	94.8	0.47	0.642
Agesq	Unmatched	2423.2	1894.2	36.0		2.14	0.034
	Matched	2327.3	2323.1	0.3	99.2	0.38	0.703
Gend	Unmatched	.58	.44	28.1		1.62	0.107
	Matched	.51724	.49218	5.0	82.1	0.72	0.470
Edu	Unmatched	.82	.94	-20.7		-1.18	0.240
	Matched	.89655	.83881	9.9	51.9	0.64	0.522
Masta	Unmatched	.9	.77	35.3		1.94	0.055
	Matched	.89655	.89828	-0.5	98.7	0.09	0.926
Hhsiz	Unmatched	5.8	5.42	13.0		0.72	0.474
	Matched	6.069	6.2371	-5.8	55.8	-0.06	0.954
Resta	Unmatched	.68	.72	-8.7		-0.50	0.615
	Matched	.7931	.74022	11.5	-32.2	-0.05	0.958
Exp	Unmatched	18	17.3	5.0		0.29	0.773
	Matched	18.241	19.293	-7.5	-50.3	-0.44	0.660
MInc	Unmatched	.8	.82	-5.1		-0.29	0.769
	Matched	.75862	.8036	-11.4	-124.9	-0.33	0.741
Ldown	Unmatched	.4	.58	-36.3		-2.10	0.038
	Matched	.55172	.61111	-12.0	67.0	-0.10	0.917
Ptsize	Unmatched	1.492	.9916	42.7		2.73	0.007
	Matched	1.3034	1.1773	10.8	74.8	0.77	0.440
Fert	Unmatched	.64	.15	114.9		6.99	0.000
	Matched	.58621	.33333	59.3	48.4	1.14	0.256
Seed	Unmatched	.9	.62	69.0		3.71	0.000
	Matched	.86207	.77074	22.5	67.4	-0.14	0.887
Cred	Unmatched	.2	.01	64.6		4.45	0.000
	Matched	.10345	.03678	22.7	64.9	0.19	0.850
Ext	Unmatched	.76	.29	105.9		6.06	0.000
	Matched	.72414	.64789	17.2	83.8	-0.20	0.840
Mktdis	Unmatched	9.1878	9.6891	-6.9		-0.39	0.700
	Matched	9.3034	10.472	-16.0	-133.1	0.38	0.701
Road	Unmatched	.96	.74	64.4		3.36	0.001
	Matched	.93103	.88028	14.9	76.9	0.62	0.534
DKE	Unmatched	.5	.5	0.0		0.00	1.000
	Matched	.51724	.4108	21.1	.	-0.22	0.828

Sample	Pseudo R2	LR chi2	p>chi2	MeanBias	MedBias
Raw	0.607	115.91	0.000	40.2	36.0
Matched	0.057	11.30	0.913	13.5	11.4

Males

Variable		Mean Treated	Mean Control	%bias	%reduct |bias|	t-test t	t-test p>|t|
FBO	Unmatched	.69231	.12	142.2		8.81	0.000
	Matched	.65217	.56974	20.5	85.6	0.20	0.845
Age	Unmatched	47.423	41.97	35.9		2.07	0.041
	Matched	47.37	47.234	0.9	97.5	0.51	0.611
Agesq	Unmatched	2454.3	2012.2	28.9		1.70	0.092
	Matched	2471.8	2471.1	0.0	99.9	0.43	0.667
Edu	Unmatched	.92308	1.05	-19.3		-1.08	0.280
	Matched	.86957	.93421	-9.9	49.1	-0.58	0.560
Masta	Unmatched	.84615	.82	7.0		0.40	0.687
	Matched	.82609	.93026	-27.8	-298.3	-0.77	0.442
Hhsiz	Unmatched	6.8462	5.4	40.4		2.34	0.021
	Matched	6.8913	5.8211	29.9	26.0	1.38	0.170
Resta	Unmatched	.78846	.56	49.9		2.84	0.005
	Matched	.76087	.82895	-14.9	70.2	-0.91	0.365
Exp	Unmatched	19.962	15.02	36.4		2.11	0.036
	Matched	19.87	18.484	10.2	72.0	0.64	0.523
MInc	Unmatched	.82692	.71	27.8		1.58	0.116
	Matched	.82609	.87763	-12.3	55.9	-1.26	0.210
Ldown	Unmatched	.53846	.48	11.6		0.68	0.497
	Matched	.54348	.72632	-36.4	-212.7	-1.30	0.196
Ptsize	Unmatched	1.724	1.5924	8.5		0.51	0.607
	Matched	1.8707	1.7966	4.8	43.7	0.39	0.695
Fert	Unmatched	.78846	.43	78.4		4.46	0.000
	Matched	.76087	.60658	33.8	57.0	0.69	0.493
Seed	Unmatched	.76923	.49	60.0		3.42	0.001
	Matched	.73913	.57895	34.4	42.6	0.96	0.336
Cred	Unmatched	.13462	.01	49.1		3.36	0.001
	Matched	.1087	.06579	16.9	65.6	0.63	0.532
Ext	Unmatched	.75	.44	66.1		3.79	0.000
	Matched	.71739	.64342	15.8	76.1	-0.33	0.739
Mktdis	Unmatched	7.0262	7.9714	-16.0		-0.92	0.360
	Matched	7.6174	9.6737	-34.8	-117.5	-0.89	0.374
Road	Unmatched	.82692	.73	23.3		1.33	0.185
	Matched	.80435	.78816	3.9	83.3	-0.08	0.938
Reg	Unmatched	.44231	.56	-23.5		-1.38	0.170
	Matched	.5	.41316	17.4	26.2	0.80	0.427

Sample	Pseudo R2	LR chi2	p>chi2	MeanBias	MedBias
Raw	0.535	104.46	0.000	40.2	32.4
Matched	0.044	9.32	0.952	18.0	16.3

Females

Variable		Mean Treated	Mean Control	%bias	%reduct |bias|	t-test t	t-test p>|t|
FBO	Unmatched	.625	.11	125.2		7.73	0.000
	Matched	.48	.32676	37.3	70.2	-0.43	0.666
Age	Unmatched	45.5	42.19	24.5		1.39	0.166
	Matched	46.16	42.807	24.8	-1.3	0.48	0.636
Agesq	Unmatched	2247	1962.9	22.6		1.29	0.198
	Matched	2328.7	1976.2	28.0	-24.1	0.63	0.529
Edu	Unmatched	.72917	.69	7.7		0.44	0.658
	Matched	.72	.71972	0.1	99.3	0.93	0.352
Masta	Unmatched	.70833	.77	-14.0		-0.81	0.421
	Matched	.72	.77746	-13.0	6.8	-0.24	0.813
Hhsize	Unmatched	7.5	6.25	32.0		1.95	0.053
	Matched	6.68	6.6775	0.1	99.8	1.09	0.276
Resta	Unmatched	.5625	.68	-24.2		-1.40	0.165
	Matched	.56	.50704	10.9	54.9	0.02	0.987
Exp	Unmatched	18.771	17.15	11.5		0.65	0.515
	Matched	16.88	16.314	4.0	65.1	0.55	0.581
MInc	Unmatched	.8125	.66	34.9		1.92	0.056
	Matched	.72	.77746	-13.1	62.3	-0.32	0.753
Ldown	Unmatched	.47917	.62	-28.4		-1.63	0.106
	Matched	.56	.55775	0.5	98.4	1.06	0.291
Ptsize	Unmatched	1.2562	.8882	41.3		2.57	0.011
	Matched	.916	1.0414	-14.1	65.9	-0.50	0.618
Fert	Unmatched	.8125	.26	132.1		7.38	0.000
	Matched	.68	.50423	42.0	68.2	0.82	0.413
Seed	Unmatched	.875	.46	97.5		5.21	0.000
	Matched	.8	.69859	23.8	75.6	0.61	0.540
Cred	Unmatched	.10417	.01	41.0		2.77	0.006
	Matched	.12	.0507	30.2	26.4	0.25	0.799
Ext	Unmatched	.72917	.22	117.6		6.79	0.000
	Matched	.64	.50282	31.7	73.1	0.50	0.617
Mktdis	Unmatched	8.2171	7.1296	18.5		1.01	0.312
	Matched	8.4236	9.6688	-21.2	-14.5	-1.06	0.293
Road	Unmatched	.6875	.62	14.1		0.80	0.426
	Matched	.68	.67887	0.2	98.3	-0.99	0.323
Reg	Unmatched	.5625	.44	24.5		1.40	0.165
	Matched	.44	.37042	13.9	43.2	1.22	0.224

Sample	Pseudo R2	LR chi2	p>chi2	MeanBias	MedBias
Raw	0.577	107.66	0.000	45.1	26.4
Matched	0.038	7.47	0.986	17.2	14.0

APPENDIX IV

QUESTIONNAIRE FOR ASSESSING THE EFFECT OF MiDA INTERVENTION ON PRODUCTIVITY OF MAIZE FARMERS IN THE AFRAM BASIN OF GHANA

Interviewer..... Date of Interview...../...../.....

District..... Community/ Village.....

Questionnaire Number..... Type of Maize Farmer.....

Millennium Development Authority (MiDA) is an authority established by the Government of Ghana to oversee and implement the details of the compact signed between the Government of Ghana and the Millennium Challenge Cooperation of the United States. One main objective of this compact was to enhance the productivity of farmers.

As part of the partial fulfillment of the requirements for the award of Master of Philosophy degree in Agricultural Economics, I am working on the research topic "*Effect of MiDA Intervention on Productivity of Maize Farmers in the Afram Basin of Ghana*". In view of this, I would kindly like to ask you some questions pertaining to the above study and any information given will be handled confidentially for academic purposes only.

A. BACKGROUND INFORMATION OF FARMER

Please indicate or tick where appropriate.

1. Name ……
2. Are you a member of a maize farmer based organization (FBO)?
    a. Yes [ ]
    b. No [ ]

If NO, Please continue from Question 5

3. How long have you been a member of the FBO?
    a. The last year and over [ ]
    b. Within the last six months to one year [ ]
    c. Within the last three months [ ]
    d. During the MiDA intervention [ ]
    e. Others (Please specify)……
4. Did you benefit from being a member of the FBO before the start of the MiDA intervention?
    a. Yes [ ]
    b. No [ ]
5. Did you participate in the MiDA intervention?
    a. Yes [ ]
    b. No [ ]
6. Age ……
7. Gender
    a. Male [ ]
    b. Female [ ]
8. Highest level of Education.
    a. None [ ]
    b. Primary [ ]
    c. JHS/ Middle school [ ]
    d. SHS/ O/A level [ ]
    e. Vocational/ Technical school [ ]
    f. Tertiary [ ]
9. Marital Status
    a. Single [ ]
    b. Married [ ]
    c. Separated/ Divorced [ ]
    d. Widowed [ ]
10. Household characteristics

Category	Number of Dependents
Adult Male (above 18 years)	
Adult female (above 18 years)	
Children (below 18)	
Total	

11. Residential Status
    a. Native [ ]
    b. Settler [ ]
12. How long have you cultivated maize? ……

13. Is maize farming your primary source of income?
    a. Yes [ ]
    b. No [ ]
14. If NO, what occupation is your primary source of income? ……

B. PRODUCTIVITY OF FARMERS

15. Please indicate the number of plots devoted to maize production in the last season (Ha)? ….
16. Type of plot ownership
    a. Owner (eg. Family, purchased) [ ]
    b. Otherwise (eg. Rent, lease, contract) [ ]
    c. Combination of both owner and otherwise [ ]
17. Please indicate the size of the plots and quantity of maize harvested from each plot.

Plot Type		Plot Size	Quantity Harvested
Own Plots	Plot 1		
	Plot 2		
	Plot 3		
Rented Plots/ otherwise	Plot 1		
	Plot 2		
	Plot 3		
Total			

18. Did you apply fertilizer in your production activity?
    a. Yes [ ]
    b. No [ ]
19. If YES, please indicate the type of fertilizer applied

Type of Fertilizer	Tick those that Apply
Urea	
Ammonia	
Sulphur	
NPK	
Others, please specify	

20. What type of seed did you cultivate?
    a. Traditional [ ]
    b. Improved seed [ ]
21. If IMPROVED seed was cultivated, please indicate the variety cultivated? ……
22. What is the source of the seed cultivated?
    a. Own seed [ ]
    b. MiDA [ ]
    c. Friend/Neighbour [ ]
    d. Market [ ]
    e. MoFA [ ]
    f. Others (Please specify)……

23. Did you receive credit in the last season from any financial institution for your farming activity?
    a. Yes [ ]
    b. No [ ]
24. Did you receive any extension visits in the last Season?
    a. Yes [ ]
    b. No [ ]
25. If YES, how many contacts did you have in the cropping season? ……
26. Do you have access road to your farm?
    a. Yes [ ]
    b. No [ ]
27. What is the distance from your farm to the nearest market (Km)? ……

C. PERCEPTIONS OF MAIZE FARMERS ON MiDA INTERVENTION

For participants only

28. How did you get to know about the MiDA intervention?
    a. Announcement [ ]
    b. Friend [ ]
    c. Family [ ]
    d. Extension agent [ ]
    e. Others (Please specify) ……
29. Why did you decide to participate in the MiDA intervention?
    ……
    ……
30. Lessons taught from land preparation to harvest were the same as what you expected?
    a. Yes [ ]
    b. No [ ]
31. If No, why? …….

Please tick the most appropriate response to the following statements.

STATEMENTS (Part I)	Agree (3)	Neutral (2)	Disagree (1)
32. The MiDA intervention covered all that we were told it will cover.	[ ]	[ ]	[ ]
33. Knowledge and skills taught on agronomic practices were easy to understand.	[ ]	[ ]	[ ]
34. Lessons on agronomic practices taught were easy to undertake on the field.	[ ]	[ ]	[ ]
35. Some of the practices taught were new to me.	[ ]	[ ]	[ ]
36. Inputs required for these new practices are readily available and accessible.	[ ]	[ ]	[ ]
37. I can apply the practices taught on my own effectively.	[ ]	[ ]	[ ]
38. The training acquired has helped to increase my output per unit area.	[ ]	[ ]	[ ]
39. The starter pack was necessary because It encouraged me to practice what I was taught during the training.	[ ]	[ ]	[ ]
40. In totality, the MiDA intervention has Increased maize yield (output per unit area) of participants.	[ ]	[ ]	[ ]
41. The MiDA Intervention was successfully implemented and I recommend that similar projects/ training be carried out.	[ ]	[ ]	[ ]

STATEMENTS (Part 2)	Agree (1)	Neutral (2)	Disagree (3)
42. The MiDA intervention did not cover all that we were told it will cover.	[ ]	[ ]	[ ]
43. Knowledge and skills taught on agronomic practices were difficult to understand.	[ ]	[ ]	[ ]
44. Lessons on agronomic practices taught were difficult to undertake on the field.	[ ]	[ ]	[ ]
45. All the practices taught were not new to me.	[ ]	[ ]	[ ]
46. Inputs required for these new practices were not readily available and accessible.	[ ]	[ ]	[ ]
47. I cannot apply the practices taught on my own effectively.	[ ]	[ ]	[ ]
48. The training acquired did not help to increase my output per unit area.	[ ]	[ ]	[ ]
49. The starter pack given was not necessary in encouraging me to practice what I was taught during the training.	[ ]	[ ]	[ ]
50. The MiDA intervention did not enhance maize yield (output per unit area) of participants.	[ ]	[ ]	[ ]
51. The MiDA Intervention was not successfully implemented and I do not recommend that similar projects/ training be carried out.	[ ]	[ ]	[ ]

Challenges Faced By Participants

52. Did you encounter any challenges when implementing the practices taught by MiDA on your field?
    a. Yes [ ]
    b. No [ ]
53. If YES, please list three of the most important challenges starting with the most pressing one……
54. What do you think, in your opinion, did not go well with the implementation of the MiDA intervention? ……
55. What three things in order of importance, do you think, should be included in the project if it is to be implemented elsewhere? …….

<u>For non-participants only</u>

56. Did you know/hear of the MiDA intervention?
    a. Yes [ ]
    b. No [ ]

57. If YES, how did you get to know about the MiDA intervention?
    a. Announcement [ ]
    b. Friend [ ]
    c. Family [ ]
    d. Extension Agent [ ]
    e. Other (Please specify) ……
58. Why did you decide not to participate in the MiDA intervention? .....

Please tick the most appropriate response to the following statements

STATEMENTS (Part I)	Agree (3)	Neutral (2)	Disagree (1)
59. In totality, MiDA intervention has help increase the yields (output per unit area) of participants.	[ ]	[ ]	[ ]
60. I recommend that similar interventions be carried out often because they are helpful.	[ ]	[ ]	[ ]

STATEMENTS (Part II)	Agree (1)	Neutral (2)	Disagree (3)
61. In totality, MiDA intervention did not help increase the yields (output per unit area) of participants.	[ ]	[ ]	[ ]
62. I do not recommend the repetition of similar interventions to be carried out either here or elsewhere.	[ ]	[ ]	[ ]