UNIVERSITY OF CAPE COAST

SMALL SCALE FARMERS' PERCEPTIONS OF THE EFFECTIVENESS OF THE FERTILIZER SUBSIDY PROGRAMME IN THE SENE WEST AND SENE EAST DISTRICTS OF THE BRONG AHAFO REGION OF GHANA

BY

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DECLARATION

Candidates' Declaration

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

Candidate's Signature…….Date……

Name: Akansuge Alexis Nyaabah

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of theses laid down by the University of Cape Coast.

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ABSTRACT

While remaining the most important sector of Ghana's economy, agriculture in Ghana faces the challenge of making substantial progress in maintaining food security because average yields remain stagnant. This is attributable to limited use of modern inputs, such as fertilizer and improved seed, and due also to the rapid decline in Africa's soil fertility status. Since its inception in 2008, that is six years to date, Ghana's fertilizer subsidy programme has undergone a number of evaluations including those of IFPRI (2012), Yawson et al (2010) and Banful (2008). These evaluations however, fell short of the views and perceptions of the beneficiaries, including those of the study area of this research.

Consequently, this study was carried out employing a descriptive-survey approach in which data were collected from 140 beneficiaries using a proportionate stratified random sampling method in the Sene-West and Sene-East districts in the Brong Ahafo Region of Ghana. The results of the study revealed that the respondents rated the overall level of participation in the programme's decision making as 1.5 which is considered very low. Generally, the effectiveness was also considered low.

It is thus recommended that policy makers and programme organizers should as a matter of urgency make a time-bound commitment to the programme, think critically about the funding, rigorous estimation of quantities as well as distribution mechanisms backed by actionable maps with timelines.

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DEDICATION

To my lovely wife, Mrs Christina Akansuge, and my children

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LIST OF ABBREVIATIONS

AEAs	Agricultural Extension Agents
AGRA	Alliance for Green Revolution in Africa
AU	African Union
CAADP	Comprehensive African Agricultural Development Programme
CGIAR	Consultative Group for International Agricultural Research
CIA	Central Intelligence Agency
DADU	District Agricultural Development Unit
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
GFSP	Government Fertilizer Subsidy Programme
GSSP	Ghana Social Support Programme
HYVs	High Yielding Varieties
IFAD	International Fund for Agricultural Development
IFDC	International Centre for Fertilizer Development
IFPRI	International Food Policy Research Institute
Kg/ha	Kilogram per hectare
MOFA	Ministry of Food and Agriculture
NCR	Nutrient-crop ratio
NEPAD	New Partnership for African Development
NGOs	Non-Government Organizations
SAP	Structural Adjustment Programme
SPSS	Statistical Product and Service Solutions
SRID	Statistics Research and Information Directorate
SSA	Sub-Saharan Africa

UN	United Nations
US	United States
VCR	Value-cost ratio

CHAPTER ONE

INTRODUCTION

Background to the study

Agriculture is a key sector to many developed and developing countries worldwide as it provides employment for most of the rural population and contributes in no mean way towards income generation, Gross Domestic Product (GDP), foreign exchange earnings, and food needs for the ever increasing populations. Fertilizer subsidy programmes, though expensive, succeeded in raising input use by farmers and increasing agricultural productivity in many countries. There is ample evidence that increased use of fertilizer has been responsible for increase in agricultural productivity worldwide. Fertilizer was as important as seed in the green revolution, contributing to as much as fifty percent (50%) of yield growth in Asia (Hopper, 1993). In a background paper during the Fertilizer Summit in Abuja, Camara & Heinemann (2006) stated emphatically that no country in modern history has made great strides in agricultural production without first increasing the use of fertilizer through subsidies.

Several studies have found that one-third of the production of cereal worldwide is due to subsidized fertilizer and other related factors of production (Bumb, 1990). Van, Keulen & Breman (1990) stated that the only real cure against land hunger in the West Africa Sahel lay in increased productivity of the arable land through the use of inorganic fertilizers. Piere (1989), reporting on fertilizer research conducted in 1985 confirmed that inorganic fertilizer in combination with other agricultural intensification practices had tripled cotton yields from 310kg/ha to 970kg/ha in West Africa.

Well-planned fertilizer subsidies were the secrets behind the success of the Green Revolution which swept through Asia and Latin America in the 60s and 70s. For instance, whereas in 2002-2003, Sub-Saharan African farmers used on average 9 kg of fertilizers per ha of arable land, fertilizer subsidies enabled fertilizer use to reach as high as 100kg/ha in South Asia, 135kg/ha in Southeastern Asia, and 73kg/ha in Latin America (Crawford, Jayne, & Kelly, 2006). This resulted in the situation where agricultural production and productivity soared in Asia and Latin America during the last four decades, but stagnated in Africa, resulting in a rising dependency on imported grains and an increase in the number of undernourished people (Future Agricultures, 2010; Wiggins & Brooks, 2010).

In response to the need for higher fertilizer use in Africa, the Africa Fertilizer Summit was held in Abuja, Nigeria, in 2006, under the auspices of the African Union (AU), New Partnership for African Development (NEPAD) and the Government of Nigeria. One of the important outputs of that summit was the Abuja Declaration on Fertilizer for an African Green Revolution, in which AU member states resolved to increase timely access to fertilizer by farmers and to raise fertilizer use to an average of 50 kg/ha by 2015 (AU, 2006). As an immediate measure, the declaration proposed, among others, the elimination of taxes and tariffs on fertilizer and raw materials for manufacturing fertilizer.

The introduction of smart subsidy was one of the five main action points agreed upon to actuate the declaration. The purpose of the smart subsidy was to make fertilizer increasingly available to small-holder farmers in African Union (AU) member states. Significantly, the AU member states

pledged to invest 10 percent of their national budget in agriculture by the year 2008 (AU, 2006). The overall objective of the Africa Fertilizer Summit was to "improve access of millions of poor African farmers to fertilizer and other complementary inputs in order to help raise their farm production and achieve food security."

Passing a resolution calling for the development of Africa's fertilizer industry in support of the Comprehensive Africa Agriculture Development Programme (CAADP) at Food and Agricultural Organization (FAO's) 23rd Regional Conference for Africa in 2004 in Johannesburg, South Africa, African ministers of agriculture noted that fertilizer use in sub-Saharan Africa is only about 9 kg/ha, compared with 150 kg/ha in the "Green Revolution" countries of East and Southeast Asia. Consequently, the ministers recommended that the Secretariat of the New Partnership for Africa's Development (NEPAD) and International Centre for Fertilizer Development (IFDC) give top priority to the development of Africa's fertilizer industry to make fertilizers more widely available, and affordable, for smallholder farmers.

Agriculture is Ghana's most important economic sector, employing over 56 percent of its total labour force on a formal and informal basis and accounting for 25 percent of the country's Gross Domestic Product (GDP) (CIA World Fact book, 2014). The performance of Ghana's economy therefore depends to a very large extent on the performance of the agricultural sector. High agricultural productivity is therefore imperative in stimulating growth in other sectors of the economy.

Data from FAO STAT (2010) show that total production of maize and rice in Ghana increased substantially in 2008 and 2009, respectively by 21 percent and 10 percent (maize), and 58 percent and 30 percent (rice). These numbers should however not be taken as outcome estimates, as a wide variety of factors unrelated to fertilizer subsidies (e.g. weather) may have affected production. However, they may serve as an indication that a massive decline in output due to higher fertilizer prices has been avoided. To what extent these increase in yield may be attributed to the Government Fertilizer Subsidy Programme (GFSP) cannot be determined for now.

Despite the importance of agriculture to the overall economy, fertilizer use in Ghana is about 7.2 kilograms per hectare (kg/ha), similar to the average rate in South Saharan Africa (SSA), but significantly lower than in other developing countries. However, fertilizer use is generally profitable, with value-cost ratios of fertilizer use ranging from 2.7 for maize to 10 for irrigated rice (FAO, 2005).

Fertilizer subsidies have gained support worldwide as well as in the African sub- region including Ghana as a policy tool to foster a Green Revolution in Africa. The general goals of fertilizer subsidy programmes according to Kelly, Crawford & Ricker- Gilbert (2011), are often to reduce poverty and boost staple crop production among smallholder farmers.

Ghana's agriculture is dominated by small scale farmers with an average farm size of about1.5 ha and characterized by low use of improved technology (Chamberlin, 2007).Yields are therefore generally low with most crops at 60 percent of achievable yields (SRID-MOFA, September 2009), indicating that there is significant potential for improvement. A major

contributor to low yields is poor soil fertility resulting from nutrient depletion and low input use. Most of the Ghana's smallholder farmers are struggling to live and to feed their families on less than US$2 a day and so are unable to afford the high prices of commercial fertilizer which are not even available in required quantities and qualities.

According to the International Fund for Agricultural Development (IFAD) (2010), support for smallholders will be crucial for future food security. "In China, Africa and other parts of the developing world, the smallholder producers produce 80 percent of food that is consumed by 80 percent of the world's population," IFAD President, Kanayo Nwanze, told a China's Daily. The World Bank (2004) asserts that supporting smallholder farming is the most effective way of stimulating economic development and reducing poverty. This accounts for the reason why smallholder farmers constitute the target population for this study.

Assistance to agricultural production in the form of fertilizer subsidies which Ghana and many other African governments withdrew from in the 90s is gradually becoming a new policy direction within the last seven years. There is common agreement that increased use of fertilizer and other productivity-enhancing inputs is a precondition for rural productivity, growth and poverty reduction (Morris, Kelly, Kopicki, & Byrelee, 2007;Gollin, 2009a).

The impetus for the introduction of the renewed fertilizer subsidies which gingered the researcher into this study therefore emanated from a number of quarters.

These include Malawi's groundbreaking 2005 fertilizer subsidy programme, Resolution five of the Abuja Declaration on Fertilizers for an African Green Revolution which called for member countries to introduce targeted subsidies for resource-poor farmers as a key measure necessary to promote an African Green Revolution. However the immediate motivation for the coming into being of the renewed fertilizer subsidy in Ghana was the global food crisis of 2007-2008, which drove fertilizer and food prices to unprecedented heights.

Statement of the problem

Since its inception in 2008, Ghana's fertilizer subsidy programme has been evaluated by the International Fertilizer Development Centre (2012) and a joint evaluation by Marika, Krausova and Afua Banful Branoah (2010b) as well as by Yawson, Armah, Afrfa, & Dadzie (2010).These evaluations were, however, carried out by interviewing only commercial directors of fertilizer importing companies, the accountant in charge of managing the voucher programme, the stock keeper in charge of receiving and disbursing vouchers at Ministry of food and agriculture. Only seven Districts based on an opportunistic selection of districts that could be accessed from the main trunk road cutting across the country were considered for interview during the evaluation. Real beneficiaries of the fertilizer subsidy were left out in these evaluation exercises.

A substantial knowledge gap remains in the area of factors that affect fertilizer use and access to fertilizer under various subsidy programmes. According to Dorward (2009), the implications of the nature of fertilizer

subsidy across Africa have not been explored by many evaluations, and the case of Ghana was no different. Issues on design and implementation, economic efficiency and equity considerations have been less studied and results are less conclusive. The literature available only looks at the total quantities of fertilizers to be imported, total cost and sources of fertilizer without considering the perceptions of the small scale farmers, their views about the programme which are vital for ensuring timely availability of the preferred fertilizers at affordable prices. Rogers (1983) found out that the perceptions of beneficiaries about a programme are very important in the participation and sustainability of a programme. This therefore makes the perceptions of the beneficiaries very important to ascertain the success or failure of the fertilizer subsidy programme.

It is therefore important that beneficiaries' perceptions of the effectiveness of the subsidy in the study area about the design and implementation procedures be considered in the evaluation. Admittedly, these evaluations revealed that the fertilizer subsidy programme was very liberal with no government intervention in procurement, distribution, and retail, even though it must be acknowledged that the tendering process was not all inclusive, thus defeating the proposed Public- Private Partnership (PPP) system. From these evaluations, the programme also achieved some successes in increasing maize yields, using AEAs in the distribution of vouchers as well as ensuring the use of region-specific and fertilizer- specific coupons. The failure of earlier evaluations to take the views of beneficiaries into consideration as part of their evaluation therefore constitutes a wide gap which has to be filled, hence this research.

Objectives of the Study

The general objective of the study is to investigate the perceived effectiveness of the Government Fertilizer Subsidy Programme by small scale farmers in the Sene East and Sene West Districts of the Brong Ahafo Region of Ghana.

The specific objectives are to:

1. Examine the demographic characteristics of beneficiaries of the Fertilizer Subsidy Programme and their effect on the effectiveness of the FSP.
2. Compare the yields and production levels of maize before and after the introduction of the FSP.
3. Examine the level of participation and satisfaction of beneficiaries with the fertilizer subsidy programme.
4. Find out farmers' perceptions about the weaknesses and strengths of the programme and how the problems can be solved.
5. Compare the perceived effectiveness of the FSP between male and female beneficiaries as well as between beneficiaries from Sene-East and West Districts.
6. Determine the overall effectiveness of the FSP in terms of accessibility, availability, affordability, and use.

Research Questions

1. What are the demographic characteristics of the beneficiary farmers?

2. What is the perceived level of technical and economic skills and knowledge of farmers in the use of fertilizer?

3. How accessible, affordable, and available is fertilizer to beneficiary farmers in terms of the location and numbers of agent in the two Districts.

4. Is there any significant difference between the estimated crop yields of farmers before and after the subsidy?

5. Is there any significant difference between male and female farmers' perceived effectiveness of the fertilizer subsidy?

6. What are the problems and strengths of the fertilizer subsidy programme as perceived by the farmers?

Variables of the study

1. For the purpose of this study, two categories of variables were of interest to the researcher. The first one was the dependent variable which basically was the perceived effectiveness of the Fertilizer Subsidy Programme by way of making fertilizer available to small scale farmers. The independent variables consist of the various components/domains of the Fertilizer Subsidy Programme as follows:

2. Respondents' demographic characteristics such as age, sex, educational background, family sizes, farm sizes, farming experience, as well as access to markets.

3. Level of participation of farmers in vital decisions pertaining to the fertilizer subsidy programme.

4. Accessibility of subsidized fertilizer to farmers in terms of affordability, transaction costs, non-price factors as well as equity and fairness.

5. Availability of the product in terms of timeliness, quantity and type of fertilizer including information about availability.

6. The knowledge level of farmers about the use of fertilizer.

Hypotheses of the study

The following hypotheses were tested during the study at 0.05 alpha levels.

H_0: There is no significant difference between the yield of maize before and after the introduction of the fertilizer subsidy programme.

$H_{1:}$ There is a significant difference between the yield of maize before and after the introduction of the fertilizer subsidy programme.

$H_{0:}$ There is no significant difference between the perceptions of males and females on the effectiveness of the fertilizer subsidy programme.

$H_{1:}$ There is a significant difference between the perceptions of male and female farmers on the effectiveness of the fertilizer subsidy programme.

$H_{0:}$ There is no significant difference between the perceptions of farmers in the Sene- East and those of the Sene- West on the effectiveness of the fertilizer subsidy programme.

$H_{1:}$ There is a significant difference between the perceptions of farmers in the Sene-East District and those of the Sene-West District on the effectiveness of the fertilizer subsidy programme.

$H_{0:}$ There is no significant difference inthe level of satisfaction with the fertilizer subsidy programme between farmers in Sene-East and those of Sene-West.

$H_{1:}$ There is a significant difference between the level of satisfaction of farmers in Sene-East and those of Sene-West on the effectiveness of the fertilizer subsidy programme.

Delimitations of the study

The researcher restricted the study to small scale farmers who have benefited from the fertilizer subsidy since its inception in 2008. Only issues about affordability, accessibility, availability and efficient use of fertilizer were handled in the research, leaving out impact on farmers since the programme was still in its maiden years. The scope of the research is limited to the Sene East and Sene West Districts.

Justification of the Study

This research will add value to existing research by investigating the perceptions of beneficiaries about the nature of the subsidy programme and its implication on the availability, accessibility and affordability of subsidized fertilizer. Consequently, the findings of this research will be used as a reference point and provide guidance for future programme designers and implementers to come out with more pragmatic fertilizer subsidy programmes Since the study delves into the strengths and weaknesses of the fertilizer subsidy programme, the results could be used to reinforce the strengths for sustainability as well as taking corrective measures to address the weaknesses and/or shortfalls of the current fertilizer subsidy programme in the study area. Also by pointing out the strengths and weaknesses of the Fertilizer Subsidy Programme, the findings of the study could provide guidance to future fertilizer subsidy programmes or any other agricultural related programmes implemented along the line of enhancing the effectiveness of agricultural technology delivery.

Another benefit of the study will be in the provision of information on the current state of knowledge and use of fertilizers under the subsidy

programme. Such information will be useful for policy makers, researchers, and Agricultural Extension Agents (AEAs) to come out with more appropriate plans for dealing with identifiable issues which are area and farmer specific.

The outcome of this study with respect to the effectiveness of the various domains of the fertilizer subsidy programme would therefore serve as a guide for Government and policy makers to make decisions on which of the domains to lay emphasis on in the light of scarce resources. Furthermore, the findings of the study will serve as a guide for other stakeholders such as NGOs, banks and other private business people who are into or would wish to go into fertilizer distribution as a business.

Limitations of the study

This study faced a number of challenges especially access to government documents and other reports and publications concerning the fertilizer subsidy programme. For example, list of beneficiary farmers from government, Ministry of Food and Agriculture (MOFA) and other stakeholders like Distributors, Agents as well as importers were not readily available.

Other limitations of this study included limited access to sufficient data from farmers, considering their inability to keep accurate records. Most of farmers' records were from memories which were not comprehensive enough.

Definitions of key terms

This section of the study will be devoted to highlighting the operational definitions of key terms and concepts used in the study which

might have meanings other than are used in this research. These are terms with unique meaning or more than one meaning and if not operationalized in the context of the study can become ambiguous.

Effectiveness: Effectiveness in this study is defined as the degree to which the fertilizer subsidy programme is able to meet the expected goals of increasing fertilizer usage to bring about an improvement in production levels as perceived or observed by beneficiary farmers. This is only measured by estimating the extent to which the design and implementation ensures that the issues of affordability, accessibility and all year availability of subsidized fertilizer are ascertained.

Perceptions: Perceptions, opinions and attitudes have been used interchangeably. In this study is used to mean farmers views on, or assessments of the FSP.

Small scale farmers: Various organizations and individuals have given different meanings as to whom small scale farmers really are. In the context of this study small scale farmers are those who cultivate 5 or less acres. Such farmers are most of the time cash trapped and so not able to afford basic farm inputs like fertilizer and improved seed.

Safety nets: These are non-contributory transfers of aid to the poor or those who are vulnerable to shocks and poverty to prevent them from falling below a certain poverty level. Safety net programmes can be provided by the public sector, that is the state, and aid donors or by the private sector like Non-Governmental Organizations (NGOs), private firms, charities, and informal household transfers.

Smart subsidy: In this study smart subsidy is used to mean a subsidy with clear and straightforward objectives, which empowers key stakeholders to participate in a programme, has an exit strategy, and contributes to the development of a competitive open market.

Agricultural inputs: In this study, agricultural inputs denote a common term for a range of materials, which may be used to enhance agricultural productivity. Most important among these are fertilizers, improved seeds as well as extension services.

Type one fertilizer dealers: These are fertilizer dealers who have contract with only a single importer.

Type two fertilizer dealers: This category of dealers have transactions with multiple importers.

Type 3 fertilizer dealers: These are fertilizer retailers who have no contract with fertilizer importers.

Type 4 fertilizer dealers: Small "table-top" retailers who repackage and sell fertilizer sourced from larger retailers.

Crowding-out: A phenomenon of subsidized fertilizer directly displacing the purchasing of fertilizer from the private sector.

Crowding-in: This is when the introduction of a fertilizer subsidy enhances the participation of the private sector in the distribution of fertilizer

CHAPTER TWO

REVIEW OF RELATED LITERATURE

General Overview

The literature review tries to bring together exiting theories and empirical studies that provide the background and basis for this study. The chapter therefore makes an attempt to review relevant works done on various aspects of fertilizer subsidy programmes with particular emphasis on the effectiveness of the fertilizer subsidy programmes. Furthermore, the literature reviews the perceptions, demographic and farm related characteristics of beneficiaries of the various programmes under review.

Fertilizer subsidy is commonly understood to mean direct budgetary support payments made by government to lower the farm gate prices of fertilizers. They are sometimes justifiable as a way to guard against market failures, which can occur when the full cost and benefits of traded goods and services are not reflected in market prices.

Types of subsidies

Subsidies may be provided directly, in the form of cash payments, or they may take the form of indirect support. Subsidies are a feature of many government budgets, and a topic of hot debate in some regions of the world. Subsidies could either be positive or negative. In the case of a positive subsidy, a farmer is rewarded for growing a crop, with the money usually being based on the amount of crop being grown or the amount of the harvest. With negative subsidies, farmers are encouraged not to produce a particular crop or product.

The U.S. government used some strategies to initiate efforts to control the agricultural economy by way of subsidies during the Great Depression of the late 1920s and early 1930s. During this period, farm prices collapsed, and farmers became increasingly desperate in attempts to salvage their livelihood, sometimes staging violent protests.

The use of agricultural inputs is fundamental in modern agriculture in developed countries, and they were a primary ingredient in the green revolution that swept through Asia and Latin America during the ‘60s and ‘70s. However, the green revolution largely by-passed Sub-Saharan Africa, and the use of agricultural inputs remains very low. In 2002-2003 Sub-Saharan African farmers used on average 9 kg of fertilizers per ha of arable land compared to 100 kg per ha in South Asia, 135 in South-East Asia and 73 in Latin America (Crawford et al., 2006). While agricultural production and productivity soared in Asia and Latin America during the last four decades, they have largely stagnated in Africa, resulting in a rising dependency on imported grains and an increase in the number of undernourished people (Future Agricultures, 2010; Wiggins & Brooks, 2010).

Reasons in favour of Fertilizer Subsidies

Proponents of agriculture subsidies point to several reasons why subsidies are necessary. They claim that the country's food supply is too critical to the nation's well-being to be governed by uncontrolled market forces. They also contend that in order to keep a steady food supply, farmers' incomes must be somewhat stable, or many farms would go out of business

during difficult economic times, hence the need for a subsidy in the agricultural sector.

The main proponents of the arguments in favour of fertilizer subsidies are many including Debrah (2000), Donovan (2004), Ellis (1992), IFDC (2003) Pender, Nkonya, & Rosegrant (2004), and Yanggen, Kelly, Reardon, Naseem, Lundberg, Maredia, Stepanek & Wanzala (1998). However, their discussions on the objectives of fertilizer subsidies were non-technical in nature until Shalit & Binswanger (1984) came out with thorough technical arguments in favor of fertilizer subsidies which they categories into financial, economic and non-economic factors.

Financial arguments in favour of fertilizer subsidies

Financial arguments include the use of fertilizer to expand total production leading to increasing the net income of farmers (Dalrymple, 1975; Ellis, 1992) as well as offsetting high fertilizer prices caused by high transport costs and limited market development Pender et al.(2004). Fertilizer subsidies also help maintain fertilizer use where fertilizer prices have increased without a corresponding increase in the prices of output (Dalrymple, 1975), or when output prices have been held down to benefit urban dwellers. The IFDC (2003) argues that fertilizer subsidies reduce the credit needs of farmers who are unable to use fertilizer due to the limited availability and high cost of credit. Fertilizer subsidies have also been used to stimulate the production of fertilizer (Debrah, 2002; IFDC, 2003).

Fertilizer subsidies stimulate domestic fertilizer production which goes a long way to ensure adequate and timely supply, save foreign exchange and

promote economic development. Segura, Shetty, & Nishimizu (1986) confirmed that subsidies have been used in the production of fertilizers in India, Bangladesh, Indonesia, Mexico, Egypt, China, Morocco, and Pakistan. The fact that fertilizer subsidies, according to (Dalrymple, 1975; Ellis, 1992) and Pender et al.(2004) lead to increased production and reduced credit needs of farmers corroborates the modernization and diffusion of innovations theories. However these purported arguments are only tenable if fertilizer subsidies are designed to take care of availability, accessibility, use and credit availability.

To compensate for low output prices which, to a large extent are due to explicit and /or implicit taxes Debrah & Breman (2002) found out that maintaining a reasonable ratio between fertilizer cost and output price is very essential and is measured as either value/cost ratio (VCR) or the nutrient-crop price ratio (NCR). Fertilizer subsidies are also known to shield farmers and other consumers from the full impact of the inherent volatility of international commodity prices.

Economic arguments in favour of fertilizer subsidies

Economic arguments basically deal with the profitability of the fertilizer subsidy programme to the beneficiaries. Fertilizer subsidies will enhance farmer adoption and use of fertilizers at optimal levels when these are hindered by lack of knowledge, risk aversion and financial constraints. According to Ellis (1992), fertilizer subsidies designed to overcome lack of knowledge and weak or missing formal financial markets risk aversion constraints are supposed to be temporary and removed once farmers have had the experience with fertilizers

Fertilizer subsidies offset policy- induced market distortions that either increase fertilizer price or reduce output prices. Pender et al. (2004) cited taxes on imports/exports or other implicit or explicit taxes on agriculture and subsidies on developed countries' agriculture that often result in unfair competition.

Fertilizer subsidies also safeguard against transaction costs and risks associated with institutional weakness and market failures that otherwise put farmers in an "under-developed" trap (Dorward, Andrew, Shenggen Fan, Jonathan Kydd, Hans Lofgreen, Jamie Morrison, Colin Poulton, Neethat Rao, Laurence Smith, Hardwick Tchale, & Sukhadeo Thorat, 2004). Fertilizer subsidies therefore shield farmers and other consumers from the high risks associated with volatile world market prices.

Donovan(2004) &Gladwin(2002) identified that fertilizer subsidies are also used as a means of counteracting the social cost of soil fertility depletion such as loss of carbon to the atmosphere which contributes to global warming and increased soil erosion that reduces the quality of downstream water supplies.

Other factors mentioned in support of fertilizer subsidies by Donova (2004) and Gladwin (2002) include deforestation and loss of biodiversity from acreage expansion the consequent reduction in national food security.

Non-economic arguments in favour of fertilizer subsidies

There are also some non-economic/welfare reasons advanced in favor of fertilizer subsidy programmes. These have been promoted for reasons that are basically non- economic, such as reducing poverty or providing a safety net for extremely poor and vulnerable populations. In order to achieve non-

economic objectives of fertilizer subsidies, it is necessary to ensure that effective targeting is done.

Arguments against Fertilizer Subsidies

Fertilizer subsidies, though lauded so much by some authors, have come under attack by another group of writers. To begin with, a Senior Research Fellow with the International Food Policy Research Institute (IFPRI), Ephraim Nkonya, stated emphatically that increasing fertilizer subsidies is not going to solve Africa's food problems and that they may in fact aggravate them. He points out that 35 percent of Zambia's agricultural budget goes to fertilizer subsidy. Nkonya, a Tanzanian, says the problem is that the subsidies often end up in the hands of the "rich" and "well-connected" rather than poor farmers. He further emphasized that getting fertilizer to the right people is only a small part of the puzzle. He recommends using organic soil fertility management by adding manure to the soil and alternating corn crops with beans, which fix nitrogen from the atmosphere and make it available to crops. These practices, he says, "are quite environmentally friendly and at the same time increase yield."

On the other hand, even though organic matter from manure and crop residues has an essential role to play in increasing land productivity, it cannot provide the amount of nutrients (N, P, and K) needed to maintain even current low levels of production (Kelly, Crawford, & Ricker-Gilbert, 1998; Yanggen, et al., 1998).

Fertilizer subsidies are also said to take considerable share of the national budgets of countries that have introduced fertilizer subsidies for its

farmers. Apart from high administrative expenses, they tend to have extremely high fiscal costs in terms of procurement and distribution, thus making them financially unsustainable, especially as market sizes increase. For instance in Ghana, though our fertilizer consumption is one of the lowest, the fertilizer subsidy programme took as much as three and half percent of the national budget in 1980 and the figure even rose to 10.6 percent in 1988 (Donovan,1996). In Zambia, government committed as much as 40 percent of the agriculture budget to fertilizer subsidy.

The International Fertilizer Development Centre (IFDC) (2003), and Jayne Govereh, Wanzala, & Demeke (2003) made a critical observation that fertilizer subsidies usually have the tendency of crowding out or suppressing the private sector from participating in the fertilizer importation and distribution. The uncertainty and instability created by the subsidy interventions even in the face of below-market fertilizer price can reduce rather than promote farmer's overall access to fertilizer. In Ghana for instance, Banful (2008) observed from field interviews that in most of the districts visited, the widely held view of the farmers was that it was illegal to sell or buy fertilizer without coupons thus crowding out the private sector dealers.

Fertilizer subsidies also promote leakages of subsidized fertilizers across national borders. This is because since fertilizer is an easily marketable commodity, low cost subsidized fertilizers are often exported illegally for resale in neighboring countries where fertilizer prices are comparatively higher. Banful (2010) found out that political influence affected the way the 2008 subsidized fertilizer was distributed in Ghana.

Late fertilizer delivery and inefficiency at field level are often cited as serious problems with fertilizer subsidies. In the central region of Ghana, Yawson et al. (2010) observed that farmers who used subsidized fertilizer in 2008 and 2009 did not realise any significant yield due to late arrival and application. In situations where public agencies are responsible for fertilizer distribution, and especially in cases where financial constraints delay the disbursement of subsidies, procurement is often delayed with the result that subsidized fertilizer reach farmers well after the optimal fertilization period. With regards to inefficiency at field level, when direct fertilizer subsidies that lower the price paid by farmers persist for a long time, the tendency is inefficient use of fertilizer. This could take the form of substituting crops towards those that respond best to the subsidized fertilizer. Ellis (1992) also observed that there was a diversion of subsidized fertilizer from the targeted crop to other crops of farmers' choice. Ellis (1992) cited atypical West African example in which fertilizer meant for cotton was diverted and used on maize farms.

Most of the fertilizer subsidy interventions in Sub-Saharan Africa including Ghana have been accused of lack/minimum complementary interventions like credit, improved seed and market for increased yield. This situation was what prompted Banful (2008) to describe the fertilizer subsidy as 'a single-pronged approach to a problem with many facets'. The researcher went further and suggested that sticking points for farmers include costs of purchasing responsive seeds, labor costs of applying fertilizer, maintaining the farm and harvesting, inadequate storage facilities for output, and unfavorable prices for output. Direct fertilizer subsidies may have limited impact when

implemented as a “stand alone” measure. The attainment of any fertilizer subsidy promotion policy objective depends to a very large extent on several other factors within the enabling environment that together affect the incentives of the policy. Since these complementary factors are needed to achieve the policy objectives, a narrow focus on using direct subsidies to reduce the price of fertilizer paid by farmers may have little impact.

Fertilizer subsidies have more often than not led to the creation of vested political interest by holders of political power. Fertilizer subsidies are supposed to be introduced as a temporary measure either to foster farmer learning or to protect an emerging fertilizer industry. However, once they are in place, they are difficult to eliminate because of entrenched political interest (Gulati, & Narayanan 2003; Donovan, 2004). Buttressing this point, Druilhe & Barreiro-Hurle (2009) said it has been established that fertilizer subsidies have become unavoidable in the agricultural policy portfolio, and that they have become a widely used policy instrument to which governments devote very large shares of their national budgets and this makes them de facto central to supporting national agricultural and food security strategies. With these political motives in mind, politicians tend to neglect the principles of efficiency, equity, and sustainability which are fundamental to ensuring an effective fertilizer subsidy Dorward & Chirwa (2011).

The nature of the early fertilizer subsidy regimes

Crawford et al. (2006) state that fertilizer subsidies differ in terms of how they are organized as well as the point at which they are applied. A subsidy could either be to the farmer, the trader or the domestic fertilizer producer. Another way would be the form of the subsidy, or how it

is provided. It can be through a cash payment, voucher/coupon, reduced market price or transport subsidy. The premier fertilizer programmes took the form of large scale "universal" subsidy programmes from the 1960's up through the 1980's (Dorward, 2009). These programmes were characterized by a government-controlled input and output marketing system, in which farmers were supplied with agricultural inputs at controlled and subsidized prices, and often on heavily subsidized credit.

During the early days of fertilizer subsidies in Africa South of the Sahara, several types of fertilizer promotion programmes existed that have been tried previously, each of which has its pros and cons Gregory & Bumb (2006).Such fertilizer structures were characterized by a lot of complexities worldwide. The structure therefore varied from one country to another depending on the immediate cause that necessitated the coming into being of the particular subsidy. Gregory & Bumb (2006) identified through various IFDC market studies, six different supply chain systems in South Saharan Africa. These systems were not exclusive, however, and while in some countries there may be only one such system in operation, in a majority of countries, a number of different systems exist in tandem.

Six fertilizer distribution systems identified by Gregory & Bumb (2006) include domestic production, imported supply, imported integrated supply, farmer groups, cooperatives, and government agencies. The domestic production and imported supply systems are handled by competitive and mature companies which may differ in functions and retail network. These are however not many in Sub Saharan Africa. The imported integrated system is common with the export cash crop sectors such as cocoa in Ghana, cotton in

West Africa and Mozambique, tea and coffee in Kenya and Tanzania. These companies procure fertilizer, supply these under seasonal crop credit conditions and buy back the product for processing and marketing. The farmer groups and cooperative systems are common where NGOs undertake various programmes in underdeveloped market systems. Beneficiaries are usually chosen either for reasons of improving food security or for increasing the production of a crop of national interest. The last distribution system considered by Gregory & Bumb (2006) is government agencies which are fast disappearing. With this system, Government agencies take the sole responsibility for the supply of fertility.

Universal Fertilizer Subsidies

Generally there are two broad categories of fertilizer subsidies that are practiced in both developed and developing countries. These are the Universal subsidies and the Smart subsidies which are sometimes called market-friendly fertilizer subsidies. Many African countries, including Kenya, Tanzania, Malawi, Zimbabwe and Zambia pursued large scale "universal" subsidy programmes from the 1960's up through the 1980's (Dorward, 2009). However, they were extremely expensive, tended to benefit relatively well-off and better connected farmers, and the advances in agricultural productivity were dependent on continued government support.

Furthermore, the universal fertilizer subsidy programmes were prone to inefficiencies arising from high administrative costs, government monopolies and political manipulation (Banful, 2010b). As the subsidy programmes were dismantled and input markets liberalized as part of the

Structural Adjustment Programme in the 1980's and 1990's, input use and agricultural productivity declined (Crawford et al., 2006). Fertilizer subsidies were applied broadly to reduce the fertilizer market price without attempting to target fertilizer subsidies to specific groups, and subsidies intended to be for the poor were often captured by larger farmers.

According to Kherallah, Delgado, Gabre-Madhin, Minot & Johnson (2002:34–39), the pre-reform period in the 1970s and early 1980s was characterized by five types of fertilizer policy or programme interventions. First was government-controlled imports and distribution, usually through state enterprises. State monopolies existed in 30 of 39 countries surveyed by FAO in the mid-1980s (FAO 1986). The second type was the imposition of price controls and subsidies on the retail price of fertilizer, partly in response to increased fertilizer prices following the oil price shock of the mid-1970s. Explicit subsidies ranged from ten percent to eighty percent of full cost.

Provision of credit to farmers for fertilizer purchase, with repayment often required through state marketing agencies was another type. Fertilizer was provided as aid-in-kind by donors, often making up all or a substantial part of fertilizer imports. Finally incentives were given for fertilizer use stemming from exchange rate and trade policy. Overvalued local currencies provided an implicit subsidy for fertilizer imports, which were also sometimes given preference in allocating scarce foreign exchange.

Literature on why and how to promote fertilizer use in Africa reflects different perspectives on the objectives being sought through the use of agricultural policy instruments, and different assessments of their impact, costs and returns. Assumptions underlying a given argument or analysis are

sometimes unstated. Dorward (2009) argues that there is the need to rethink the way input subsidy programmes are designed as the impact of subsidy will vary depending on the type or nature of the subsidy and the level at which it is applied. This suggests that there were no well- planned exit strategies for the fertilizer subsidy programmes that were implemented in most cases, and the programmes only remained in so long as government continued to support them.

Fertilizer Subsidy Programme Reforms

The primary role of input subsidies in agricultural development should be to promote adoption of new technologies and accelerate agricultural production (Ellis, 1992). Despite the failure of past fertilizer subsidy programmes, many agricultural experts still view fertilizer subsidies as a viable means of restoring soil fertility to help ensure food security and eliminate malnutrition and poverty in Sub-Saharan Africa (Denning, Kabambe, Sanchez, Malik, Flor, Harawa, Nkhoma, Zamba, Banda, Magombo, Keating, Wangila & Sachs, 2009;Morris et al., 2007).

After a period of liberalized input markets by the end of the last century, new subsidy programmes began to emerge in several African countries. The Malawian government pioneered the return to fertilizer subsidies in 1998 when it started distributing free fertilizer after having discontinued similar programmes in the early 1990s. It was followed by Nigeria (1999), Zambia (2000), the United Republic of Tanzania (2002), Kenya (2006), and Ghana (2008) in that order.

After the 2008 food and fertilizer prices crisis, fertilizer subsidies have become all the more popular as governments have felt the urge to quickly improve domestic food production. This was made possible because governments were now able to use direct budget support from donors who were previously reluctant to support such expenditure (Kelly et al., 2011). More importantly, they also remain an attractive policy option for national governments because they are visible and popular with voters.

Smart Fertilizer Subsidies

The revival of fertilizer subsidies came along with innovations in design seeking to avoid the downsides of past programmes which were characterized by high costs, poor targeting and displacement of the private sector. According to Minde, Jayne, Cawford, Ariga & Govereh (2008) &Tiba (2009), smart fertilizer subsidies are meant to address the shortfalls of universal subsidies. The new form of fertilizer subsidy that replaced the universal subsidy was termed "smart" or targeted subsidies directed at specific farmers/crops. They also aim at supporting private sector distribution and market-friendly solutions, generally with an associated poverty reduction and welfare enhancement motive. They frequently use vouchers (or coupons) to entitle beneficiaries to the subsidized fertilizer.

Minde & Ndlovu (2007b) describe smart subsidies as those involving specific targeting to farmers who would not otherwise have used purchased fertilizer, measurable impacts, achievable goals, results orientation, and timely duration of implementation, i.e. being time-bound or having a feasible exit strategy. Smart subsidy programmes are meant to address the shortcomings of

the universal subsidies. To be “smart”, subsidy programmes should adhere to a number of design principles, as presented by Minde et al. (2008) and Tiba (2009) as outlined below.

Smart subsidies should be targeted specifically at farmers, who do not already apply agricultural inputs, as well as the poorest and most vulnerable households. This reduces the risks of displacing commercial (non-subsidized) input sales and promotes pro-poor growth. Smart subsidy programmes should utilize and support the further development of existing private input supply networks, rather than crowding them out with state-controlled distribution systems. This enhances the efficiency of input delivery as well as increases the likelihood that the programme has a sustained impact after its termination. Smart subsidy programmes should devise credible exit strategies to put a time limit on the support. This is primarily to reduce the risks that the programme becomes “hijacked” by political interests and to facilitate long term sustainability (Dorward, 2009).

These three characteristics are largely complementary. If subsidies are well targeted, the greater demand for inputs is likely to encourage potential entrepreneurs to establish new businesses, which promotes the development of a competitive input market. Similarly, the more efficient the targeting is and input delivery system, the more effective and credible the exit strategy will be. Smart fertilizer subsidies brought about a change in implementation, basically, by way of the introduction of vouchers in all targeted subsidy schemes with the exception of Zambia in the sub-region.

Smart Fertilizer Subsidies from the perspective of economic principles

Efficiency

The characterization of smart subsidies outlined in the preceding paragraphs presupposes that the concept of smart subsidies is based on the economic principles of efficiency, equity, and sustainability**.** On the issue of efficiency, Crawford et al (2006) assert that strong evidence suggests that fertilizer subsidies raise productivity to appreciable levels and are therefore considered to be sustaining intensive agriculture in the long term without depleting soil fertility. The two possible answers are first, because of some barriers which economists term market failures which prevent farmers from realizing the full potential of subsidized fertilizers, and second, the excessively high economic costs of delivering subsidized fertilizers to farmers which are not profitable enough. Banful (2010b) observed that fifty percent of market fertilizer price across Sub-Saharan Africa are as a result of transaction costs compared with twenty percent in Thailand.

In the case where the first answer is correct, fertilizer subsidies may be efficient in so far as they help farmers overcome market distortions associated with market failures. On the other hand, if the second answer is correct, then fertilizer subsidies are inefficient. This because such subsidies merely encourage the adoption of inputs, which are more costly to procure than the benefits they provide.

In cases of low farmer density, the potential demand for expensive agricultural inputs may be so low that agro-dealers will find it hard to cover the costs of setting up a shop. Coupled with relatively low agricultural productivity, the investment could simply be unprofitable, demand for

fertilizer may not exist, and suppliers will be unwilling to offer access to fertilizer. In such a case, fertilizer subsidies could boost demand and encourage fertilizer suppliers to expand their presence to remote areas. However, the subsidies would be inefficient. Some of the costs of supply would shift from farmers to the state, but the costs would still outweigh the economic benefits.

The first possible answer to why agricultural input adoption in SSA is so low suggests that market failures exist to distort input markets and discourage farmers from using agricultural inputs. Example of market failures most frequently cited in the literature according to Dorward (2009) are credit constraints, imperfect competition and risk of crop failure.

During fertilizer subsidies, when farmers are unable to obtain the necessary funding (or if credit costs are too high), they may not be able to make an otherwise profitable investment in agricultural inputs. This is what Dorward (2009) refers to as the affordability problem. This is very important because fertilizer subsidies are often targeted at the poor and vulnerable farmers. A subsidy reduces the funding needs, but may not necessarily resolve the distortion completely, as farmers still have to cover the subsidized prices.

Imperfect competition during fertilizer subsidies tend to lead to higher prices in order to capture greater profits or to cover more inefficient business practices. According to Dorward & Chirwa (2011), the increase in fertilizer prices in Malawi was due to imperfect competition which was a result of expanding the fertilizer subsidy to tea and coffee crops. Holden & Lunduka (2010 p. 16) also noted politically motivated rent seeking behaviours associated with Malawi's fertilizer subsidy including a paramount chief being

caught selling coupons and therefore put in prison until the president himself reacted quickly to get him released. This may result in farmers not being able to afford investments, which would be profitable with a more competitive market. In this case, an input subsidy can have both positive and negative consequences. It may increase aggregate demand, attract new entrants to the market and increase competition. However, if this does not happen, for instance if the demand impact is too weak or if the subsidies are implemented in a way that favors incumbents, the subsidy may largely benefit the imperfectly competitive firms.

Investing in agricultural inputs is a risky business, particularly since many hybrid seeds and fertilizers require a reasonably well timed application and stable water supply. A season of prolonged drought can largely wipe out the entire investment and generate significant losses. Particularly the poorest smallholders are very vulnerable to poor harvests may not be able to absorb the costs of a failed investment. Rather than risk losing everything, they may choose not to apply agricultural inputs, settling for a smaller but more stable surplus. Agricultural input subsidies increase the expected benefits of the investment and reduce the costs of a failed investment (Dorward, 2009).

The implication of these earlier discussions is that fertilizer subsidies may be efficient if they overcome the distortions associated with market failures and inefficient if they do not. The difficulty of measuring market distortions makes the extent to which these distortions affect the efficiency of fertilizer subsidies virtually unavailable. For instance the general high fertilizer prices in 2008 may be taken to mean that fertilizer use was inefficient for many farmers and should be discontinued. In any case an abrupt reduction

in the demand for fertilizer could have serious ramifications on the input market by driving vulnerable suppliers out of business, which could over time exacerbate problems of imperfectly competitive markets and limited access to inputs in some areas.

Another contentious issue relates to the poor state of development of the private fertilizer markets in many Sub-Saharan African countries. Proponents of smart fertilizer subsidies like Minde et al. (2008) and Tiba (2009) laid emphasis on employing a market-oriented approach to ensure efficient delivery of the subsidized fertilizers to farmers. However, the absence of private fertilizer suppliers especially in the rural areas because of excessively high marketing costs and small costumer base may be problematic. Programme designers therefore remain in a state of dilemma as to whether to pursue a market oriented approach or to establish a state-managed supply system.

Taking these challenges into consideration, the study will delve into the likely effects of market distortions on fertilizer subsidies. The study will also examine equity, efficiency and sustainability issues, outline possible trade-offs, and identify areas where more critical information is needed for a clearer programme design and implementation strategies.

Equity

Generally agricultural inputs subsidies are expected to ensure equality since they serve as an income transfer to the poor smallholders when well-targeted. Fertilizers subsidies are no exception. Bumb, Teboh, Mariko, & Thiam (1994) argued that politicians consider equity and food security as prerogatives of government and so regard fertilizer strategy as a move to

meting equity and food security objectives. As a result promoting the widespread use of fertilizer is synonymous to promoting equity and food security. It is however not even certain whether such redistributive objectives are compatible with the efficiency criteria on two counts, one, the poorest smallholders are most likely the ones that are most constrained by market failures, such as credit constraints and vulnerability to the risks of crop failures and two, poor subsistence farmers may lack complementary resources, such as skills, scale of operation, productive assets, or the financial resources to pay even the subsidized prices, to make effective use of the subsidized inputs.

From the analysis on equity and efficiency it is clear that whether a particular subsidy is meant to ensure equity or efficiency depends on the objective of the subsidy that is, whether it is to achieve pro-poor growth or increasing national self-sufficiency in food production. At any point in time, there has to be a trade-off between equity and efficiency. This therefore calls for the development of very specific and unambiguous objectives. Ghana's fertilizer subsidy programme was a victim of this lack of clear-cut object because it was hurriedly implemented in an attempt to remedy the 2007 price hikes in fertilizers food and oil which was global in nature (Banful, 2008).

Sustainability

Fertilizer subsidies are said to be sustainable if they can be maintained over a long period without impacting negatively on the public purse, or if the outcomes in terms of wider participation in the fertilizer usage and improved agricultural productivity persist after their termination. Failure of the universal subsidies to satisfy these two conditions was what accounted for their

ineffectiveness. However, according to Banful (2010), because of the political economy surrounding the fertilizer subsidy, various stakeholders especially the politicians had vested interest in the continuation and expansion of fertilizer subsidies to the detriment of efficiency and sustainability. This was particularly the case when fertilizer subsidies were rationed and targeted at specific groups which enabled the people controlling how subsidies are targeted to exploit the situation for their personal or political gain, hence rent seeking. The politics of fertilizer subsidization therefore carry a risk that the programme gains a life of its own, grows more inefficient and less equitable, and eventually becomes unsustainable.

To overcome the shortcomings outlined in the earlier fertilizer subsidy programme, fertilizer subsidies must be temporary measures designed with clear exit strategies detailing the termination of the programmes. In fact, a sustainable smart subsidy programme seeks to effect a permanent impact by a short term boost or to "kick-start" the market for agricultural subsidies. This can only be done by alleviating the market failures characterizing the input markets directly or by raising the productive capacity of poor smallholders to a sufficiently high level that the market failures are no longer constraining them.

Clearly, if the subsidy programme succeeds in permanently developing a more competitive private input supply, the lower prices will make inputs more widely accessible to smallholders. Similarly, if the programme helps smallholders accumulate productive and financial assets from a few years of surplus harvests, the farmers may be able to finance full-priced fertilizers from their own savings after programme termination. In fact, Dorward (2009) argues that political economy difficulties are particularly problematic in poor

rural societies for two reasons. The first reason is that the potential personal and political gains from subsidy rents are very large relative to other income opportunities, so incentives for political manipulation are strong. The second reason being that fiscal resources are very scarce and costly to collect, so the adverse consequences of wasteful policies can be great.

Gender dimensions in Fertilizer Subsidies

In Ghana, the issue of gender inequality is a challenge to many development organizations that aim to ensure food security and improve living conditions in rural communities. Despite the fact that it is widely accepted that women contribute about fifty percent of the country's food, the majority of them are excluded from decision-making processes and access to vital agricultural inputs such as subsidized fertilizers (Duncan, 2004).

Access to and use of subsidized fertilizer tends to have gender dimensions, reflecting elements of traditional gender roles in agriculture. Giving an account of the nature of Nigeria's fertilizer subsidy, Eboh, Ujah & Amaechina (2006) noted that while women constitute over sixty percent of the agricultural producers in the country, they have less than commensurate access to productive resources and inputs, including fertilizer. In the view of Mbilinyi (2006; p. 6) there has been a male bias in terms of access to and control over key productive assets such as fertilizers. This male bias has been a barrier to improvement in small scale agriculture, given that women represent more than half of the agricultural labor force in many countries including Ghana. Banful (2009) cited the unequal access of women to fertilizer under the fertilizer subsidy programme as a limitation to the effectiveness of the programme since

women farmers form the majority of the small scale farmers who are the main target of the fertilizer subsidy in Ghana and elsewhere.

Fertilizer Subsidy Vouchers

Vouchers, also called coupons, are generally considered as certificates which are designed in the form of cheque book-sized leaflets contained in booklets. Vouchers entitle individual beneficiaries to a price discount that is equivalent to the face value of the voucher (Banful, 2009). The face value of the voucher is the amount of the subsidy to be paid by government after the beneficiary has made the down payment of the matching amount. Farmers redeem the value of the vouchers for inputs at local, often small scale, private input suppliers. The beneficiaries are then empowered to purchase specific quantities of fertilizer from qualified agents/distributors who have duly registered and will accept vouchers. The agents and distributors in turn redeem the vouchers for cash payment from government (Yawson et al., 2010). Thus, the vouchers represent a transfer of funds from government to beneficiary farmers. Vouchers have the additional advantage of bringing greater flexibility in the implementation of the subsidy and transparent tracking of delivery and use.

However, the difficulty in redeeming vouchers coupled with the delay on the part of government to pay the subsidized portion to the importers for transaction to go on smoothly made the voucher system a bit problematic. In addition, the voucher system was difficult to handle because of counterfeiting, the cumbersome and bureaucratic administration of vouchers, and the fact that

beneficiaries had the task of identifying the AEAs and for that matter the operational areas to which they belong.

Fertilizer subsidy vouchers have several challenges when used in the operationalization of fertilizer subsidies. First, they involve high financial and administrative cost in the production and/or importation, allocation and distribution and finally reimbursement of suppliers. Second, fraud of various kinds including counterfeiting and the creation of secondary markets are also common with the use of vouchers. Finally, apart from the system of delivery and administration of coupons being too cumbersome and bureaucratic, there were no clear-cut criteria for the allocation vouchers.

Participation and fertilizer subsidy programme implementation

According to the World Bank (1996), participation is a process through which stakeholders influence and share control over developmental initiatives and the decisions and resources which affect them. Widely used typologies and classifications of forms and levels of participation, according to Pretty (1994), are based on three dimensions: information input; decision making; and different key functions in planning such as situational analysis, problem identification, goal setting and implementation. Paul (1986) and Biggs (1989) have used the level of involvement in decision making as a basis for classifying different types and degrees of participation as follows:

Receiving information is the first level of involvement in decision making. Here participants are merely informed about what the programme will do after it has been decided by others. They play no role at all in arriving at the decision taken.

Another level of participation in decision making is passive information giving. At this level participants are only given the opportunity to respond to questions and issues that interventionists deem relevant for decision making. Participants therefore only have ideas about what the interventionists intend to do but have contribution to make.

Consultation forms another form of participation. Participants are asked about their views but the interventionists unilaterally decide what to do with the information. Interventionists seek the views of participants and then settle on which line of action to take.

Participants also collaborate with development partners in programme planning and implementation. They are therefore partners in the programme and jointly decide about issues with programme staff.

Self-mobilization is the final level of participation in decision making as outlined by Paul (1986) and Biggs (1989.Participants here initiate, work on and decide on programmes independently with interventionists. Decisions on beneficiaries and packages are taken together.

Genuine participation of people in a programme is therefore non-directive and does not impose ideas on them. It entails the active involvement of the beneficiaries in the planning process and enhanced by their interaction with experts that increases the influence farmers can exert upon the programme planning process.

An evaluation by the World Bank (1996) found that putting responsibility in the hands of farmers to decide on agricultural programmes can make services more responsive to local conditions, more accountable, more effective and more sustainable. Therefore encouraging the use of

participatory methods in the design and implementation of programmes such as the fertilizer subsidy increases farmers' ownership of such programmes.

Demographic and farm-related characteristics as they affect the effectiveness of the fertilizer subsidy programme

Demographic factors that were considered for discussion in this study included sex, age, educational background, family sizes and farming experience of respondents. Farm size was the only farm-related characteristic given attention in so far as it affects the intensity of fertilizer use and subsequent effect on the effectiveness of the fertilizer subsidy programme.

The age of a farmer is said to be a latent characteristic that can affect his involvement and use of subsidized fertilizer and can influence a farmer's participation in the programme in a of several ways. This therefore makes it contentious in the direction of the effect of age in the participation in the fertilizer subsidy programme.

Age was found to positively influence the acceptance and cultivation of sorghum in Burkina Faso (Adesina & Baidu-Forson (1995), and peanuts in Georgia (McNamara, Wetztein & Douce, 1991). This effect is thought to stem from accumulated knowledge and experience of farming systems acquired from observation and experimenting with various programmes.

On the contrary, age has also been found to be negatively correlated with participation in agricultural programmes such as fertilizer subsidies. In studies on land conservation practices in Niger (Badu-Forson, 1999) rice in Guinea (Adesina & Badu-Forson, 1995), fertilizer in Malawi (Green & Ng'ong'ola, 1993), Hybrid Cocoa in Ghana (Boahene, Snijders & Folmer,

1999), age was either not significant or was negatively related to participation in agricultural programmes.

The explanation was that, older farmers, perhaps because of investing several years in a particular practice may not want to jeopardize their investment by involving themselves in new ventures. Another reason for the aged being reluctant to invest in new programmes is that some programmes take a long time to yield fruits which they may not live to benefit (Caswell, 2001; Khanna, 2001). Moreover, elderly farmers often have different goals other than income-maximization, in which case, they will not be expected to participate in income-enhancing programmes. Several other studies of fertilizer use in Sub-Saharan Africa found age to be insignificant (Green & N'ong'ola 1993, Croppenstedt & Demeke, 1996; Nkonya, Schroeder & Norman, 1997, Kabila, Hugo &Mwangi, 2000).

According to Dlova, Fraser & Belete (2004), age is one of the factors that can affect the probability of a farmer participating in agricultural initiatives. Results from the study on the effect of age on the participation in agricultural programmes by Dlova et al. (2004) concluded that older farmers are less capable of carrying out physical activities while younger ones are capable. They therefore concluded that younger farmers are more able to participate in programmes like fertilizer subsidies which are labour intensive. Thus, because young farmers are more adaptive and more willing than older people to try programmes like fertilizer subsidies, age is therefore an influencing factor. Bemridge (1984) also concluded that as farmers get older, they often become conservative and reluctant to accept risk and also work for fewer hours.

Sex issues in agricultural production and programme design and participation have been investigated for a long time now. However, most of these studies show mixed evidence regarding the differential role played by men and women in various programmes. Doss & Morris (2001), studying factors influencing the use of improved maize in Ghana, and Over field & Fleming (2001) studying coffee production in Papua New Guinea, show significant effects of sex in programme acceptance and participation. Different rates of fertilizer and other technology use are typically observed between male and female farmers. Doss & Morris (2001) asserted that farmers' sex may influence their willingness to accept and participate in the fertilizer subsidy for a number of reasons. First, male and female farmers may have different levels of access to credit, land and other resources. They may also differ in the types of crops they grow and as a result their preferences of using fertilizer.

Finally, sex of farmers is expected to influence both acceptance and use of fertilizer both positively and negatively. Females are generally constrained in terms of access to resources and will use their income in enhancing household food and nutritional requirements.

A lot of literature on farm size focuses on its importance in influencing the intensity of participation in agricultural programmes such as fertilizer subsidies and is often considered by many as the first and probably the most important determinant. Farm size is frequently analysed in many adoption studies (Shakya & Flinn, 1985; Green & Ng'ong'ola, 1993; Adesina & Badu-Forson, 1995; Nkonya, et al., 1997; Fernandez-Cornejo, 1998; Boahene, Snijders & Folmer, 1999; Doss & Morris, 2001; Daku, 2002).The effect of

farm size has been variously found to be positive (McNamara, Wetztein, & Douce, 1991; Abara & Singh, 1992; Feder, Just & Zilberman, 1985; Fernandez-Cornejo, 1996; Kasenge, 1998), negative (Yaron, Dinar & Voet, 1992) or even neutral (Mugisa-Mutetikka, Opio,Ugen, Tukamuhabwa, Kayiwa, Niringiye & E. Kikoba, 2000). Farm size affects adoption cost, risk perceptions, human capital, credit constraints, labour requirements and more. With small farm sizes it has been argued by Abara & Singh (1993) that large fixed costs become a constraint to the participation in programmes especially if such programmes require substantial amount of set-up cost, so-called "lumpy technology." In relation to lumpy technology, Feder et al. (1985) further noted that only large farms will participate in such programmes. In Kenya, for example, a study by Gagre-Madhin & Haggblade (2001) found that large commercial farms adopted new high-yielding maize varieties more rapidly than the smaller farms.

A counter argument on the effect of farm size can be found in Yaron et al. (1992) who demonstrated that a small land area may provide an incentive to participate in a programme like the fertilizer subsidy which is an input-intensive and labour-intensive as well as a land-saving programme. In that study, the available land was small, so most farms were small. Hence, participation in land-saving programmes seemed to be the only option to increasing agricultural production.

Family size

The effect of family size in the participation in programmes such as fertilizer subsidies can be challenging. Researchers like (Voh (1989) and Shakya & Flinn (1985) assert that large family size can hinder the

participation of some households in programmes such as fertilizer subsidy programmes because a bulk of the financial resources are used for other family commitments with virtually nothing left for the purchase of subsidized fertilizer. According to Feder et al. (1985), labour constraints may affect a household's ability and willingness to participate in agriculture programmes like fertilizer subsidies. It is for this reason that family size of households is typically hypothesized to have positive effects upon their decision to get involved in programmes of that nature (Croppendedt & Demeke, 1996;Green & N'ong'ola, 1996).

Also, family size, according to Yonannes, Gunjal, & Garth, (1990),can be an incentive for participation in the fertilizer subsidy as more agriculture output is required to meet the family food consumption needs or as more family labour is required for participation in programmes like the fertilizer subsidy programme.

Normally, the larger the family size, the more likely the farmer is to participate in interventions like fertilizer subsidy, *ceteris paribus.* However, this will only work if the family members are old enough to perform tasks on the farm, otherwise if the household size consists of majority young children who cannot work on the farm, it will not be feasible. On the contrary, in studies carried out by Nkonya et al. (1997) and Kabila et al. (2000), family size was not found to be significant in the intensity of fertilize use.

The role of education in participation in agricultural programmes has been explored extensively in the literature. Studies that have sought to establish the effect of education on adoption in most cases relate to years of formal schooling (Feder et al., 1985;Tjornhom, 1995). Generally education is

thought to create a favourable mental attitude for the acceptance of new practices especially information-intensive and management-intensive practices (Caswell, 2001) on adoption. According to Wozniak (1984),education enhances the allocative ability of decision makers by enabling them to think critically and use information sources efficiently. Furthermore, producers with more education should be aware of more sources of information, and more efficient in evaluating and interpreting information about innovations than the less educated ones. Education was found to positively affect adoption of improved maize varieties in West Shoa, Ethiopia (Allen, Kilvington, Nixon & Yeabsley, 2000), Tanzania (Nkonya et al., 1997), and Nepal (Shakaya & Flinn, 1985).

Considerable amount of experience in farming may foster the participation in agricultural programmes such as fertilizer subsidies. In a study to determine the adoption and level of demand for fertilizer for cereal growing farmers, Croppenstedt & Demeke (1996) found out that farming experience is very important in determining the participation of farmers as well as the quantity of fertilizer used per hectare. They asserted that a farmer who adopts fertilizer is likely to increase use substantially by twenty three percent in the second year of usage

In another study on fertilizer adoption and use intensity in Northern Ghana, Martey, Wiredu, Etwire, Fosu, Buah, Bidzakin, Ahiabor, & Kusi (2013) discovered that experienced farmers were more likely to increase fertilizer use than the less experienced ones. Differing from Martey et al. (2013), Akudugu, Guo & Dadzie (2011) observed that experienced farmers who have accumulated several years of experience in farming through

experimentation and observation may find it difficult to part with such experience for new programmes whose relative advantage may be uncertain.

Theoretical basis of the research

This study is based on two theories, the Modernization theory and the Diffusion of innovations theory (DoI).

The Modernization Theory

Modernization theory is a theory used to explain the process of modernization within societies. Modernization theory looks at the internal factors of a country while assuming that, with assistance, underdeveloped countries can be brought to the same level with the developed countries. Developing the modernization theory, Rostow (1960) refers to it as a theory which states that development in developing worlds can be attained through following the processes of development that are used by currently developed nations.

Development in this context refers to economic growth that leads to increased living standards. Living standard is however, problematic depending on whether it is measured in simple economic terms or it includes social and health measures like education and life expectancy. In summary modernization is a social economic theory which highlights the role played by the developed countries in modernizing and facilitating sustainable development in the less developed ones Hollis & Robinson, (1986). The fertilizer subsidy programme can be linked to the modernization theory in a number of perspectives. First, Rostow (1960) postulated that the modernization theory looks at the internal factors and conclude that with the

necessary assistance, undeveloped nations can be brought to the same level with developed ones.

Since the modernization theory talks about developing countries attaining development by imitating the developed countries, the fertilizer subsidy also leads to development by following the footsteps of the likes of Malawi, Rwanda, South- East Asia and the Americas. So the modernization theory forms a good foundation upon which this study is conducted.

Rostow (1960) postulated a five-stage model of development which he said will be applicable to all nations. This model is vital in the sense that its emphasis is on the idea that an underdeveloped country is able to develop economically by focusing on the resources that are in short supply in order to expand beyond local industries to reach global market. The five stages include the traditional society stage, the pre-condition for take-off, the take-off stage, the drive to maturity stage, and the high mass consumption.

The traditional society stage is when the country has not yet developed but majority of the people are engaged in subsistence agriculture. What is important to note here is that this stage of development is concerned with societies in which the people have a pre- scientific understanding of issues and are fatalistic in nature with magical minds (Hollis, 1979). They believe that things like goods and services come into being by divine forces rather than the intervention of man or ingenuity.

The economic growth stage is called the pre-condition for take-off which is characterized by increased capital use in agriculture, necessity for external funding and some growth in savings and investments. It is in this stage that agriculture is commercialized and mechanized to bring about

technological advancement and growth in entrepreneurial activities (Rostow, 1960). Agricultural activities play an important role in the process of transition or development.

The third stage is called the take-off stage of development which is sometimes called the economic take-off stage. Dynamic economic growth due to sharp stimulus of economic, political or technological nature is a common feature of this stage. The growth or economic progress becomes a normal trend or situation in these societies because those factors that were affecting or limiting growth are removed. There is therefore an increase in industrialization at this stage.

The fourth stage after the take off stage is the drive to maturity stage during which modern technology is extended to other sectors of the economy or society. Drive to maturity stage refers to the period when the country has applied the range of modern technology to the bulk of its resources. According to Todaro & Smith (2003), this is a self-sustaining stage during which the economy finds its place in the international economy and those goods that were imported begin to be produce locally.

The fifth and final stage is called the age of high mass consumption where the leading sectors in the society shift towards durable goods and services. This time, the consumers focus on durable goods and hardly remember the subsistence activities of the other stages. Preston (1988) asserts that this stage is concerned with high output levels, mass consumption of consumer durables and increase in employment in the service sectors. It is characterized by an increase in per capita income, changes in the structure of the working force including those working in the offices or factories and an

increase in the desire to benefit from the consumption of the fruits of a mature economy.

The Diffusion of Innovations (DoI)

Diffusion of innovation as a theory lays emphasis on innovation as an agent of behavioural change, with innovation considered as an idea, practice, or an object thought of as new (Rogers, 2003, p. 12). Diffusion is the process of communicating new ideas through certain channels over time among members of a social system. It has a special connotation in that, the message being communicated concerns new ideas.

As a result of the fact that the DoI theory has it that it is the perceived attributes of an innovation that determines its rate of adoption than the characteristics of the adopters, this can be likened to the fertilizer subsidy where the participation and involvement of the farmers depend on the design and implementation modalities than farmer characteristics.

Originally published in 1962, building particularly on rural sociology research in the uptake of agricultural technology in the United States, the diffusion of innovation theory has subsequently been very widely applied to various disciplines including marketing, development and health (Greenhalgh, Robert, Macfarlane, Bate & Kyriakidou, 2004).Furthermore, the DoI theory has been chosen as the theoretical bases for this study because the DoI theory posits that the adoption of innovations is dependent on five factors, relative advantage, compatibility, trialability, complexity, and observability. Similarly, farmers will only participate in the fertilizer subsidy programme if only it will

lend itself to trialability and observability backed by relative advantage which also hold true for the DoI theory.

The DoI posits that behavior will change more rapidly if innovations are perceived as being better than previous options. These options must have relative advantages over the former ones, and be consistent with existing values, experiences and needs of potential adopters. They are also expected to be easy to understand and use (complexity), testable through smaller units (trialability), and the results of which must be visible (observability).

Social systems/diffusion networks are critical to this theory since diffusion occurs through them. This is because these social systems create boundaries or barriers around the diffusion due to the fact that social networks and communication come together around the concepts of homophily and heterophily. Homophily is defined as the extent to which interacting individuals are similar in their attributes like education, social status and values with heterophily being the opposite.

Generally, communication is most likely to be effective within homophilous social networks where members share common understandings, language and meanings. However, homophily can be problematic in situations where difference in knowledge or views is needed. DoI asserts that homophily can act as a barrier to the flow of innovations in a system and that some heterophly is therefore essential for diffusion of innovation to occur.

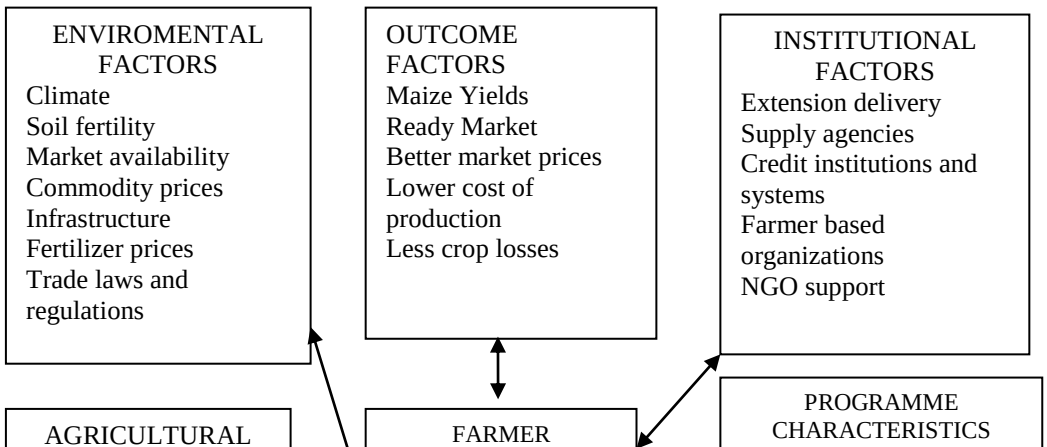

Figure 1: Conceptual framework of the fertilizer subsidy programme
Source: Author's Construct

Conceptual Framework of the fertilizer subsidy programme

The idea of conceptual framework has been used by many writers including Stake (1995) and Yin (2003), but they failed to fully describe or provide a model of a conceptual framework to which reference can be made. However, one source that provided examples of conceptual frameworks is Miles & Huberman (1994). The two authors outlined a few purposes which a conceptual framework seeks to accomplish in any research work. First a conceptual framework clearly identifies who will and who will not be included in the study. Secondly, it describes the relationship that may be present based on logic, theory, and/or experience and finally provides the researcher the opportunity to gather general constructs into what they call intellectual "bins" (Miles & Huberman, 1994, P. 18).

Figure 1 is a simplified conceptual framework upon which this study will be based. Positive impacts from fertilizer subsidies are determined by on-

farm physical production, subsidized fertilizer supply system efficiency, transport and communication costs, as well as by the effectiveness and efficiency of the implementation of the subsidy itself.

The farmer's perception of the fertilizer subsidy programme depends on a number of factors grouped as:

1. Farmer characteristics
2. Environmental factors
3. Institutional factors
4. Programme characteristics
5. Agricultural input supply
6. Outcome factors

Farmer characteristics are the personal and occupational attributes of the farmer. They include the farmer's educational level, age, competence in fertilizer application and other farm operations, attitude towards the subsidy programme and change, income level, farm size etc. Environmental factors include climatic conditions, rainfall patterns, soil conditions, availability of markets commodity prices, political environment, trade regulations and laws, market price for fertilizer, other programme running in the community etc.

Institutional factors include respondents' membership to any Farmer-Based Organizations (FBO), informational flow channels, channels of communication, training programmes, commodity price regulations etc. Programme characteristics refer to the attributes of the Fertilizer Subsidy Programme itself. They include the method of operation, number of farmers involved, methods of distribution, personnel involved etc.

Fertilizer use can only be effective when other agricultural production inputs are available, accessible and affordable to the farmer. Inputs have to be sustainably supplied and must be compatible with the environment, and suitable for the farming operation and conditions. In this light, the flow of inputs for agricultural production will influence the perception of an individual on the effectiveness of the fertilizer subsidy programme.

The outcome of the fertilizer subsidy programme in the short term is likely to influence the farmers' perception of the programme effectiveness. Outcomes such as good yields, lowered costs of production, high quality produce, improved commodity prices, improved marketability of products, etc., are the usual criteria upon which the farmer bases his judgment of the effectiveness of the intervention. All these varieties of factors influence the farmers, decision and he finally judges whether the programme has been successful or not.

CHAPTER THREE

METHODOLOGY

General Overview

This chapter deals with the description of procedures and techniques used to collect and analyze data for the study. It captures the design, the population, the sample size, the sampling procedure, the research instruments, data collection and data processing and analytical tools that were used as well as the rationale behind the use of these techniques for the study.

Study Area

The Sene West District was created out of the then Atebubu-Amantin District in 1988. It is one of the twenty-seven (27) districts in Brong Ahafo Region of Ghana. The district lies within Longitudes 0^o 15'E and 0^o 15'W, and Latitudes 7^o N and 8^o 30'N. Out of the 27 administrative districts in the Brong Ahafo Region, Sene has the largest land area, which is about 8586.44 km^2. It shares boundaries with the Volta Lake and East Gonja District to the north, Volta Lake, Krachi and Jasikan districts in the Volta Region to the east and south-east, KwahuNorth and Sekyere East Districts to the south and south-west, and Atebubu-Amantin District to the west.

Land in the study area is generally available, perhaps due to the low population density of the area. Stools, clans, either families or individuals, own lands in the district. The stools and clans allow indigenes free access to communal lands for farming activities. Migrant farmers are granted user rights to communal lands with various tenancy arrangements. However, occasionally there are land disputes that pose a problem for agricultural development.

The economy of the district is characterized by a relatively large agricultural sector, which is mainly at the subsistence level. Agriculture accounts for more than 80percent of the income of the people. Crops like yam, maize, and rice, legumes such as groundnuts, cowpeas, soybeans, and vegetables like tomatoes, garden eggs, pepper and okra are produced in the district. Livestock such as cattle, sheep, goats, pigs and birds such as fowls and guinea fowls make up important aspects of the agricultural activities in the district and contribute substantially towards household incomes.

The District falls between the Wet Semi-Equatorial and Tropical Continental Climatic Regions of Ghana. That is the district is part of the transitional zone between the two major climatic regions. The Sene District is characterized by high temperatures throughout the year with a mean annual temperature of about 27^{o}C.The Relative Humidity of the area is quite high, averaging over 75 percent throughout the year. It however varies generally between the wet and dry months.

Sene district has a bi-modal rainfall regime. April to July is the period for the major rainfall while August to mid- October, is the minor rainfall period. Mean annual rainfall of about 1,191.2 mm is recorded in the district. Following the rains is the dry season, which starts in November and ends up in March. The dry conditions during this period promote bushfires, which are sometimes consciously started by farmers and hunters, or unconsciously by improper handling of fire. The study area lies within the Sene-Obosom River Basins and the Volta Lake. Three major rivers drain the study area. These are the Volta, the Pru and Sene Rivers. This has provided opportunities for the

emergence of fishing as a major economic activity and the development of irrigation facilities for small scale rice production.

However, the long distance from the district capital to the regional capital, Sunyani (about 241km via Techiman and Nkoranza) poses as one of the major development constraints in the district. It is the farthest district from Sunyani, the regional capital. Poorly developed road network across the length and breadth of the district is another serious developmental threat in the area.

The Sene East District has almost the same climatic characteristics like Sene West except that it is drier in terms of rainfall both in intensity and distribution. The road network is one of the worst in the Region and is a serious challenge to the development of the two Districts. This may pose the biggest challenge when it comes to effective implementation of the fertilizer subsidy programme in terms of distribution and accessibility.

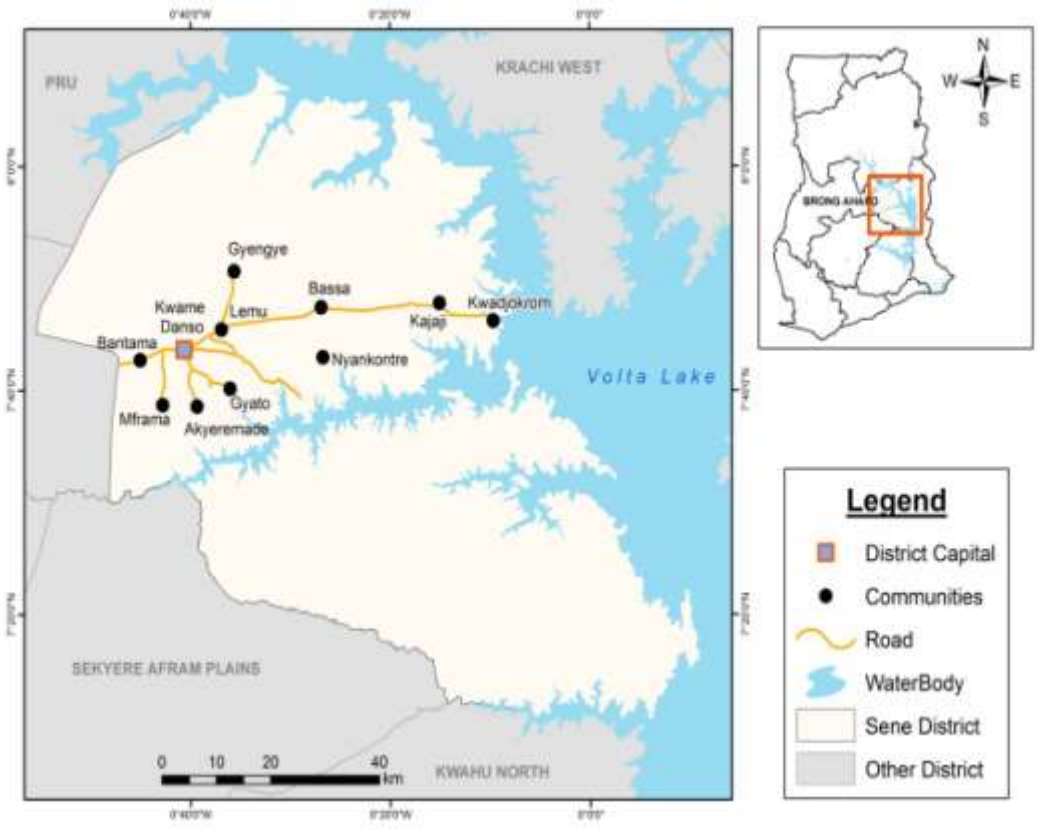

Figure 2: Map of Sene District
Source: Geography Department (UCC)

The Study Design

The study adopted a descriptive survey approach in order to assess farmers' perceptions about the various design characteristics and implementation modalities of the fertilizer subsidy programme in so far as they affect the effectiveness of the programme. Specifically, the research design was a descriptive survey, the reason being that it enabled the researcher to describe the nature of the fertilizer subsidy programme as at the time of the survey. It was also chosen because it is one of the commonest types of quantitative social science study designs.

Survey research owes its popularity to its versatility, efficiency, and generalizability. It is efficient because many variables can be measured without substantially increasing time and cost. Surveys also generally gather data from a relatively large number of cases at a particular time (Best & Kahn, 1998).An important use of the survey in impact studies is to collect data on perceptions or opinions about the activities or outcomes of a programme or project (Bennett, 1979).Survey research lends itself to probability sampling from large samples. It is therefore very appealing because of its generalizability which is a central research goal. Finally, Bennett (1979) emphasised that the survey requires fewer resources, time, and money than other designs that are used in impact studies such as the experimental and matched-set time-trend studies.

The Study Population

The population for the research was all small holder beneficiaries of the Government Fertilizer Subsidy Program in the Sene East and West

Districts. This is made up of 1600, 1150 from Sene West and 450 from Sene East.

Sampling Method

A combination of purposive and proportionate stratified random sampling procedures was adopted for the research. This is because this study was being conducted in two districts, so stratified random sampling procedure was to ensure that the researcher will have proportional representation of the population subgroups. Purposive sampling is where the researcher targets a group of people believed to be typical or average or a group of people specially picked for some unique purpose. The reason for using stratification is that there were no fertilizer agents in Sene East and the distance between Sene West and Sene East is far, about 56 kilometres. This therefore explains why the researcher decided to settle on two Districts, Sene-east and Sene-West from which farmers who have benefited from the fertilizer subsidy were selected. The reason for the choice of Sene-East and Sene-West was that a lot of the farmers are small farmers who are unable to afford fertilizers at the market prices. For participating farmers, the District Agricultural Development Units were contacted for the lists of farmers who benefited from the programme and this served as the sampling frame.

Sample size

Whereas it is generally agreed upon by researchers that determining an adequate sample size remains one of the most controversial aspects of sampling, all of them do acknowledge that given the resources, the larger the representative sample used, the better it is for the researcher. According to the

law of large numbers, the larger the sample size, the better the estimates, or the larger the sample the closer the "true" value of the population is approached.

Researchers have come out with various tables and formulae for estimating appropriate sample sizes for given populations which give the confident intervals, level of precision and degree of variability in the attributes being measured (Israel, 1992). Despite the agreement on the law of large numbers, there is consensus that the law holds only when the sample is randomly chosen. Best & Kahn (1998) postulate that there is no fixed number or percentage of subjects that determine an adequate sample size and further argued that sample size may depend on the nature of the population, the data to be gathered, the type of analysis and funds available.

Patton (2002) even becomes more realistic when he stated that there is no rule of thumb in determining the right sample size. He further stressed that a sample size is contingent on issues such as what one wants to know, the purpose of the inquiry, what is at stake, what it will be used for, what will have credibility, and what can be done with available time and resources (Patton, 2002).

Based on the explanation by Israel (1992) as outlined above, 140 participants were selected for this study. This is because, first, Israel (1992) is of the view that where complex selection methods like stratified random sampling is to be used and second, where descriptive statistics like means and frequencies are to be used, any there is no rule thumb for determining the sample size. These ideas in addition to the time and funds available to the

researcher were the guiding principles for selecting 140 participants for the study.

Secondary data of small scale farmers who benefited from the fertilizer subsidy programme was obtained from the respective District Agricultural Development Units (DADUs). Four Hundred and Fifty (450) farmers benefited from Sene East and One Thousand One Hundred and Fifty (1150) farmers for Sene West, making a total of 1600.

Instruments for Data Collection

The researcher developed a structured interview schedule as an instrument for the study. In order to ascertain that the instrument measures what it purports to measure, it must go through some judgment by both the researcher and experts in the field of research. Consequently, the interview schedule was validated by my supervisors and other senior members from the Department of Agricultural Economics and Extension, University of Cape Coast.

The interview schedule was made up of seven (7) domains as follows:

a. Demographic and socio economic background

b. Farm related characteristics

c. Level of beneficiaries' knowledge about fertilizers

d. Level of participation in the programme

e. Level of perceived effectiveness of the programme

f. Level of satisfaction of the programme's performance

g. Perceived strengths and weaknesses of the programme

In order to measure, measure the levels of participation, satisfaction, accessibility, availability and the overall effectiveness of the FSP, more

accurately, a Likert-type scale was used. The choice of the scale was based on the consideration that this study was aimed at capturing farmers' perceptions about various aspects of the fertilizer subsidy programme. According to Sirkin (1999), the Likert-type scale is considered very appropriate for this kind of investigation. Sirkin (1999) argued that since people's perceptions are not quantifiable, the Likert scale is best suited to finding the views of the beneficiaries. For the perceived effectiveness of the fertilizer subsidy progamme, a five-point Likert scale was used as portrayed in Table one.

Table 1: Interpretations of Likert-type-scales

Ratings	Intervals	Perceived effectiveness	Level of participation
5	4.45 - 5.00	Very effective	Very high
4	3.45 –4.44	Effective	High
3	2.45 – 3.44	Moderately effective	Moderately high
2	1.45 – 2.44	Ineffective	Low
1	1.00 – 1.44	Very ineffective	Very low

Source: Author's construct, 2015

Pre-testing

According to Wimmer & Dominick (1994), pre-testing or pilot testing a questionnaire or interview schedule before its administration is crucial for ironing out many of the potential unanticipated difficulties during the research process. Consequently, a pre-test was carried out in the field to confirm the appropriateness of the instrument for the respondents as well as ascertaining its reliability. This enabled the researcher to detect any possible errors and revise the instrument accordingly to ensure internal consistency among

the items. Kumar (1996) postulated that a pre-test should not be carried out on the sample of your study but on a similar population from which the sample is drawn. The pre-test was thus conducted by interviewing selected farmers who also benefited from the fertilizer subsidy programme in Garadima, a farming community in the Atebubu-Amantin District. A total of 30 beneficiary farmers, which is considered optimal for reliability analysis, were used for the pre-test. The results of the pre-test were as found in Table two.

Table 2: Reliability coefficients of subscales of the research instrument

Scale	Number of items	Cronbach alpha
Perceived effectiveness.	14	0.893
Perceived participation.	8	0.782
Perceived level satisfaction	12	0.790
Availability	5	0. 762
Perceive accessibility	6	0.876

n= 30, Source: Field Survey Data, 2014.

Data Collection

Data collection was undertaken with the assistance of Agricultural Extension Agents (AEAs) and National Service Personnel in the Ministry of Food and Agriculture (MoFA) in the two Districts. The AEAs were taken through the interview schedule to equip them with the skills needed to accomplish the task of soliciting information from beneficiary farmers. The purpose of this training was also meant to enable the AEAs to understand the objectives of the study and also to get acquainted with the content of the interview schedule. It was also impressed on the research assistants not to

disclose the identity of respondents in so far as their demographic characteristics were concerned to ensure that quality and reliable data were obtained. After the training, research assistant were dispatched to the field for data collection. The researcher then carried out periodic monitoring trips to see how research assistants were fairing in the field. The whole data collection exercise lasted one month and two weeks from 14/03/14 to 30/04/14.

Data Analysis

After data collection, data cleaning was done by scrutinizing the completed schedules to identify and minimize as much as possible errors such as incompleteness, misclassification and gaps in the information obtained from the respondents. Data was then coded and analyzed using Statistical Package for Social Scientists (SPSS) software package. In most of the analysis, descriptive statistics were computed for variables for each objective.

With the help of the SPSS the researcher was able to generate statistics like means, modes, frequencies, percentages, and standard deviations. Other statistical tools that were used for analyzing the various objectives include independent sample t-test, and dependent (paired sample) t-test. Researchers generally specify the probability of committing aType1error that they are willing to accept, that is, *a priori* (Trochim, 2000). In the social sciences most researchers select an alpha= 0.05. This means that the researcher accepted a probability of five percent (5%) of making a Type1error.Therefore, in this study, analpha of 0.05 was set as *a priori* to examine any statistical significance between and among selected variables.

An independent sample t-test was conducted to compare the mean scores of the perceptions of male and female beneficiaries from the two Districts in terms of level of participation, level of satisfaction as well as perceived effectiveness of the fertilizer subsidy programme.

For the description of the demographic and socio-economic characteristics of respondents in objective one, descriptive statistics such as frequencies, percentages, means, modes, and standard deviations were used to compute the respondents' age, family sizes, educational qualifications as well as farm sizes.

In estimating the contribution of fertilizer subsidy to crop production in objective two, means, standard deviations and mean differences were used to describe the yields before and after the fertilizer subsidy. However, the dependent paired samples t-test was used to find out whether there was a significant difference between crop yields before and after the fertilizer subsidy programme.

Objective three was aimed at examining the level of participation and satisfaction of beneficiaries with the FSP. Analytical tools used to accomplish this objective included means, percentages and standard deviations.

Objective four sought to identify the weaknesses and strengths of the fertilizer subsidy programme and how to overcome the weaknesses. Frequencies and percentages of respondents were used to describe the perceptions of beneficiaries on the strengths and weaknesses and how the programme may be improved.

Objective five sought to compare the level of effectiveness of the programme as perceived by male and female beneficiaries as well as the

perceptions of respondents from Sene-East as against those of Sene-West. To accomplish this, means and standard deviations were computed and comparisons made, while independent samples t-tests were used to determine whether there were significant differences between male and female farmers' perceptions as well as between farmers from Sene-East and Sene - West.

Frequencies, Percentages, Means, modes and standard deviations were used to analyze objective six which delves into the overall effectiveness interms of accessibility, availability, affordability.

A summary of the analytical tools for analyzing the various objectives are provided in Table three.

Table 3: Summary of statistical tools for analyzing each objective

Specific Objective	Statistical tool for analysis
One	Frequencies, means, percentages, mode and standard deviations.
Two	Frequencies, means, percentages, weighted means and standard deviations.
Three	Means, percentages, and standard deviations, and Independent t-test.
Four	Means, standard deviations, Mean difference, and Dependent (paired) sample t-test.
Five	Frequencies, means, percentages, and standard deviations.
Six	Frequencies, percentages, means

Source: Author's Construct.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter focuses on the discussion of the findings of the study in relation to the specific objectives.

Demographic, socio-economic and farm related characteristics of respondents of the fertilizer subsidy programme

This section gives a broad overview of the demographic and socio-economic characteristics of respondents. On the participation of farmers in agricultural interventions such as fertilizer subsidy, large volumes of literature are available to explain the various factors that influence fertilizer usage.

According to Rogers(2003), Sunding & Zilberman (2001), and Feder & Umali (1993), there is agreement that the participation of farmers in agricultural interventions like fertilizer subsidy depends on a range of personal, social, cultural and economic factors, as well as on the characteristics of the interventions itself. It is therefore important to examine these factors to find out their effect and impact on the subsidy programme in the study area. The personal characteristics include sex, age, educational background, family size, and years of farming experience as well as farm sizes.

Before discussing the effect of the factors that influence the participation and use of these interventions, an understanding of the term fertilizer subsidy as well as its effectiveness is important. Fertilizer subsidy is commonly understood as direct budgetary support payments made by government to lower the farm gate prices of fertilizers. According to Banful

(2008) Ghana's subsidy was in response to dramatic increases in food and fertilizer prices. The presumed goal of Ghana's subsidy according to Banful (2008) was therefore to encourage fertilizer use so that food crop output in 2008 would not be drastically reduced below 2007 levels due to soaring cost of fertilizer.

The effectiveness of the fertilizer subsidy programme is defined as the degree to which the fertilizer subsidy programme is able to meet the expected goals of increasing fertilizer usage to bring about an improvement in production levels as perceived or observed by beneficiary farmers. The effectiveness of the fertilizer subsidy is also dependent on how well the issues of availability, accessibility and affordability are addressed by the programme.

Age of respondents

The age of respondents is important in so far as it affects the effectiveness of the fertilizer subsidy programme which seeks to accomplish objective one of the study. The results of the study, as found in Table 4 indicate that most of the respondents are between 15-45years (77.2%). The mean age of the respondents was 39 years with a range of 23-66 years. The mean age of 39 years implies that most of the farmers are still in the economically active age group and effectively make use of the fertilizer programme. According to Dlova, Fraser & Belete (2004), age is one of the factors that can affect the probability of a farmer participating in government programmes such as fertilizer subsidies. Results from their study concluded that older farmers are less capable of carrying out physical activities like

fertilizer application while younger ones are capable, thus corroborating this current study.

Table 4: Age distribution of respondents of the fertilizer subsidy programme in the Sene East and Sene- West Districts

Age Range	Frequency	Percentage	Cumulative %
15-25	5	3.6	3.6
26-34	50	35.7	39.3
35-45	53	37.9	77.2
46-54	25	17.8	95.0
55-65	6	4.3	99.3
66-74	1	0.7	100
Total	**140**	**100**	

n=140, Mean=38.5, SD=9.2, Min. =23, Max= 66.
Source: Field Survey Data, 2014.

In his study, Ayamga (2006) also opined that older farmers, apart from being risk averse, are said to be much less receptive to new practices. Younger farmers on the other hand are more active and ready to venture into new programmes. It is also a generally agreed upon view that older farmers might have established in certain businesses and are a bit conservative, less flexible and more skeptical about the benefits of new ventures.

It has also been observed by Caswell (2001) that as farmers advance in age, their rate of involvement in progammes such as fertilizer subsidy diminish. Older farmers, perhaps because investing several years in a particular practice may not want to risk by trying something entirely new.

Bembridge (1984) also concluded that as farmers get older, they often become more conservative and reluctant to accept risk. They work for fewer hours and cannot cope well with programmes like fertilizer subsidies. The fact that a lot of the participants in the fertilizer subsidy programme in the study area are within the economically active age brackets implies that the programme has the potential of being embraced by many farmers into the future.

Sex of respondents

Objective one of the study was also meant to investigate the role of the sex of respondents on the effectiveness of the fertilizer subsidy programme. Differential involvement of men and women in various programmes and projects worldwide cannot be overemphasized. In particular, women are more often than not marginalised in agricultural programmes despite the fact that 48.7 percent of the female population of Ghana is self-employed in the agricultural sector (Duncan, 2004). Duncan (2004) went further to discover that female participation in the agricultural sector of the economy of Ghana was 51.8 percent (2000 Population Census). It is therefore important to investigate the extent of involvement of women in the fertilizer subsidy programme in the study area.

Results from the study show that a majority of farmers (80.3%) were males with nineteen percent being females. It is common knowledge that women are responsible for at least sixty percent of the farming activities in almost all communities in Africa including Ghana. This is supported by Duncan (2004) who again reported that Ghanaian women farmers produce

sixty percent of the food crops in Ghana. Studies carried out by Doss and Morris (2001) on factors affecting improved maize cultivation in Ghana, and Overfield and Fleming (2001) who also studied the production of coffee in Papua New Guinea both show insignificant effects of gender on the effectiveness of the programmes.

On the contrary, another school of thought has it that sex of farmers affect participation in fertilizer use intensity. For instance according to Nnadi & Akwiwu (2008) females are usually engaged in domestic activities and are also considered as resources and these negatively impact on both the decision to participate and the extent of fertilizer use.

Educational qualification of respondents

In ensuring the effectiveness of the fertilizer subsidy which is the main aim of objective one, the educational background of the respondents is very important. Generally, educational qualification is very low in the study area as depicted in Table 5. Respondents with no formal education at all form the largest percentage of thirty-one percent followed by Middle/Junior High School level with 30 percent. The third highest category of respondents was those who completed primary school who formed 19 percent of the respondents. Only 12 percent of respondents attained Senior Secondary School level while Tertiary level had just 7.7 percent of respondents as depicted in Table 5.

This distribution of respondents by educational qualification has a lot of implications for their involvement in the fertilizer subsidy in the study area. Bosompem (2006), citing Byrness & Byrness (1978), argued that education enhances one's ability to receive, decode and understand information and that

farmers' level of education, to a very large extent, determines the type of task he/she can undertake in a programme, and therefore the type and level of participation. Education could also increase the chances of the farmer earning non-farm income which could reduce the household dependency on agriculture and thus the intensity of fertilizer use. Varying a bit from this argument, Adesina & Zinnah (1993) asserted that the characteristics of the interventions itself have a lot of influence on its use. In particular, their relative complexities, risk component as well as investment all play an important role its adoption.

Table 5: Educational qualification of respondents of the fertilizer subsidy programme

Level	Frequency	Percentage	Cumulative%
No formal Edu.	43	31.3	31.3
Middle/JHS	42	3.0	80.3
Primary Sch.	27	19.0	50.3
Secondary	17	12.0	92.3
Tertiary	11	7.7	100
Total	**140**	**100**	

n=140,
Source: Field Survey Data, 2014.

Education has been found by Caswell et al. (2001) to create a favorable mental attitude of farmers for the acceptance of new practices especially of information-intensive and management-intensive practices on adoption. Education enhances the allocative ability of decision makers by enabling them

to think critically and use information sources efficiently. Farmers with high educational qualification have been exposed to more sources of information, and are therefore more efficient in evaluating and interpreting information about programmes than those with less education (Wozniak 1984). In a research to find out the effect of education in the adoption of improved maize varieties, Allen et al. (2000) and Nkonya et al. (1997) observed that the higher the educational qualification, the higher the participation rate in Ethiopia and Tanzania respectively.

Family Size of respondents

In order to deal with objective one effectively, the household size is one of the characteristics of respondents to be looked at since it will among other things determine the availability of labour and resources to enhance participation in the fertilizer subsidy programme. From Table six, 92.1% (129) of the respondents had family sizes between one and ten while nine respondents had family sizes from 11-20. Two respondents had family sizes of, 41, and 43 respectively. The mean number of family members was seven, the standard deviation, 5.9 with the minimum and maximum being one and 43 respectively. Aryeetey (2004) reported of an average family size of 6.9 in the forest region of Ghana which is consistent with the findings in this study even though they are in two different ecological zones.

Table 6: Family size distribution of respondents of the fertilize subsidy programme

Range	Frequency	Percentages	Cumulative %
1-10	129	92.1	92.1
11-20	9	6.4	98.5
21-30	-	-	98.5
31-40	-	-	98.5
41-50	2	1.4	100
Total	**140**	**100**	

n=140, Mean= 7, SD= 5.9, Min. =1, Max. =43, Source: Field Survey Data, 2014.

The effect of family size on the participation of farmers in agricultural interventions has always been conceptualized with mixed feelings and can therefore be ambiguous. It can hinder the adoption of such interventions in areas where farmers are very poor and the financial resources are used for other family commitments with little left for purchase of farm inputs like subsidized fertilizer (Voh, 1982; Shakya & Flinn, 1985). On the contrary, it can also be an incentive for the use of interventions such as fertilizer since more agricultural output is required to meet the family food consumption needs (Yonannes et al. 1989). Considering the fact that the study area is characteristic of large family sizes as portrayed by the findings, the fertilizer subsidy programme will be partronised by most farmers in order to meet their family food requirements and other basic needs.

Farm Sizes of respondents

Farm size as a farm characteristic has a lot of impact in determining the effectiveness of the fertilizer subsidy which is the motive of objective one. This is because farm size is known to affect and be affected by costs, risk perceptions, human capital, credit constraints, labor requirements, tenure arrangements and more (Adesina & Baidu-Forson, 1995; Nkonya et al.,1997; Doss & Morris, 2001). Table seven illustrates the distribution of farm sizes of the beneficiaries of the fertilizer subsidy programme in the study area. The results from the study indicate that about 45 percent of the 140 beneficiary farmers interviewed cultivated 4 acres each. The average size of land under cultivation by beneficiaries in the study area was 3.5 acres with a standard deviation of 1.1, suggesting that there wasn't much variation in the number of acres done by the beneficiaries. As few as five beneficiaries cultivated one acre each while 25 farmers cultivated two acres each.

Table 7: Farm sizes of respondents of the fertilizer subsidy programme

Acreage	Frequency	Percentage	Cumulative %
1	5	3.5	3.5
2	25	17.8	21.3
3	29	20.7	42.0
4	63	45.0	88.0
5	18	12.0	100
Total	**140**	**100**	

N=140,
Source: Field Survey Data, 2014.
Mean=3.5 SD=1.1714, Mode =4.

Several studies have revealed that farm size has a considerable impact on the use of fertilizer. For example (Shakya & Flinn, 1985; Harper, Rister, Mjelde, Drees, Way, 1990; Green & Ng'ong'ola, 1993; Adisena & Badu-Forson, 1995; Nkonya et al., 1997; Fernandez-Cornejo, 1998; Badu-Forson1999; Boahene et al, 1999; Doss & Morris, 2001; and Daku, 2002) postulated that farm sizes will generally have a positive impact on a household's decision to use interventions such as fertilizer subsidy. Households with larger cultivated areas will tend to have more productive assets and fewer credit constraints than smaller ones. Doss & Morris 2001 reported that larger farm sizes positively affect the use of both new varieties of maize as well as fertilizer in Ghana, thus, confirming the results of this study. On the other hand, Yaron et al. (1992); and Harper et al. (1990) saw farm size to be negatively correlated with the intensity of use of fertilizer. Smaller households who use fertilizer tend to use it more intensively than larger households (Feder et al. 1985).

Farming Experience of respondents

Considerable amount of farming experience over the years may facilitate the use of subsidized fertilizer. It is therefore necessary to assess the level of experience of the respondents to ascertain the extent to which this will affect the effectiveness of the fertilizer subsidy as is required in objective one.

Table eight illustrates that the number of respondents who had from one to10 years of farming experience accounted for more than half of the total (54.2%).That 54.2 percent of respondents had a maximum of 10 years of farming experience seems to suggest that most respondents in the study area

are not very experienced in farming. The mean farming experience was 11.7 years.

Table 8: Farming experience of respondents of the Fertilizer Subsidy Programme

Range	Frequency	Percentage	Cumulative %
1-10	76	54.2	54.2
11-20	48	34.2	88.4
21-30	14	10.0	98.4
31-40	2	1.4	100
Total	**140**	**100**	

n=140, Source: Field Survey Data, 2014. Mean=11.7, Min. =2, Max. =33

In a study by Martey et al. (2013) on fertilizer use intensity among smallholder farmers in Northern Ghana, it was found out that experienced farmers are more likely to increase fertilizer use under the subsidy. It was also observed by Martey et al. (2013) that some agricultural extension programmes use experienced farmers to demonstrate the use of fertilizers to increase agricultural production. The finding of this studyis therefore at variance with the results of their research. Nevertheless, some authors are of the view that the length of experience in farming is probably an indicator of a farmer's commitment to agriculture and does not necessarily predispose him/her to adoption of government interventions. For example, farming experience was not found to be significant by Nkonya et al. (1997) and Kabila et al. (2000) influencing programme participation.

Khanna (2001), in a similar study found out that higher level of experience led to higher rates of participation in high-input agriculture such as

the fertilizer subsidy programme. This contrasts with the findings of this study which has come out that the less experienced farmers participated more in the fertilizer subsidy programme. In a study to investigate the factors that influence farmers' decision to participate in agricultural programmes in Northern Ghana, Akudugu et al. (2011) observed that farmers who have accumulated years of experience in farming may find it difficult to part with such experience for new programmes whose relative advantages may be uncertain.

An examination of the level of changes in the yield of maize after the implementation of the fertilizer subsidy programme (2008- 2012)

In addition to comparing yields before and after the fertilizer subsidy programme, objective two also seeks to investigate the production level as the years go by. This section therefore looks at the trend in the production levels for a five-year period. Table nine portrays the yields of maize of the respondents from 2008 before subsidy to 2012 after the coming into being of the fertilizer subsidy programme. The yields are in maxi-bags per acre.

Table 9: Level of changes in yield of maize over a five-year period (2008-2012)

Year	$\bar{x}$	SD	Min	Max
2008	3.2	1.5	1	10
2009	6.6	2.6	2	17
2010	8	3	1	20
2011	8.1	3	2	17
2012	9	3.4	3	19

N = 140
Source: Field Survey Data, 2014

The essence of Table nine is to show the changes in maize yields levels over the five year period, notably 2008 before the introduction of the fertilizer subsidy programme and then each year after the implementation of the programme. This was necessary in order to observe other factors that could have led to increases in maize yields other than the fertilizer subsidy programme. A study of yields for the five-year period will enable the researcher to distinguish between the contribution of factors such as good rainfall and that of the subsidy programme.

Table nine of this study also revealed that there was a steady increase in yields of respondents throughout the period of the fertilizer subsidy. The mean yield before the introduction of the fertilizer subsidy was 3.2 maxi-bags with the minimum and maximum number of bags standing at one and 10 respectively.

The mean yield for 2009 was 6.6 maxi-bags as against 3.2 maxi-bags for the previous year representing an increment of 106%. This can be attributed to the fertilizer subsidy or some other factors which have not been included in the study. Also the maximum yield for the 2009 season was 17 maxi-bags with a minimum yield of 2 maxi-bags. The standard deviation in yield for 2009 was 2.6, indicating that there was some variation in yield among the respondents. This could be due to differential application rates attributable to affordability issues which compel some respondents to apply fertilizer sparingly.

In 2010, an average yield of eight maxi-bags was recorded which was an increase of 2 maxi-bags over that of 2009 farming season. Appendix 5 shows that out of the 92 respondents who provided yields for 2010, 47% had

yields from between 5-10 maxi-bags which were increments over that of 2009 in which 40.8% of 84 respondents recorded yields from between 5-10 maxi-bags. The increment was therefore above that of 2009 both in absolute and relative terms. There was also an increment in the number of respondents who were able to achieve yields of between 11-13 maxi bags. In 2009, only five respondents had yields of between11-13 maxi-bags while in 2010 11 respondents recorded this yield level. Also one respondent each recorded yields of between 17-19 maxi-bags and 20-22maxi-bags, showing a remarkable improvement over the previous years.

The year 2011 portrayed an even higher improvement over 2009 and 2010. During this year 60.7% of 113 respondents were able to provide yield figures that fall between 5-10 maxi-bags which were over and above that of the previous year (Appendix 5). The average yield however remained virtually the same as 2010 since it was only 0.1 maxi-bags above that of 2010. The minimum yield was 2 maxi-bags per acre with the maximum yield being 17 maxi-bags. This year recorded a rather high standard deviation of 3.0 which meant that there was a wide variation in the yields of the respondents.

For the 2012 season, almost all respondents, 97.8%, were able to provide information on their yields. The distribution of respondents by yield levels was 7.8% for ≤ 4 maxi-bags, 84.3% for between 5-13 maxi-bags, 4.3% for between 14-16 maxi-bags and 1.4% for between 17-19 maxi-bags.(Appendix 5). There was an increase of 1 maxi-bag in the mean yield over that of 2011, a standard deviation of 3.4 with minimum and maximum yields standing at three maxi- bags and 18 maxi-bags respectively. This wide range of variation in yield could have either been due to how well some

respondents used fertilizer over others or difference in rainfall pattern in the two districts. On the average there was an appreciable performance in the yields of respondents as some respondents were able to record as high as 20 maxi-bags per acre in 2010.

Comparison of yield of maize of respondents before and after the fertilizer subsidy programme

Table 10 provides the dependent sample t-tests for farmers' yields before (2008) and after (2012) the FSP. Data from Table 10 clearly indicates that there was a statistical significant difference (0.000) between the mean yields of maize of respondents in the years 2008 and 2009. This is because the yields and standard deviation of yields in 2008 stood at 3.1 and 1.5 respectively as against 6.7 and 2.7 respectively in 2009. The mean difference yield level was therefore 3.6. The standard deviation of 2.7 in 2009 demonstrates that there was a bit of variation in the yield levels of beneficiaries which might be due to differential fertilizer application rates or rainfall pattern.

Similarly, there was a statistical significant difference (0.000) in the yields of maize between the 2008 and 2010 farming seasons as shown by the 2008 mean yield of 3.1maxi-bags and a mean yield of 8 maxi-bags. There was an improvement in the yield of 2010 above the previous year which resulted in an additional 1.3 maxi-bags and a standard deviation of 3 which is indicative of some variation in the yield levels of respondents.

Table 10 also depicts that there were also statistical significant (0.000) differences between the mean yields of maize of respondents in 2011($\bar{x}$=8.1,

SD=3.0) and (x=9.0, SD=3.3) in 2012. The wide standard deviation could however be explained by the fact that some farmers were able to plant earlier than others and were therefore able to obtain good yields as against the late planters.

Mean yields were computed for the period 2008 to 2012 after the introduction of the fertilizer subsidy programme and an average of 7.1 maxi-bags per acre was realized which showed an average increase of 4.0 maxi-bags per acre over that of 2008. The dependent samples t-test therefore elucidates that there were statistically significant differences (0.000) between the mean yields of respondents before (x=3.1, SD=1.5) and after (x=7.1, SD= 1.8) the coming into being of the fertilizer subsidy programme. This finding has therefore provided the grounds for the first null hypothesis which stated that there is no significant difference between the yields of respondents before and after the fertilizer subsidy programme to be rejected. This has adequately demonstrated that there was a steady increase in the mean yields of maize except for 2011 when there was a very negligible increase in yield from 8 maxi-bags per acre to 8.1 maxi-bags per acre.

Table 10: Dependent (paired sample) t-test of estimated yield of maize of respondents before and after the fertilizer subsidy programme

Years	n	x yield bags/acre	SD	MD	t-ratio	Sig.
2008	86	3.1	1.5	3.6	16.26	.000
2009	86	6.7	2.7			
2008	92	3.1	1.5	4.6	18.74	.000
2010	92	8.0	3.0			
2008	115	3.1	2.0	4.8	21.26	.000
2011	115	8.1	3.0			
2008	138	3.1	1.5	5.8	23.54	.000
2012	138	9.0	3.3			

*p< 0.05 n=140, Source: Field Survey Data, 2014

Respondents' perceived levels of participation and satisfaction with the fertilizer subsidy programme

Participation of beneficiaries in the planning, designing and implementation of interventions such as fertilizer subsidies inculcates in the beneficiaries a feeling of ownership which in turn enhances participation in the programme which objective three seeks to accomplish. Issues considered under participation included unit of sale, types of fertilizers, time of delivery, selection of agents and distributors as well as identification of beneficiaries. On satisfaction, similar issues were considered as under participation but included farmer registration, monitoring and evaluation, transaction cost and location of agents which is good proxy for travel distance.

The data displayed in Table 11 shows a summary of the level of participation of beneficiaries in the fertilizer subsidy programme. Results indicate that participation in the determination of the unit of sale and types of

fertilizer to be included was low with means of 2.3 and 2.1 respectively on a Likert scale of one to five. As regards participation in issues like quantity of fertilizer, time of delivery, identification of beneficiaries, price negotiation, complementary interventions, and selection of agents and distributors, there was very low participation with mean ratings of 1.22-1.62. There was however, very little variation in their perception in these areas as shown by the standard deviations which ranged from 0.47 to 0.85. The overall mean rating for the level of participation is therefore considered very low, 1.55, and very minimal variation in beneficiaries' perception as indicated by a standard deviation of 0.42.

Table 11: Mean perceived level of participation of respondents in the fertilizer subsidy programme

Items of participation	n	$\bar{X}$	SD
Determination of unit of sale	140	2.30	1.10
Deciding the types of fertilizers	140	2.10	1.21
Quantity of fertilizer	140	1.62	0.85
Determining time of delivery of fertilizer	140	1.34	o.62
Identification of beneficiaries	140	1.30	0.69
Decision on complementary services	140	1,30	0.47
Involvement in the selection of agents and distributors	140	1.24	0.56
Participation in price determination	140	1.22	0.53
Weighted mean ($\bar{X}$w)		1.55	0.42

n=140, Source: Field Survey Data, 2014. Scale: 5= Very High, 4= High, 3= Moderate, 2= Low, 1= Very Low
Overall mean= 1.55, SD= 0.42, Range= 1.08

Perceived level of satisfaction of respondents with the fertilizer subsidy programme

On the whole as summarized in Table 12, beneficiaries' perceived level of satisfaction with areas like selection of beneficiaries and the unit of sale were each assessed as satisfactory with a mean rating of 4.0. Results also show that there was a considerable level of variation in their perceptions of the level of satisfaction with SDs of 0.94 and 1.01 respectively.

With issues like monitoring and supervision, farmer registration, affordability and types of fertilizer, the perceived level of satisfaction was moderate with a mean rating ranging from 2.5 to 3.0. There was also considerable level of variation in respondents' perceptions. The rest of the components were said to be dissatisfactory with mean ratings ranging from 2.2 to 2.3. Overall satisfaction was 2.6 with a standard deviation of 0.56 implying a moderate level of satisfaction with views that had very minimal variation.

These findings imply that the level of satisfaction was only moderate and so there needs to be some modifications in the design and implementation modalities to improve upon affordability, availability, and accessibility of subsidized fertilizers. For details of the level of satisfaction of respondents, see Appendix 3.

Table 12: Mean perceived level of satisfaction of the respondents with the fertilizer subsidy programme

Areas of satisfaction	n	$\bar{x}$	SD
Mode of selection of beneficiaries	140	3.8	0.94
The unit of sale of subsidized fertilizers	140	3.5	1.01
Registration of farmers and issue of passbooks	140	3.0	1.33
The extent of monitoring and supervision	140	2.8	1.2
The quantities and types of fertilizers included	138	2.7	1.09
Affordability of subsidized price by farmers	139	2.5	0.92
The extent of transaction costs	139	2.3	1.05
Availability of complementary services	140	2.3	1.18
Time of delivery of subsidized fertilizers	136	2.2	1.1
Method of determining the subsidized price	140	2.2	1.1
The location of agents and distributors	140	2.2	1.2
Travel distance covered by farmers	138	2.0	1.23
Weighted mean ($\bar{x}$w)		2.63	0.56

n= 140**,**
Source: Field Survey Data, 2014**.**
Scale: 5=Very satisfied4= Satisfied, 3= moderately satisfied, 2= Dissatisfied, 1= Very dissatisfied

Perceived strengths of the FSP

Objective four sought to find out what the weaknesses and strengths of the fertilizer subsidy were and how to overcome them. Table 13 therefore depicts the various strengths of the fertilizer subsidy programme as perceived by the beneficiaries. These perceived strengths are arranged in a descending order according to the number of respondents and the corresponding

percentages against each of them. It can be deduced from the table that increase in maize yields was considered the main strength of the fertilizer subsidy programme with70 percent of them who expressed that concern.

Farmer registration and issue of pass books and increased fertilizer use followed with (57.1%) and (44.3%) respondents rating them as the second and third strongest components of the FSP. During data collection, a good number of respondents were appreciative of the farmer registration and issue of pass books which gave them entitlement to the subsidized fertilizer. The ratings outlined in Table 13 does not include other components of the programme such as reduction of poverty, complementary services, reduction of credit needs, and lack of government involvement which were perceived by a few respondents as strengths of the fertilizer subsidy programme. Increase of quantity of fertilizer available to farmers during the fertilizer subsidy was perceived by twenty-six percent of the respondents as one of the strengths. This is however, a very contentious issue because a lot of evaluations revealed that there were shortages of subsidized fertilizer nationwide during the fertilizer subsidy. For example, Banful (2008) reported that there was widespread shortage of the subsidized fertilizers especially sulphate of ammonia, 23:10:05 and urea. In all the districts visited, there was no unsubsidized fertilizer available for sale.

Table 13: Frequency distribution of the strengths of the subsidy programme

Major strengths of the FSP	f	%
It increased maize yields	98	70
Entitlement through farmer registration	80	57
It enhanced adoption of fertilizer	62	44
It increased fertilizer use per acre	42	30
Quantity of fertilizer available to farmers increased.	37	26

N=140, Source: Field Survey Data, 2014. (Multiple Responses)

Major weaknesses of the fertilizer subsidy programme and proposed measures to remedy the weaknesses as perceived by beneficiaries Objective four continues to find measures that can be put in place to remedy the shortfalls of the fertilizer subsidy programme. Despite high subsidy rates of fertilizer alongside the increases in fertilizer use per acre as well as increases in the yields of maize in the study area, respondents indicated that some constraints prevented them from taking advantage of the full potential of the use of fertilizer through the subsidy. The major problems and suggested solutions are presented in Tables 14 and 15 respectively. These constraints are presented in a decreasing order as found in Table 14 according to the beneficiaries' perceptions.

With reference to Table 14 the three main weaknesses of the subsidy programme were shortages of subsidized fertilizer, inadequate market for increased maize due to the subsidy and long distances beneficiaries travel in order to have access to subsidized fertilizer.

Table14: Frequency distribution of respondents' perceived constraints/ weaknesses of the FSP

Major constraints/weaknesses of FSP	f	%
No rigorous estimation of fertilizer quantities needed	86	61.4
Long distances travelled by beneficiaries	85	60.7
No ready markets for produce at appreciable prices	80	57.1
Inadequate number of agents and distributors	71	50.7
Subsidized prices are still too high.	65	46.4
Late delivery of subsidized fertilizer	60	42.8
Small coverage of registration exercise	54	38.5
Irregular supply of subsidized fertilizer	48	34.2
Leakages of subsidized fertilizers to non-beneficiaries	30	21.4

n=140, Source: Field Survey Data, 2014.(Multiple Responses)

The percentages of respondents who perceived these areas as problems were 61.4percent, 60.7percent and 57.1percent respectively. Respondents also considered inadequate number of fertilizer agents which is a good proxy for long travel distance, high price of fertilizer despite the subsidy, and late arrival of subsidized fertilizer which were perceived by 50.7percent, 46.4percent, and 42.8 percent respectively as serious challenges of the programme.

The main problem that beneficiaries had to contend with is therefore the uneven distribution network which leads to long travel distances, few agents, high prices as well as late arrival of fertilizers. According to Fontainne & Sindzingre (1991), fertilizer availability means getting the right fertilizer to the right place at the right time. They went further to emphasize that these conditions are at least as important as price-response interactions in

determining fertilizer use and if not observed critically can compromise the effectiveness of any fertilizer subsidy. Banful (2009) reports that the total prices of fertilizer during the 2008 programme period as negotiated by the government and importers were in most cases significantly higher than the market prices prevailing immediately prior to the launch of the programme. For instance, in Kumasi NPK 15:15:15 was sold for GHS 35.00 in June 2008 whereas negotiated prices for July- December were GHS 50.50 and GHS 51.50 respectively.

Another problem encountered by beneficiaries of the fertilizer subsidy programme was the registration of farmers to give them entitlement to the subsidized fertilizer by way of pass books. The registration, according to the beneficiaries, was limited to the district capitals and communities around the District capitals, thus denying farmers in the hinterlands the right to benefit from the subsidy. Banful (2010) found out from her study of Ghana's fertilizer subsidy programme that some farmers could not register to acquire pass books because they did not know the operational areas they belonged to. This is because the AEAs did the registration for only farmers who were within their operational areas and so a farmer needed to know his/her operational area.

The data from Table 14 indicate that some other farmers complained of irregularity in the supply of fertilizer as well as leakages of subsidized fertilizer to unintended beneficiaries due to poor targeting mechanism. On the issue of irregularity of fertilizer supply, Yawson et al. (2010) declared that fertilizer was not available to farmers during the planting season when it was most needed. In fact they indicated respondents' worry that there was no subsidized fertilizer during the planting time, which was the most critical time

for fertilizer application to them. This was the ordeal the farmers in the study area had to contend with.

To overcome these challenges, the following recommendations have been suggested by respondents in Table 15.

Table 15: Suggestions for solving some of the problems of the fertilizer subsidy programme

Suggested solutions to the problems of the Fertilizer Subsidy Programme	f	%
Further reduction in the subsidized price of fertilizer.	69	49.3
Favourable and ready market for the increased maize produce.	26	18.6
Time of arrival of subsidized fertilizer should early before the planting season.	25	17.9
Number of agents and distributors should be increased.	17	12.1
Beneficiaries must be consulted on the quantities and types of fertilizer to be included in the programme.	17	12.1
The distribution network of subsidized fertilizer needs to be improved to reach the farming communities.	11	7.9
Fertilizer supply should be regular throughout the country.	8	5.7
Tractor services and other complementary services must be part of the programme.	5	3.6
Registration and issue of passbooks should be more widespread.	4	3.0
The subsidy needs to be in progress all year round.	4	3.0
Some beneficiaries recommended the maintenance of the programme.	3	2.1
The programme must ensure uniform prices of subsidized fertilizer throughout the country.	2	1.4
Some farmers suggested that Farmer-Based Organizations should be watchdogs of the FSP.	2	1.4

Source: Field Survey Data, n= 140 (Multiple Responses)

Comparisons of mean levels of participation, mean levels of satisfaction as well as perceived level of effectiveness of the FSP by districts

Objective five of the study was meant to compare the perceived level of the effectiveness as well as the level of participation and satisfaction with the FSP. An independent sample t-test was therefore computed to compare the level of participation, satisfaction and effectiveness of respondents from the two districts. Table 16showsthe means and standard deviations of the respondents' level of participation, satisfaction as well as their perceived level of effectiveness of the subsidy programme.

The means and standard deviations show that respondents from Sene West and Sene East view the level of participation as very low with very little variation in their views ($\bar{X}= 1.5,\ SD = 0.48$) and ($\bar{X}$=1.6, SD=0.28) respectively. This outcome indicates that there was no difference between the levels of participation between respondents from both Sene-East and Sene-West. However, respondents from both Sene East and Sene West viewed the level of participation as very low in terms of the determination of prices as well as the number of agents and distributors.

According to the World Bank (1996), participation of beneficiaries in programmes like the FSP increases farmers' ownership of programmes. This then makes agricultural programmes more responsive to beneficiaries' needs which in turn ensure more effective and more sustainable programmes. The low level of participation therefore reduces the effectiveness of the FSP.

Table 16: An independent sample t-test on the levels of participation, satisfaction and perceived level of effectiveness by districts

Sub-score	District	n	Mean	SD	Mean Difference	t-(2-tailed)	Sig.
Perceived level of participation	S. West	100	1.5	0.48	-0.14	1.77	0.78
	S. East	40	1.65	0.28			
Perceived level of satisfaction	S. West	100	2.76	0.65	0.46	4.26	0.000
	S. East	40	2.3	0.36			
Perceived level of effectiveness	S. West	100	2.9	0.75	0.73	5.72	0.000
	S. East	40	2.16	0.44			

P< 0.05 Source: Field Survey Data, 2014

Rating scales: For mean participation: 1=Very low, 2=Low, 3=Moderate, 4=High, 5=Very high

For level satisfaction: 1= Very dissatisfied, 2=Dissatisfied, 3=Moderate, 4=Satisfied, 5=Very satisfied

For mean effectiveness: 1= Very ineffective, 2=Ineffective, 3=somewhat effective, 4=Effective, 5=Very effective

Source: Field Survey Data, 2014.

The level of satisfaction of respondents in Sene West was ($\bar{X}= 2.76, SD = 0.65$) as against ($\bar{X}$=2.3, SD=0.36) for those of Sene-East.The mean value for the level of satisfaction of respondents of Sene West was higher than those of the Sene East, suggesting that respondents in Sene-West were more satisfied than those of Sene- East. This finding sounds rational in the sense that Sene-East was quite far from the district capital of

Sene-West where the fertilizer agents were located, thus limiting their level of satisfaction.

As far as the perceived level of the effectiveness of the fertilizer subsidy programme was concerned, respondents in Sene West perceived the fertilizer subsidy programme to be slightly more effective than respondents in Sene East. The mean perception of respondents from Sene- West was 2.90 as against 2.16 for respondents from Sene- East.

The independent samples t-test computed indicated that there was no statistically significant(Sig. 0.78) difference between the perception of respondents from both Sene-West and Sene- East with regards to the level of participation in the fertilizer subsidy programme at 0.05 alpha levels. This implies that the level of participation was similar for beneficiaries from both districts.

For the level of satisfaction and the perceived level of the effectiveness of the subsidy programme, the Independent t-tests show that there were significant differences(Sig=0.000)between the perceptions of respondents from the two districts with regards to their perceptions of the effectiveness, and their levels of satisfaction with the fertilizer subsidy programme.

The third hypothesis stated that there was no significant difference between the perceptions of respondents about the level of effectiveness of the fertilizer subsidy programme by respondents from both Sene-East and Sene-West Districts. The fourth hypothesis also states that there were no significant differences between the level of satisfaction with the FSP by respondents from Sene-East and Sene-West. In both cases the Null hypothesis were rejected and the Alternatives accepted.

Comparisons of mean levels of participation, mean levels of satisfaction as well as perceived level of effectiveness of the FSP by sex

Objective five of this study seeks further to make a comparison of male and female beneficiaries' perceptions about the level of participation, level of satisfaction as well as perceived level of effectiveness of the FSP. Another independent samples t-test was therefore carried out to compare the level of participation, the level of satisfaction as well as the perceived level of effectiveness of the fertilizer subsidy programme by male and female beneficiaries. From Table 17, the independent samples t-test at 0.05 alpha levels revealed statistically significant values in the perceptions of males and females with regards to level of participation, level of satisfaction, and perceived level of the effectiveness of the fertilizer subsidy programme. The means for females were higher than those for males except for the level of satisfaction where the mean of males was higher than that of females. An interesting observation was that there were no significant statistical differences between male and female respondents concerning the effectiveness of the fertilizer subsidy programme.

The independent samples t-test exhibited in Table 17 showed that there was a Sig. value of (0.79) at an alpha level of 0.05 showing that there was no significant difference in the perceptions of male and female respondents about the effectiveness of the fertilizer subsidy programme. We therefore fail to reject the null hypothesis of the second hypothesis which states that there is no significant difference between the perceptions of males and females of the effectiveness of the fertilizer subsidy. The implication is that the null hypothesis was true. The results of this study is at variance with the finding of

Nelson (1981) cited in Bosompem (2006) which argued that programmes that are effective for males do not translate automatically into effective programmes for females. The fact that both male and female participants perceived the FSP as effective means that the FSP has a bright future since both male and female farmers will participate in it.

The seemingly equal perceptions of male and female respondents about the effectiveness of the subsidy programme is consistent with the finding of Banful (2008)when the research discovered that there packaging of subsidized fertilizer enhanced affordability by almost all categories of farmers, especially female

Table 17: An independent sampled t-test on the levels of participation, satisfaction and perceived level of effectiveness by sex

Sub-score	Sex	n	Mean	SD	MD	t-ratio	Sig.
Perceived level of participation	Male	113	1.54	0.44	-0.01	-0.109	0.91
	Female	27	1.55	0.42			
Perceived level of satisfaction	Male	113	2.64	0.62	0.11	0.84	0.40
	Female	27	2.53	0.60			
Perceived level of effectiveness	Male	113	2.68	0.36	-0.04	-0.26	0.79
	Female	27	2.72	0.54			

P< 0.05 Source: Field Survey Data, 2014
Rating scales: For mean participation: 1=Very low, 2=Low, 3=Moderate, 4=High, 5=Very high
For level satisfaction: 1= Very dissatisfied, 2=Dissatisfied, 3= Moderate, 4=Satisfied, 5=Very satisfied
For mean effectiveness: 1= Very ineffective, 2=Ineffective, 3=somewhat effective, 4=Effective, 5=Very effective
Source: Field Survey Data, 2014.

From Table 17, the independent samples t-test at 0.05 alpha levels also revealed that there was a statistical significant value of 0.91in the perceptions of males and females with regards to levels of participation while the level of satisfaction showed statistical significant value of 0.40 at an alpha level of 0.05 These significant values reveal that there were no significant differences between the perceptions of male and female respondents in the level of participation and satisfaction. The mean perception of the level of participation by female respondents was 1.55 while that of male respondents was 1.54 meaning that the perception of female respondents about the level of participation in the programme was higher than that of male perception. On the other, the perceived level of satisfaction of males (2.64) was higher than female level of satisfaction (2.53). However the revelation of the independent samples t-test shows that there were no significant differences in the male and female respondents' perceptions about the level of participation, satisfaction as well as the overall effectiveness of the FSP.

The level of availability of subsidized fertilizer to respondents

The availability of subsidized fertilizer to beneficiaries is a prerequisite for ensuring the effectiveness of the fertilizer subsidy programme as is required of objective six of this study. The availability of subsidized fertilizer was assessed on the basis of five domains as follows:

a. Quantities of subsidized fertilizer at beneficiaries' disposal
b. Travel distance in order to access subsidized fertilizer
c. Time of delivery of subsidized fertilizer to beneficiaries
d. Distribution network for subsidized fertilizer
e. Suitability of types of fertilizer include in the programme

Table 18: Mean perceived level of availability of subsidized fertilizer to respondents

Availability	n	$\bar{x}$	SD
Suitability of types of fertilizers included	140	2.9	0.9
Quantities of fertilizers available to respondents	140	2.8	1.1
Reduced travel distance by respondents	140	2.3	1.3
Distribution network for subsidized fertilizers	139	2.3	1.2
Time of delivery of subsidized fertilizers	139	2.2	1.2
Weighted mean ($\bar{x}$w)		2.4	0.9

N= 140, Source: Owners' Construct

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

General Overview

This chapter deals with the summary, conclusions and recommendations of the study based on the findings. Suggestions are then made for future research direction which will be contingent on the gaps that were observed in the research.

Summary

The study examined the overall effectiveness of the fertilizer subsidy programme in terms of accessibility, availability, affordability as well as the use of subsidized fertilizer under the fertilizer subsidy programme. The study was undertaken in the Sene West and Sene East Districts of the Brong Ahafo Region of Ghana. In specific terms the research delved into the following areas:

1. Describe the demographic and socio-economic characteristics of participating farmers in terms of sex, age, formal education, household size, land holding size, years of farming experience, and sources of extension services.
2. Compare the yields and production levels of maize before and after the fertilizer subsidy.
3. Examine the level of participation and satisfaction of respondents about the Fertilizer Subsidy Proramme.
4. Find out farmers' perceptions about the problems and strengths of the programme and how the problems can be solved.

5. Compare the perceived effectiveness of the fertilizer subsidy programme between males and females as well as between farmers from Sene-East and West Districts.
6. Determine the overall effectiveness of the fertilizer subsidy programme in terms of accessibility, availability, affordability, and use of subsidized fertilizer.

The role of agriculture in the economic development of Ghana cannot be overemphasized. The sector is however faced with a lot of constraints including insufficient and erratic rainfall, soil fertility decline coupled with high prices of agricultural inputs especially fertilizers and unfavorable marketing of farm produce. The sky-rocketing prices of food items and inorganic fertilizer together with the aforementioned problems brought the fertilizer subsidy programme into being in 2008. The essence of this research was therefore meant to address some of the shortfalls of earlier evaluations which fell short of the views of beneficiaries about the fertilizer subsidy in the study area. It is hoped that the findings of this study will be useful to government, NGOs and other stakeholders involved in the distribution and retail of fertilizers to improve upon the design and implementation modalities for future fertilizer subsidy programmes.

The two districts were purposively selected because they were considered remote and far away from the rest of the districts in the Brong Ahafo region and therefore neglected by earlier programme evaluations. Another reason was for ease of Data collection since the researcher works in the District.

This study used a descriptive-survey design. A proportionate stratified random sample of 140 beneficiary farmers was selected for the study. A validated researcher-designed interview schedule was used to collect the required information from farmers. To measure the individual perceptions more accurately, Likert-type scale was used to gather farmers' attitudes and perceptions. Data was then coded and analysed using Statistical Product for Services Solutions (SPSS). Frequencies, percentages, means, and standard deviations were computed to describe the nature of the data.

Independent samples t-tests were computed to compare any significant differences between means across selected groups that is, between the two districts, and between males and females in terms of level of participation, level of satisfaction perceived effectiveness of the fertilizer subsidy programme. A dependent (paired) samples t-test was also computed to compare yield level of respondents before the subsidy and after the introduction of the fertilizer subsidy programme.

Farmers' demographic and socio-economic characteristics

Majority of the sampled beneficiaries (80.7%) were males. Female beneficiaries constituted 19.3% of the total sampled beneficiaries. In general, respondents within the age groups of 26-34years and 35-45years constituted the bulk of respondents representing 35.7percent and 37.9 percent respectively. The mean age of farmers was 38.5.

Generally, educational qualification is very low in the study area. The results also reveal that a total of 31 percent of the respondents have no formal education while 30 percent farmers had education up to JHS level and 19

percent completed only primary school. Mean household size for the respondents was seven with a standard deviation of 5.9 which is indicative of a wide variation in the number of persons per household.

Forty -four percent of respondents were reported to cultivate holdings of four acres. Mean land holding size was 3.5 acres with a standard deviation of 1.17. Five respondents cultivated one acre each while nineteen respondents cultivated five acres each. More than 37.1 percent had at least 15 years of farming experience. The mean farming experience was 11.7 with a standard deviation of 11.32 implying that there was a great variation in the years of farming experience among farmers.

The results also revealed that before the implementation of FSP 84.2 percent of farmers interviewed had four bags of maize or less per acre of land. About 14.9 percent of farmers interviewed had yields more than four bags per acre of land. The mean yield was 3.1 bags per acre. The yield trend of beneficiaries indicated that there was a steady increase in their yields as the years went by. After the introduction of the subsidy, there was a gradual increase in yields except for 2011 when there was only an increase of 0.1 maxi-bags per acre. Observed statistical significant differences also existed between mean yields of 2008 ($\bar{X}$=3.1, SD=1.5) and that of the overall average of the five years (2009 to 2013) ($\bar{X}$=7.1 SD=1.8) after the introduction of the programme. The trend showed a significant improvement in the yields of maize farmers after the implementation of the FSP.

Respondents' perception of level of participation in the Fertilizer Subsidy Programme

Results of the study reveal that the level of beneficiaries' participation in areas such as participation in deciding the quantity of fertilizers, time of delivery, identification of beneficiaries, and price negotiation was either low or very low ($\bar{X}$=1.22 to 1.62). Results also show that there was very little variation in their perceptions of their level of participation in the indicated activities with standard deviations ranging from 0.47 to 0.85. With respect to farmers' participation in the determination of the unit of sale and types of fertilizer was low in these areas with mean rating of ($\bar{X}$=2.10-2.30). However, farmers' opinions varied substantially on these two domains with SD=1.10 for determination of unit of sale, and types of fertilizers with SD of 1.21 organization.

Beneficiaries' perceptions of level of satisfaction with the Fertilizer Subsidy Programme

Respondents' rated their level of satisfaction with the fertilizer subsidy from 2.5 to 3 8 which is moderately satisfied to satisfied. This rating was with regards to types and quantities of fertilizer and the method of select in beneficiaries. Other issues like price negotiation, location of agents and distributors as well as the availability of complementary interventions were rated between 2.2- 2.3 which is considered unsatisfactory. Overall mean rating for degree of satisfaction with technologies was 2.63 with little variation in their perceptions, SD=0.56.

Beneficiaries' perceptions of the effectiveness of the Fertilizer Subsidy Programme

Results from the survey indicate that the effectiveness of the fertilizer subsidy programme was perceived as being effective as far as equity of male and female access to subsidized fertilizer was concerned with a rating of 3.6 which is almost 4 and so considered effective.

For aspects of the subsidy such as travel distance, delivery time, location of agents, affordability, and transaction costs, respondents perceived their level of effectiveness as low, with mean ratings ranging from 2.2 to 2.4. The rest of the domains were considered as somewhat effective (2.5-3.2) while the overall mean rating for the effectiveness was 2.7 with a standard deviation of 0.41.

Strengths, Weaknesses and Suggestions for improvement in the Fertilizer Subsidy Programme

Strengths: The strengths of the fertilizer subsidy programme as found below are arranged in a descending order according to the number of respondents who perceive them as such.

1. Increase in maize yields
2. Entitlement through farmer registration and issue of pass books
3. Increase of adoption rate of fertilizer use
4. Increase of fertilizer use per acre
5. Increase in quantity of fertilizer available to farmers.

Despite the strengths of the programme, there were a number of challenges that the programme faced in its implementation. Farmers' responses

however showed that the major problems that they faced during the programme implementation included; no rigorous estimation of fertilizer quantities (61.4%), long travel distances (60.7%), no well negotiated market for maize produce (57.1%), inadequate distribution network (50.7%) as well as subsidized price which was considered even too high (46.4%) and needed further subsidization.

Other components regarded as problematic during the fertilizer subsidy were late delivery of fertilizer, narrow coverage of the registration exercise, irregular supply and leakages of subsidized fertilizers to non- beneficiaries. Of these, late delivery and narrow coverage were considered more problematic because fertilizer application is time specific and the narrow coverage indirectly neglected farmers in the remote areas who are the rightful beneficiaries of the subsidy.

Based on the observed challenges, respondents made some suggestions as to how the problems could be solved or at least minimized. These included a further reduction in the price of fertilizer, ready market for produce, early fertilizer delivery, improved distribution network and a more rigorous determination of types and quantities of subsidized fertilizers.

Conclusions

Based on the results of the study, conclusions drawn include the following:

The study revealed that majority (77%) of the farmers in the study area was within the economically active age bracket. The minimum and maximum ages were23 years and66 years respectively with an average age of 38.5 years.

Results from the study also revealed that educational standard is very low in the study area since majority of the respondents (80.3%) either had no formal education or a maximum of Middle School Leaving Certificate. As few as 11 (7.7%) had tertiary education.

Furthermore, the study indicated that 42% of the respondents cultivated less than four acres whereas 58% cultivated 4 acres and above with as few as five respondents doing just an acre each.

The respondents in the study area have an average farming experience of 11.7 years with majority of them (54.2%) having a maximum of 10 years farming experience. This confirms the fact that the respondents are in the economically active age group with not very rich farming experience.

Generally the household size of respondents was high, ranging from one to forty-three with a mean of seven. This high household size suggests the availability of enough labour for fertilizer application. This is however dependent on the age distribution within the household.

The results of the study showed that a majority of the respondents (80.3%) were males and the rest being females. This represented a ratio of 1:4 for females and males respectively.

The study also indicated that respondents' participation in the determination of the unit of sale and types of fertilizer to be included was considered low whereas participation in issues like quantity of fertilizer, time of delivery, identification of beneficiaries, price negotiation, complementary interventions, and selection of agents and distributors, there was very low. So participation in the programme as a whole was generally low.

The results of the study showed a variation in the level of satisfaction with the various components. Selection of beneficiaries and the unit of sale were assessed as having a mean of 4.0 and so considered as satisfactory while monitoring and supervision, farmer registration, affordability and types of fertilizer had a mean of 3.0 which is moderate. The overall satisfaction of 2.6 and a standard deviation of 0.56 were neither here nor there and so considered as moderately satisfactory.

Both male and female respondents perceived the effectiveness of the FSP to be moderately effective even though the perception of female respondents was slightly higher than that of the male respondents. However, there was a significant difference between perceived levels of effectiveness of the programme by respondents from the two Districts. The perceptions of respondents from Sene-West about the effectiveness of the FSP were higher than those from Sene-East.

This finding of the study has provided the grounds for the first null hypotheses which stated that there is no significant difference between the yields of respondents before and after the fertilizer subsidy programme to be rejected. This is because the subsidy programme led to an increase in yields of maize to a very appreciable level.

The Fertilizer Subsidy Programme significantly improved the yields of farmers in the study area. The average yields increased by 132.2 % five years after the implementation of the subsidy programme from 3.1 maxi- bags per acre to 7.2 maxi- bags per acre. Analysis of the data revealed that the main strengths of the fertilizer subsidy programme rested on the increase in maize

yields, entitlement through farmer registration as well as improvement in adoption and use of fertilizer.

Information generated from data has demonstrated that the major constraints of the fertilizer subsidy programme included lack of ready market for produce, high price of already subsidized fertilizer, late delivery, and irregular supply of right fertilizer in the right quantities as well as inappropriate distribution network. Suggestions to minimize or solve the problems faced by beneficiaries were further reduction in the subsidized price, early arrival of subsidized fertilizer, improved distribution network of agents and distributors and ready market for increased maize due to the fertilizer subsidy.

Recommendations

Based on the major challenges of the fertilizer subsidy programme, the following recommendations are made in an attempt to address them:

Government and MoFA should allow the beneficiaries and other opinion leaders in the communities to participate in making decisions such as types of fertilizers, selection of fertilizer agents as well as the determination of the prices of subsidized fertilizers.

MoFA and the District Assemblies must endeavor to increase the number of fertilizer agents in the Sene-East District. To further improve widespread distribution of subsidized fertilizers, a differential or spatial transport subsidy could be considered for prospective private entrepreneurs who have the zeal to go into fertilizer distribution. This is because it was one

of the areas which made respondents in Sene-East to perceive the effectiveness as very ineffective

To deal with the problem of late delivery of subsidized fertilizers to beneficiaries which reduces the effectiveness of the programme, Government, Ministry of Finance, and MoFA should initiate early negotiations and early budget approval as well as reimbursement of importers so that the fertilizers are in stock in the regions and districts prior to the planting season.

AEAs should intensify farmer registration and issue of passbooks since it is one of the main strengths of the FSP. Its strength lies in the fact that it is the surest way of giving entitlement to farmers to access the subsidized fertilizer. Taking the low educational background of the respondents into consideration, MoFA has to embark on a massive training and demonstrations. This will help the farmers, who are mostly illiterate to grasp the technical and managerial aspects of the use of subsidized fertilizer.

Government needs to bring on board complementary services like ready market for produce, credit, improved seed and extension services. In particular, future subsidy programmes must as a matter of urgency make provision for access markets at favorable prices for maize produce in order to increase the profitability of the use of subsidized fertilizer.

There was a general consensus that the subsidized price is still not affordable to majority of the respondents which calls for a further subsidization of the already subsidized price. Government should therefore make the subsidy rate consistent and predictable and affordable in order to enhance farmers' ability to save the top-up amount and purchase the fertilizer.

Suggestions for further studies

1. The impact of this study is not conclusive since the scope was limited to the effectiveness of the fertilizer subsidy programme with regards to design and implementation. Consequently, it is suggested that another research be carried out to assess the extent to which the FSP contributed to an improvement in the incomes and overall living standards of beneficiaries.

2. Furthermore, the FSP was implemented in collaboration with other agencies like MoFA, Fertilizer importing companies, and Fertilizer agents and Distributors. However, their views were not taken into consideration during the study. A more comprehensive study should therefore be undertaken to make the study broad-based and more exhaustive.

3. It is also suggested that the study should be repeated in the study area after some time to investigate the trend of achievement of the objectives of the Fertilizer Subsidy Programme.

4. A similar study should be carried out in some other districts in the Brong Ahafo region to find out the extent of conformity of findings from other parts of the region.

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APPENDICES

Appendix A

Structured Interview Schedule for respondents of the fertilizer subsidy programme. Structured Interview Schedule for small scale farmers who benefited from the fertilizer subsidy in the Sene East and west Districts of the Brong Ahafo Region of Ghana

District……..

Community/Town…….

Date of interview……..

Serial Number/code……..

A. Demographic and socio-economic Background.

1. Sex Male [ ] Female [ ]

2. What was your age as at your last birth day (years)? .....

3. What is your marital status?

Married [ ] Single [ ]

4. What is your highest educational qualification?

No formal education [ ]

Primary school [ ]

Middle Sch. / JHS [ ]

Secondary /SHS [ ]

Tertiary [ ]

Others (Specify…… [ ]

5. Kindly state your family size (State the figure)……

B. Farm related characteristics of beneficiary farmers

6. What is the size of your maize farm (in acres).....?

7. For how long have you been farming (in years?).....

8. Where did you get information about the fertilizer subsidy programme? (Tick all that are applicable)

MoFA Office [ ]

Local Radio Stations [ ]

Fertilizer Dealers [ ]

Fellow farmers [ ]

Others (specify) …… [ ]

9. How did you become a beneficiary?

Selected by Agricultural Extension Agents [ ]

Selected by local leaders [ ]

Self-volunteered [ ]

Selected by subsidy programme officials [ ]

Others (specify)…….. [ ]

10. A. Did you get the amount of fertilizer that you required?

[ ] Yes [ ] No

If yes, use the following four-point Likert scale to indicate how often you had your desired amount of fertilizer.

Always [ ]

Most of the time [ ]

Sometimes [ ]

Rarely [ ]

Never [ ]

10. B. If never, give reasons why you couldn't get…….

……

……..

11. A. In your opinion, has the fertilizer subsidy brought about any increase in crop yields?

Yes [ ] No [ ]

11. B. If yes in 11A, indicate your yield before and after the fertilizer subsidy programme.

Farming Season	**Crop (Maize)**	**Yield before (maxi bags/acre)**	**Yield after (maxi bags/acre)**
2009			
2010			
2011			
2012			
2013			

12. Do you have access to education and demonstrations of the use of fertilizers ? Yes [ ] No [ ]

13. What are the sources of agricultural extension services for your maize enterprise? (Tick all those that apply).

Agricultural Extension agents [ ]

Fellow farmers [ ]

Non-Governmental Organizations [ ]

Farmer-Based Organizations [ ]

Others (Specify)…… [ ]

14. To whom do you sell your farm maize produce? (Tick all that apply)

Local traders [ ]

Government Agencies (Name them) [ ]

…….

Cooperative societies (Name them)

……

Others (Specify)……..……

NGOs [ ]

15. Are you satisfied with the price they pay you? Use the five-point Likert scale options provided to indicate your level of satisfaction by ticking √ in the box of your choice.

VS = Very satisfied, [ ]

S = Satisfied, [ ]

N = Neutral, [ ]

D =Dissatisfied, [ ]

VD = Very dissatisfied [ ].

16. When do you usually sell your farm produce?

Immediately after harvest [ ]

Stored and sold later [ ]

Both [ ]

Harvested fresh [ ]

C. The level of beneficiaries' knowledge about the importance and use of fertilizers.

17. Some aspects of the fertilizer subsidy programme are listed below. Provide your knowledge level of each of the aspects.

Use the four-point Likert scale for your responses. Tick [√] in the corresponding boxes provided.

4= Very knowledgeable about (VK), 3= Knowledgeable about (K), 2= Somewhat knowledgeable about (SK), 1= Not knowledgeable about (NK):

Aspect	**VK**	**K**	**SK**	**NK**
Awareness of the existence of the programme				
The economic importance of fertilizer				
Knowledge of the right application of fertilizer				

D. Perceptions about the level of participation by beneficiaries in the programme.

18. Various components of the fertilizer subsidy programme are provided below. Indicate your level participation in each component.

Use the five-point Likert scale for your responses. Tick [√] in the corresponding boxes provided.

5= Very high (VH) 4= High (H) 3= Moderate (H) 2= Low (L) 1= Very low (VL):

Component of subsidy	**VH**	**H**	**M**	**L**	**VL**
To what extent were you consulted on the quantity of fertilizer you will use in the season?					

What was your level of involvement in determining the time of fertilizer delivery?					
To what extent were you involved in the identification of beneficiaries?					
To what extent were you involved in negotiating the price of the subsidized fertilizer?					
How convenient was the unit of sale of fertilizer for your maize farm?					
What was your level of participation in deciding the types of fertilizers for your farm?					
To what extent were you involved in the selection of agents/retailers of fertilizer?					
What was your level of involvement in determining complementary services to augment the subsidy programme.					

E. Perceptions of beneficiaries on the effectiveness of the various components of the fertilizer subsidy programme.

19. Various components of the fertilizer subsidy have been provided in the table below. Indicate your views about the effectiveness of each of them using the five-point Likert scale responses provided. Tick [√] in the corresponding boxes provided.

5=Very Effective (VE), 4= Effective (E), 3= somewhat effective (SE), 2= Ineffective (I),

1= Very ineffective (VI).

Component	**VE**	**E**	**SE**	**I**	**VI**
Selection of distributors and retailers was open all persons with the potential for fertilizer distribution.					
Units of sale of subsidized fertilizers were suitable for all categories of farmers.					
The subsidy rate is fixed and well-defined and so does not vary.					
All farmers were registered and given passbooks which gives them entitlement to subsidized fertilizer.					
Provision of complementary services like extension services, improved seed, and credit to support the subsidy.					
The application of restrictions to limit leakages to non-beneficiaries.					
Quantities of fertilizer available to farmers have increased.					
Reduction in the distance between fertilizer depots and retail shops and the farm-gate.					
Delivery of subsidized fertilizer to farmers early enough, before the planting season.					

The price of the subsidized fertilizer was affordable for farmers during the subsidy.					
Maintaining the transaction costs of acquiring subsidized fertilizers to the barest minimum.					
Providing farmers with the right choice of fertilizers for their farms.					
Ensuring that the numbers and location of agents and distributors of subsidized fertilizers convenient to farmers.					
Equality of access to subsidized fertilizer by males and females.					

20. To what extent has the fertilizer subsidy programme been able to meet the following objectives contained in the fertilizer subsidy policy document?

Use the Likert scale responses given to indicate your opinion accordingly.

5= Avery large extent (VE), 4= Appreciable extent (AE), 3= Minimal extent (ME), 2= little extent (LE), 1= Never met objectives (NO):

Objectives	**VE**	**AE**	**ME**	**LE**	**NO**
Increasing the production level of major crops (maize).					
Maintaining fertilizer prices at the 2007 levels					
Making the subsidized fertilizer available to small scale farmers.					

F. Farmers' level of satisfaction with the various components of the subsidy programme.

21. Below are the components of the fertilizer subsidy programme. For each of the components, indicate the level of your satisfaction about each component. Use the following five-point scale for level of satisfaction:

5=Very satisfied (VS) 4=Satisfied (S) 3=Neutral (N) 2=Dissatisfied (D) 1=Very dissatisfied (VD):

Component	**VS**	**S**	**N**	**D**	**VD**
Method of selection of beneficiaries by agricultural extension agents.					
Determination of the price of subsidized fertilizer by Government and importers only.					
Packaging of subsidized fertilizer in 50kg bags as well as in the American tin, the "olonka".					
Locating fertilizer distributors and agents mostly in the district and regional capitals.					
The extent of monitoring and supervision of distributors to ensure that they sell subsidized fertilizers at the right prices.					
The distance you travel to purchase subsidized fertilizer?					
The use of registration and issue of passbooks to farmers as a means of giving them entitlement to subsidized fertilizer.					
The level of the affordability of the subsidized					

fertilizer by beneficiaries.					
The extent of transaction costs in purchasing the subsidized fertilizer					
Time of delivery of subsidized fertilizer to farmers.					
The quantities of the various kinds of fertilizer received during the farming season.					
The level of complementary interventions within the subsidy programme to augment the subsidy.					

G. Farmers' perceptions about the strengths and weaknesses of the fertilizer subsidy programme.

22. Below are some statements about the fertilizer subsidy programme. Rate these statements using the 5-point rating scale provided by ticking [√] in the appropriate box to indicate your level of agreement with each of the statements. Note that 5 represents the highest level of agreement while 1 represents the lowest level of agreement.

Statements	5	4	3	2	1
There has been an increase in the yield of maize.					
The subsidy has enhanced my adoption and use of fertilizer thereby increasing agricultural productivity.					
Fertilizer use has increased among my fellow farmers.					
The subsidy has reduced the credit needs of farmers.					
Poverty level of my household has reduced.					

The subsidy included improved seed which is responsive to fertilizer.					
Agric. Extension Agents were used to register farmers in their operational areas.					
Government was not involved in the importation and distribution of subsidized fertilizers.					
There was no restriction in the number of bags of fertilizer per farmer.					
The price for the subsidized fertilizer was too high.					
A lot of farmers have to travel long distances to purchase subsidized fertilizer.					
Subsidized fertilizers arrive late.					
The number of agents and distributors was inadequate.					
There were a lot of leakages of subsidized fertilizer to non-beneficiaries.					
The supply of subsidized fertilizer was irregular.					
There were a lot of unregistered farmers without passbooks.					
There was no market arrangement for the increased yield.					
Farmers were not involved in the estimation of the quantities of fertilizers for the season.					
There wasn't sufficient monitoring and supervision of agents and distributors.					

23. Suggest some measures you think when put in place can help deal with the weaknesses mentioned in Q 22 to bring about an improvement in the programme.

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Appendix B

Frequency Distribution of the perceptions of beneficiaries of the effectiveness of the Fertilizer Subsidy Programme

Components of the Fertilizer Subsidy Programme	**VE**		**E**		**SE**		**I**		**VI**	
	f	%	f	%	f	%	f	%	f	%
Selection of fertilizer agents.	7	5.0	26	18.6	40	28.6	38	27.1	29	20.7
Maintaining a fixed subsidy rate.	12	8.6	38	27.1	39	27.9	28	20.0	21	15.0
Farmers' registration and issue of passbooks.	17	12.1	54	38.6	25	17.9	22	15.7	22	15.7
Complementary interventions to augment the program.	17	12.1	9	6.4	42	30.0	50	35.7	22	15.7
Checking leakages in the system.	9	6.4	25	17.9	27	19.3	44	31.4	35	25.0
Male and female farmers' access to subsidized fertilizers.	50	35.7	4	29.3	7	5.0	20	14.3	21	15.0
Increase in quantities of fertilizers available to farmers.	4	2.9	36	25.7	51	36.4	29	20.7	20	14.3
Distances farmers travel to buy	6	4.3	28	20.0	21	15.0	32	22.9	53	37.9

subsidized fertilizers.										
Delivery of subsidized fertilizer early	12	8.6	12	8.6	16	11.4	53	37.9	46	32.9
The location of Distributors and Agents convenient to all farmers.	6	4.3	18	12.9	38	27.1	32	22.9	45	32.1
The unit of sale affordable by all categories of farmers.	3	2.1	41	29.3	49	35.0	37	26.4	10	7.1
Affordability of subsidized fertilizer in terms of its price.	7	5.0	12	8.6	27	19.3	57	40.7	36	25.7
Transaction costs of buying reduced.	8	5.7	19	13.6	30	21.4	50	37.5	32	22.9
Consultation on the types of fertilizers needed.	11	7.9	37	26.4	41	29.3	31	22.1	19	13.6

n = 140, Source: Field Survey Data, 2014

VE =Very Effective, E = Effective, SE = Moderately Effective, I = Ineffective, VI= Very Ineffective.

Appendix C:

Frequency Distribution of the levels of satisfaction of beneficiaries with various aspects of the Fertilizer Subsidy Programme

Levels of satisfaction of respondents	**VS**		**S**		**N**		**D**		**VD**	
	f	%	f	%	f	%	f	%	f	%
Mode of selection of beneficiaries.	34	24.3	62	44.3	31	22.1	11	7.9	2	1.4
The method of determination of the price.	6	4.3	13	9.3	25	17.9	50	35.7	46	32.9
The unit of sale.	16	11.4	67	47.9	29	20.7	23	16.4	5	3.6
Location of fertilizer distributors and agents.	9	6.4	12	8.6	23	16.4	54	38.6	42	30.0
The extent of monitoring and supervision.	10	7.1	30	21.4	40	28.6	36	25.7	24	17.1
The long distance farmers travel.	7	5.0	15	10.7	21	15.0	30	21.4	65	46.4
The registration of farmers and issue of passbooks.	17	12.1	41	29.3	26	18.6	29	20.7	27	19.3
The ability of all farmers to buy.	2	1.4	15	10.7	54	38.6	48	34.3	20	14.3

The extent of transact costs incurred.	2	1.4	18	12.9	34	24.3	48	34.3	38	27.1
Time of delivery of fertilizers.	9	6.4	10	7.1	14	10.0	68	48.6	35	25.0
The quantities and types of fertilizer.	10	7.1	19	13.6	48	34.6	43	31.7	18	12.9
Complementary interventions within the subsidy programme.	4	2.9	24	17.1	31	22.1	35	20.0	46	32.9

n =140, Source: Field Survey Data, 2014.

VS= Very satisfied, S= Satisfied, N= Neutral, D= Dissatisfied, VD= Very dissatisfied

Appendix D:

Frequency distribution of the strengths of the fertilizer subsidy programme as perceived by the respondents.

Perceived strengths of the subsidy program.	**5**		**4**		**3**		**2**		**1**	
	f	%	F	%	f	%	f	%	f	%
It increased maize yields.	98	70.0	23	16.4	9	6.4	5	3.6	5	3.6
Enhanced the adoption of fertilizer.	62	44.3	48	34.3	13	9.3	16	11.4	1	0.7
It increased fertilizer use by farmers.	42	30.0	53	37.9	34	24.3	8	5.7	3	2.1
It reduced the credit needs of farmers.	26	18.6	33	23.6	35	25.0	17	12.1	27	19.6
Reduced poverty among farmers.	31	22.1	37	26.4	42	30.0	23	16.4	7	5.0
Included improved seed.	27	19.3	20	14.3	33	23.6	31	22.1	29	20.7
AEAs registered a lot of farmers and	80	57.1	32	22.9	11	7.9	10	7.1	7	5.0

gave them passbooks.										
Government was not involved in importation.	12	8.6	9	6.4	21	15.	37	26.4	45	32.1
Farmers could buy any quantity of fertilizer.	37	26.4	15	10.7	15	10.7	39	27.9	34	24.3
Total	415		270		213		186		158	1242

n= 142, Source: Field Survey Data, 2014.

Appendix E:

Frequency distribution of the trend of yields of maize of respondents over a 5-year period (2008- 2012)

Yield in	2008		2009		2010		2011		2012	
bags/acre	f	%	f	%	f	%	f	%	f	%
≤ 4	118	84.2	21	15	10	7.1	11	7.8	11	7.8
5-7	19	13.5	34	24.3	30	21.5	35	26.4	39	27.8
8-10	2	1.4	23	16.5	37	26.5	48	34.3	38	27.2
11-13	-	-	5	3.5	11	7.9	10	7.2	41	29.3
14-16	-	-	-	-	-	-	5	3.5	6	4.3
17-19	-	-	1	0.7	1	0.7	2	1.4	2	1.4
20-22	-	-	-	-	1	0.7	-	-	-	-
Total	139	99.1	84	60.0	92	64.9	113	80.7	137	97.9

n =140, Source:

Field Survey Data, 2014