THE IMPACT OF NATIONAL AGRICULTURAL INPUT VOUCHER SCHEME ON RICE PRODUCTION AT THE KIROKA IRRIGATION SCHEME, MOROGORO DISTRICT

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL ECONOMICS OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA

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ABSTRACT

This research was conducted at the Kiroka Irrigation Scheme in Morogoro District with an overall objective of generating knowledge about the impact of National Agricultural Input Voucher Scheme (NAIVS) on rice production in Tanzania. The specific objectives of the study were (a) to examine farmers' perception and response towards NAIVS at the Kiroka Irrigation Scheme, (b) to assess the implementation of NAIVS at the Kiroka Irrigation Scheme, (c) to assess the impact of fertilizer and seed vouchers on rice production at the Kiroka Irrigation Scheme. Farmers were selected using purposive and simple random sampling techniques to get a sample size of 120 input voucher users and 30 non-input voucher users. Primary data were collected by using structured questionnaire. The collected data were analysed using Statistical Package for Social Science (SPSS) version (16.0). Descriptive statistics, Conditional Outcome Model (COM) and Paired Samples T-test were used as analytical tools. Descriptive statistics shows that farmers were aware about Input Voucher Scheme. It was found that for the first two cropping seasons, vouchers were timely delivered while in 2011/12 cropping season vouchers were delivered late due to delayed vouchers delivery by MAFC. Also Rice Yellow Mottle Virus (RYMV) disease and shortage of water during the dry season affect paddy production. Paired Samples T-test revealed that the difference between the mean difference of paddy yield of input voucher users and non-input voucher users (difference of the difference) before and after NAIVS is 2.2 t/ha. This implies a significant increase by 2.2 t/ha from 1.73 t/ha during the baseline survey. The COM shows that for every unit increase in seed rate (kg/acre), 153.2 kg/acre increase in paddy yield is predicted; holding other variables constant. Also for every unit increase in fertilizer rate (kg/acre), 0.6 kg/acre increase in paddy yield is predicted; holding other variables constant.

DECLARATION

I, Godfrey Edward, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

_____ _____

Godfrey Edward Date

(Msc-Candidate)

The above declaration is confirmed by:

_____ _____

Dr. Anna A. Temu (PhD) Date

(Supervisor)

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DEDICATION

I dedicate this dissertation to my wife Immaculatha Justin and my daughter Hillary for nursing me with affections and love and their dedicated partnership to the success of my life. Also to my father, Edward Heruman and my beloved mother, Florensia, who laid the foundation of my education.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

ACT	Agricultural Council of Tanzania
AFSP	Accelerated Food Security Project
AMCOS	Agricultural Marketing Co-operative Societies
ASDP	Agriculture Sector Development Programme
ATP	Adenosine Triphosphate
BCA	Benefit-Cost Analysis
CBA	Cost-Benefit Analysis
CBO	Community Based Organization
COM	Conditional Outcome Model
DALDO	District Agriculture and Livestock Officer
DAP	Diammonium Phosphate
DC	District Commissioner
DED	District Executive Director
DSA	Daily Subsistence Allowance
DVC	District Voucher Committee
FANRPAN	Food, Agriculture and Natural Resources Policy Analysis Network
FAO	Food and Agriculture Organization of the United Nations
GFRP	Global Food Price Response Programme
IDA	International Development Association
KATC	Kilimanjaro Agricultural Training Institute
LGA	Local Government Authority
M&E	Monitoring and Evaluation
MAFC	Ministry of Agriculture, Food Security and Cooperatives
MATI	Ministry of Agriculture Training Institute

MOFACU	Morogoro Farmers Co-operative Union
MRP	Minjingu Rock Phosphate
NAIVS	National Agricultural Input Voucher Scheme
NGO	Non-Governmental Organization
NMB	National Microfinance Bank
NVSC	National Voucher Steering Committee
OLS	Ordinary Least Square
OPV	Open Pollinated Variety
PIM	Project Implementation Manual
PMO-RALG	Prime Minister Office-Regional Administration and Local Government
PPP	Public Private Partnership
QDS	Quality Declared Seed
RVC	Regional Voucher Committee
RWH	Rain Water Harvest
SACCOS	Savings and Credit Co-operative Societies
SNAL	Sokoine National Agricultural Library
SPSS	Statistical Package of Social Science
SSA	Sub-Saharan Africa
TC-SDIA	Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture
VAEO	Village Agricultural Extension Officer
VEO	Village Executive Officer
VG	Village Government
VIF	Variance Inflation Factor
VVC	Village Voucher Committee
WAEO	Ward Agricultural Extension Officer

WARDA	West Africa Rice Development Association
WEO	Ward Executive Officer

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

The uses of agricultural inputs is fundamental in modern agriculture in developed countries, and were the primary ingredient in the green revolution that swept through Asia and Latin America during the 1960s and 1970s. However, the green revolution largely by-passed Sub-Saharan Africa (SSA), and the use of agricultural inputs remains very low. In 2002/03 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 kg in South-East Asia and 73 kg in Latin America (Crawford, 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 (Wiggins and Brooks, 2010).

Agricultural input intensity is very low in Tanzania, farmers use on average 8 kg/ha of fertilizers (below SSA average), and only 5.7% of rice farmers and 0.7% of maize farmers use improved seed varieties together with fertilizers. Agricultural productivity is low by international standards and relative to Tanzania's own potential as measured by research field tests and on-farm trials (World Bank, 2009). The government therefore argued that the best way to improve national food security in the face of high international food prices was to promote the use of agricultural inputs to raise productivity. The pilot subsidy programme initiated in 2008 and later expanded into the National Agricultural Inputs Voucher Scheme (NAIVS) in 2009 was launched by the Government of Tanzania in response to the high food and fertilizer prices which prevailed in 2007/08.

NAIVS is being implemented through Accelerated Food Security Project (AFSP) since June 2009. The goal of the project is to enhance national food security and avert the food crisis that could arise because of persistently high, volatile prices for food and agricultural inputs. The objective of the Project is to contribute to higher food production and productivity in target areas by improving farmers' access to critical agricultural inputs. Under this Project, by 2012/13 NAIVS would expand to reach 2.5 million households in 65 districts (URT, 2009).

Vouchers are like real money and certificates by which smallholder farmers are given the ability to pay for inputs such as fertilizer and seeds at a registered shop of their choice (Kachule and Chilongo, 2007).

The vouchers allow farmers to obtain a predetermined package of inputs from private suppliers. Each package provides sufficient inputs for half of a hectare of land at subsidized prices. The subsidy consists of 50 percent of the prevailing market price for the input package. Each eligible farmer received vouchers for a maximum of three years. The input package consists of three vouchers. One was for nitrogenous (N) fertilizer-one bag of urea. A second was for phosphorous (P) fertilizer-either one bag of DAP or two bags of Minjingu Rock Phosphate (MRP) with nitrogen supplement (also called Minjingu Mazao), depending on the farmer's choice. A third voucher was for seed (10 kilograms of a hybrid or open-pollinated maize variety or a rice variety) sufficient for half an hectare of maize or rice. Rice yields were projected to rise from 1 735 kg/ha in the baseline year to about 3 100 kg/ha in the last year of the Project (URT, 2009).

1.2 Statement of the Problem

Tanzanian rice productivity is lower than most neighbouring countries and one of the lowest in the world. Furthermore, Tanzania hardly meets its own rice demand and

therefore imports large quantities, mostly from South-East Asia. The critical weaknesses of the subsector are, among others, limited production and distribution of improved seeds, low quality (i.e. due to mixing of varieties), inefficient chains, insufficient input suppliers and extension workers (ACT, 2010).

Many studies have been done on the impact of National Agricultural Inputs Voucher Scheme mainly for Maize and tobacco production. Mguruse (2007) and Mng'olage (2008) found that there has been a significant increase in maize production level since the inception of the subsidy programme in Tanzania. In Malawi, there has been a progressive increase in yield from less than 1.0MT to 2.04MT/ha (Luhanga and Sungani, 2007). According to baseline survey conducted by MAFC (2009) the average paddy yield in the NAIVS target area was 1.73 t/ha (Appendix 7). The latest statistics by the UN Food and Agriculture organization shows that the world's average paddy yield was about 4.3 t/ha in 2009. This shows that paddy yield in Tanzania is below the world average.

The National Agricultural Input Voucher Scheme (NAIVS) in Tanzania is a very new and still an on-going programme launched in 2009. Therefore, little evidence is presently available on the general performance of programme (Pan and Christianensen, 2011). Currently, it has not been proven whether NAIVS had reached its primary objective of increasing paddy yield and change farming practices over time in the target areas. This is a study that tries to assess what changes are as a result of NAIVS.

1.3 Objective of the Study

1.3.1 Overall objective

The overall objective of this research was to generate knowledge about the impact of National Agricultural Inputs Voucher Scheme on rice production in Tanzania.

1.3.2 Specific objectives

The specific objectives of this study were:

(i) To examine farmers perception and response towards NAIVS at the Kiroka Irrigation Scheme.

(ii) To assess the implementation of National Agricultural Inputs Voucher Scheme at the Kiroka Irrigation Scheme.

(iii) To assess the impact of fertilizer and seed vouchers on rice production at the Kiroka Irrigation Scheme.

1.4 Hypothesis

Rice produced by smallholder farmers before and after the application of fertilizers and improved seed is not statistically different.

1.5 Justification of the Study

Currently little has been done on the impact of the National Agricultural Inputs Voucher Scheme on small holder rice productivity under irrigation in Tanzania. Therefore this study is intended to come up with empirical data that would ultimately influence policy makers, decision makers, researchers and Non-Governmental Organizations on how to increase the number of resource poor rice farmers to benefit through the project and how to address the challenges encountered during project implementation. In addition the research findings would have great potential to the body of knowledge in studying impact of government intervention in the agricultural sector.

1.6 Scope and Limitation of the Study

This is a case study which focused on the Kiroka Irrigation Scheme. It is limited to government intervention in form of fertilizer and seed subsidy distributed through

vouchers. The limitations of the study were: (a) some respondents were reluctant to frankly respond to some of the questions, (b) some respondents do not keep records and due to memory lapse take time to recall some information, (c) there was difficult in getting sampling frame and samples because some farmers demanded money before being interviewed, (d) some respondents were using traditional measures such as plastic buckets instead of bags or kilogram which then caused to re-phrase some questions to get correct units conversion.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Theoretical Framework

2.1.1 Definition of key terms used in the study

2.1.1.1 Voucher

Voucher is a method of provision of some goods or services in which individuals have been given funds solely for the purchase of the specified goods or services. In order to ensure that the money provided has been spent for the specified purpose, a coupon or "voucher" is given which can only be exchanged for the specified goods (Saakshi, 2009). It is also defined by Kachule and Chilongo (2007) that voucher is like real money and certificates by which smallholder farmers are given the ability to pay for inputs at a registered shop of their choice.

2.1.1.2 Subsidy

Subsidy is the opposite of a tax in that, under a subsidy, the government pays a certain amount to the private producer in order to have him sell the commodities at a price less than the cost of producing the commodity (Saakshi, 2009). Moreover, Pratap and Gupta (1991) defined subsidy as a form of financial assistance paid to a business or economic sector and is used to support businesses that might otherwise fail, or to encourage activities that would otherwise not take place.

2.1.1.3 Fertilizer

According to Tisdale *et al.* (1997), fertilizer is defined as a synthetic chemical substance or mixture used to enrich soil so as to promote plant growth. In order for a plant to grow and thrive, it needs a number of different chemical elements. A mineral element is considered essential to plant growth and development if the element is involved in plant

metabolic functions and the plant cannot complete its life cycle without the element. The most important of these are Nitrogen, Phosphorus and Potassium. These elements are important for building basic blocks such as amino acids, cell membranes and Adenosine Triphosphate (ATP). To make plants grow faster, supply of elements that the plants need in readily available forms is necessary. A sustainable form of agriculture is based on the promise that nutrients which are removed with the harvested crops will be replaced. Mineral fertilizers allow farmers to supplement the nutrients which are already present in the soil**.**

2.2 Conceptual Framework

The causal relationships, transmission mechanisms and underlying factors defining the distributional impact of fertilizer and seed subsidy policy in Tanzania is depicted by using the conceptual scheme given in Fig.1. In theory, fertilizer and improved seed subsidy programme in Tanzania aimed at making fertilizer and improved seed prices affordable to poor smallholder farmers in order to ensure increased agricultural outputs, productivity and income as well as maintaining food supply to the teeming population (Food security). Farmers actually enjoy the fertilizer and improved seed subsidy if and only if they buy the fertilizer and improved seed at the government recommended subsidy-based retail prices. Anticipated primary effects of fertilizer and improved seed subsidy include lowered unit cost of fertilizer and improved seed (and perhaps lowered costs of farm production; increased fertilizer and improved seed demand/utilization. In a similar vein, the expected secondary effects include increased crop output, productivity and incomes and by implication, poverty alleviation (Eboh, 2006).

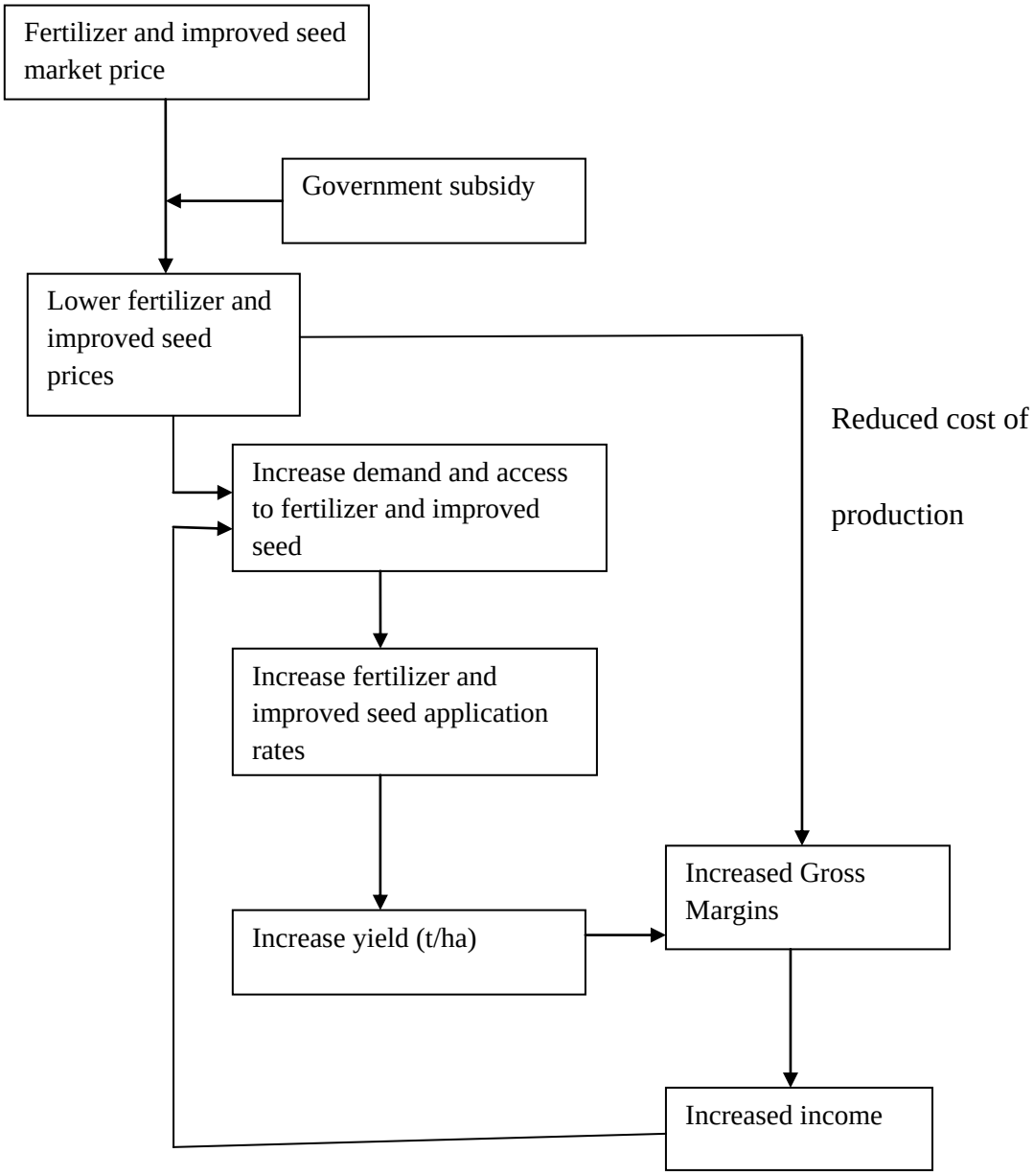

Figure 1: Data analytical Conceptual Framework illustrating transmission of benefit of government fertilizer and improved seeds subsidy.

2.3 Review of Empirical Research on Input Voucher Scheme

2.3.1 The effect of input voucher on maize and tobacco production

In Malawi, the two years in which input voucher programme has been implemented have led to an increase in maize production at both the household and national level, leading to a national maize surplus of 5000 MT in 2005/06 and of over 1.2 million MT in 2006/07 season. This has helped save foreign exchange previously used to import maize often of

lower and non-preferred quality. In these years it was first time in Malawi to have progressive increase in yield from less than 1.0 MT to 2.04 MT/ha. This has been attributed to the timely delivery of inputs through the private sector, which in turn allowed smallholder farmers to apply the inputs in a more timely fashion than was the case in the pre-voucher system years. There was also increased use of new technologies such as hybrid seed among the smallholder farmers. This was so because the voucher recipients have joined the smallholder farmers who were already able to use cash for improved seed and fertilizer (Luhanga and Sungani, 2007).

A 2007 Monitoring Survey revealed that between 2005 and 2006 the number of people below the poverty line in Malawi declined from 50% to 45%. This was attributed to the increase in fertilizer application from 17% in 2005 to 30% in 2006 of the households. Removing the impact of good rainfall, it was estimated that the fertilizer subsidy led to an increase in maize production of about 25% (Whitworth, 2007). In Tanzania, 24% of maize farmers use improved seeds, 20% use fertilizers, and only 6% use both. Subsidy for fertilizer and improved seeds for maize and rice varieties for farmers in Tanzania is expected to boost food production, reduce prices of food staples and increase incomes (Coy, 2011).

Gilbert (2011) argued that receiving subsidized fertilizer in a given year raises maize and tobacco production as well as the net value of rainy-season crop production in that year. Receipt of subsidized fertilizer over the prior three seasons also has a significant positive effect on current year maize production. However, receipt of subsidized fertilizer in the prior three consecutive years has no discernable effect on the net-value of total crop production in the current year. Moreover, we find no evidence that prior or current receipt of subsidized fertilizer contributes to off-farm or total household income.

2.3.2 The importance of Input Voucher scheme

If designed correctly, vouchers can promote free market competition among sellers, providing them an incentive to improve their services. Vouchers also allow for greater economic diversity by offering small farmers opportunities to purchase inputs which were previously unaffordable. Thus, vouchers would also help to shift small farmers' mindset to focusing attention on how to get as much value as possible from their vouchers. In other words, small farmers will start to demand that sellers be efficient. For example, in Malawi smallholder farmers are demanding high quality inputs delivered in a timely fashion (Kachule and Chilongo, 2007).

Mangisoni *et al.* (2007) noted that vouchers reduce transaction costs and beneficiaries are given a choice in the type and quantity available of any input. At the same time vouchers allow participation of the private sector and have potential for market development at local level.

2.3.3 Determinants of fertilizer adoption and use

The fertilizer price relative to millet was always a highly significant determinant of fertilizer adoption in Niger. This suggests that there were factors other than the fertilizer – crop price ratio that supported the use of more fertilizers in Bangladesh and Niger (Abdoulage and Sander, 2005).

Mbata (1994) identifies that labour, credit availability, membership of cooperative society, level of education of the farmers, contact with extension agents and farm size were important factors influencing fertilizer adoption and use among small scale farmers in Kenya.

Temu (2005) argues that output prices exert great influence on input purchases and that both fixed and variable transaction costs affect input use decision. Travel costs in input and output markets have distinct effects on input usage, implying distinct avenues for interventions to promote more intensive use of agricultural inputs.

Extension services focus on imparting key messages to farmers on each visit, with the complexity of these messages being increased in subsequent visits. Initial messages aim at improving basic production techniques, with attention being focused on land preparation, the timeliness of operations, crop spacing, plant population sizes, the use of better seed varieties and on weeding. After the simple message, attention shifts to more complex messages such as those relating to fertilizer use (Nkonya *et al*., 1997).

2.4 Impact Assessment

2.4.1 Meaning of impact assessment

In its broadest sense, impact assessment is the process of identifying the anticipated or actual impacts of a development intervention, on those social, economic and environmental factors which the intervention is designed to affect or may inadvertently affect. It may take place before approval of an intervention (*ex ante*), after completion (*ex post*), or at any stage in between. *Ex ante* assessment forecasts potential impacts as part of the planning, design and approval of an intervention. *Ex post* assessment identifies actual impacts during and after implementation, to enable corrective action to be taken if necessary and to provide information for improving the design of future interventions.

2.4.2 Impact assessment methods

The impact assessment methods of different government interventions in the agricultural sector are as summarized below:

2.4.2.1 Informal experimental design

According to Kothari (2011) informal experimental designs are those designs that normally use a less sophisticated form of analysis based on differences in magnitude. These are (a) before-and-after without control design, (b) after-only with control design, and (c) before-and-after with control design. On the other hand, formal experimental designs offer relatively more control and use precise statistical procedures for analysis. The types of this design are (a) completely randomized design, (b) randomized block design and (c) Latin square design and (d) factorial designs.

(a) Before-and-after without control design

In this design a single test group or area is selected and the dependent variable is measured before the introduction of the treatment. The treatment is then introduced and the dependent variable is measured again after the treatment has been introduced. The effect of the treatment would be equal to the level of the phenomenon after the treatment minus the level of the phenomenon before the treatment. The design can be represented as follows:

Test group or area	Level of phenomenon before treatment(X)	Treatment Introduced →	Level of phenomenon after treatment (Y)

Treatment Effect = (Y) – (X)

The main difficult of this design is that with the passage of time considerable extraneous variations may be there in its treatment effect.

(b) After-only with control design

In this design two groups or areas (test group or area and control group or area) are selected and the treatment is introduced into the test group or area only. The dependent variable is then measured in both the areas at the same time. Treatment impact is assessed

by subtracting the value of the dependent variable in the control group or area from its value in the test group or area. This can be exhibited in the following form:

Test area: Treatment introduced → Level of phenomenon after treatment(Y)

Control area: → Level of phenomenon without treatment (Z)

Treatment effect = (Y) – (Z)

The basic assumption in such a design is that the two areas are identical with respect to their behaviour towards the phenomenon considered. If this assumption is not true, there is the possibility of extraneous variation entering into the treatment effect. However, data can be collected in such a design without the introduction of problems with the passage of time. In this respect the design is superior to before-and-after without control design. After-only with control design was used by Patel (2011) baseline report in the World Bank for assessing the impact of NAIVS. The study was designed to compare voucher beneficiaries (treatment group) to eligible non-beneficiaries (control group).

(c) Before-and-after with control design

In this design two areas or groups are selected and the dependent variable is measured in both areas and groups for an identical time-period before the treatment. The treatment is then introduced into the test area or group only, and the dependent variable is measured in both for an identical time-period after the introduction of the treatment. The treatment effect is determined by subtracting the change in the dependent variable in the control area or group from the change in the dependent variable in the test area or group. This design can be shown in this way:

	Time period I		Time period II
Test area:	Level of phenomenon Before treatment (X)	Treatment introduced →	Level of phenomenon after treatment (Y)
Control area:	Level of phenomenon Without treatment (A)		Level of phenomenon without treatment (Z)

Treatment Effect = (Y- X) – (Z - A)

This design is superior to the above two designs for the simple reason that it avoids extraneous variation resulting both from the passage of time and from non-comparability of the test and control areas. But at times, due to lack of historical data, time or comparable control areas, we should prefer to select one of the first two informal designs.

2.4.2.2 Cost benefit analysis

Cost benefit analysis (CBA), sometimes called benefit–cost analysis (BCA), is a systematic process for calculating and comparing benefits and costs of a project, decision or government policy (hereafter, "project").

CBA has two purposes: (a) to determine if it is a sound investment/decision (justification/feasibility) and (b) to provide a basis for comparing projects. It involves comparing the total expected cost of each option against the total expected benefits, to see whether the benefits outweigh the costs, and by how much.

2.5 Sample Size and Its Determination

With reference to Kothari (2011), in sampling analysis the most ticklish questions is: what should be the size of the sample or how large or small should be “n”? If the sample size is too small, it may not serve to achieve the objectives and if it is too large, we may incur huge cost and waste resources. As a general rule, one can say that the sample must be of an optimum size; that is it should be neither is excessively large nor too small. Technically, the sample size should be large enough to give a confidence interval of desired width. Size of the sample should be determined by a researcher keeping in view the following points:

Nature of universe: Universe may be either homogenous or heterogeneous in nature. If the items of the universe are homogeneous, a small sample can serve the purpose. But if the items are heterogeneous, a large sample would be required.

Number of classes proposed: If many class-groups (groups and sub-groups) are to be formed, a large sample would be required because a small sample might not be able to give a reasonable number of items in each class-group.

Nature of study: If items are to be intensively and continuously studied, the sample should be small. For a general survey the size of the sample should be large, but a small sample is considered appropriate in technical surveys.

Type of sampling: Sampling technique plays an important part in determining the size of the sample. A small random sample is opting to be much superior to a larger but badly selected sample.

Standard of accuracy and acceptable confidence level: If the standard of accuracy or the level of precision is to be kept high, relatively larger sample is required. For doubling the accuracy for a fixed significance level, the sample size has to be increased fourfold.

Availability of finance: In practice, size of the sample depends upon the amount of money available for the study purpose. This factor should be kept in view while determining the size of the sample for large samples result in increasing the cost of sampling estimates.

Other considerations: Nature of units, size of the population, size of questionnaire, availability of trained investigators, the conditions under which the sample is being conducted and the time available for completion of the study.

Based on the above points, the determination of sample size through the approach based on precision rate is given by:

$$e = z.\frac{\sigma_p}{\sqrt{n}}$$

Where by:

z = the value of the standard variate at a given confidence level and it is 1.96 for a 95% confidence level

n = size of the sample

σ_p = standard deviation of the population to be estimated from past experience or on the basis of a trial sample

e = acceptable error which is kept within + or – 3

However, Matata *et al.* (2001) argued that having 80-120 respondents are adequate for most social-economic studies in Sub-Saharan Africa. On the other hand, Bailey (1998) argues that regardless of the population size, a sample of 30 is the minimum for data collection.

2.6 Analytical Framework

2.6.1 Conditional outcome model

The model concerns with the determination of the potential secondary effects of fertilizer subsidy. It describes whether fertilizer subsidy has translated into increased crop outputs and productivity to smallholder farmers. The Conditional outcome model (COM) such as land productivity (Y_{ij}) conditional on the level of fertilizer demand or utilization (F_{ij}) is given by:

$$Y_{ij} = X_{ijt}\beta + F_{ijt}\delta + \eta^{y}_{ij} + \mu^{y}_{j} + \varepsilon^{y}_{ijt}$$

Where δ is the effect of fertilizer, i^{th} household, j^{th} village, t is time period, X is a vector of household characteristics, β is a vector of unknown parameters to be estimated, η is an unmeasured determinant of the fertilizer demand that is time invariant and fixed within the household and ε is a non-systematic error. The model estimates the secondary impact of fertilizer subsidy on outcome of particular interest such land productivity with cross sectional data (where t=1) (Pitt and Khandker, 1998).

Differentiating the Y_{ij} equation at two points of the yields, the following outcome equation is obtained; $\Delta Y_{ij} = \Delta X_{ij}\beta + \Delta F_{ij}\delta + \Delta \varepsilon^{y}_{ij}$

Consistent estimates of fertilizer effect δ can be obtained from above equation using a household fixed effect under the assumption that the error terms of the fertilizer and outcome equations are uncorrelated. Also Ebor (2006) used the conditional outcome model in the determination of secondary effect of fertilizer subsidies on maize output.

Mng'olage (2008) shows that, the conditional outcome Model for Maize output (Y_{ak}) on the level of fertilizer demand (F_{ij}) is given by;

$Y_{ak} =$ (FERT, DST, EXTNV, FMS, POM, AG, EXP, FS, EDUC and ε)

$Y_{ak} = \alpha_o + \beta_1 FERT + \beta_2 DST + \beta_3 EXTNV + \beta_4 FMS + \beta_5 AG + \beta_6 EXP + \beta_7 FS + \beta_8 EDUC + \varepsilon i$

Where:

Y_{ak} = output of Maize produced by smallholder farmer in kg/ha

F_{ij} = amount of fertilizer applied in kg/ha

AG = age of the respondents in years

EXP = number of years of household involved in farming activities,

FS = number of dependants of household

EDUC = number of years the household head has been to school

EXTNV = number of visits of extension officer to the farmer per year

FMS = Farm Size in hectares

DST = Distance from farm to procurement source in Kilometers

PFERT = price of fertilizer in shillings per bag of 50 kg

POM = price of Maize in shillings per 100 kg bag

α_o and $\beta_i =$ coefficients to be estimated and εi = error term, which is independent normally distributed with mean zero and variance.

Table 1 show the variable used in the Conditional Outcome Model for maize.

Table 1: Summary of variables used in the Conditional Outcome Model for Maize

s/n	Variable code	Description	Units	Expected sign
1	Y_{ak}	Quantity of Maize output	kg/ha	Dependent variable
2	F_{ij}	Quantity of fertilizer used	kg/ha	Positive
3	DST	Distance	Kilometer	Negative
4	EXTV	Extension visits	Number of visits	Positive
5	AG	Age	Years	Positive
6	EXP	Experience	Years	Positive
7	FS	Family size	Dependants	Positive
8	EDUC	Education	Years	Positive
9	PFERT	Price of fertilizer	Tsh/50kg bag	Negative

Source: Mng'olage (2008)

2.6.2 Paired-samples t-test

Paired samples t-test is used in 'before-and-after' studies, or when the samples are the matched pairs, or the case is a control study. Also, the paired samples t- test compares the means of two variables. It computes the difference between the two variables for each case, and tests to see if the average difference is significantly different from zero.

According to Kothari (2011), paired t-test is a way to test for comparing two related samples, involving small values of n that does not require the variance of the two populations to be equal, but the assumption that the two populations are normal must continue to apply. For a paired t-test, it is necessary that the observations in the two samples be collected in the form of what is called matched pairs; that is "each observation in one sample must be paired with an observation in the other sample in such a manner that these observations are somehow "matched" or related, in an attempt to eliminate extraneous factors which are not of interest in test". Such a test is generally considered appropriate in a before-and-after-treatment study. For instance, we may test a group of certain students before and after training in order to know whether the training is effective, in that situation we may use paired t-test.

2.7 Accelerated Food Security Project

According to URT (2009), this section describes Accelerated Food Security Project (AFSP) by focusing on introduction, objective of the project, targeting, costs, implementation of the project at district and village levels, voucher release process and voucher redemption process.

2.7.1 An overview of the project

The Project was one of a package of three complementary operations that form the World Bank's response to the Government of Tanzania's request for urgent support for its Accelerated Food Security Programme. The Programme's goal was to enhance national food security and avert the food crisis that could arise because of persistently high, volatile prices for food and agricultural inputs. The Bank was using expedited procedures under its Global Food Price Response Programme (GFRP) and the Emergency Recovery Loan procedures (OP/BP 8.00) to respond to the government's request.

As a short-term emergency response, the AFSP was a standalone Project that would finance urgent, time-bound interventions to supplement the government's medium- and long-term agricultural development agenda, which was supported by IDA and four other development partners through a basket fund for the Agriculture Sector Development Programme (ASDP). The Project would scale up government efforts to boost domestic food production, make food more widely available, and increase the stability of food crop production. The Project would mostly finance activities that address the immediate concerns of maintaining and increasing food production through the National Agricultural Inputs Voucher Scheme (NAIVS). The Project would be implemented by the Ministry of Agriculture, Food Security, and Cooperatives (MAFC) in accordance with the Project Implementation Manual (PIM).

2.7.2 Project objective and description

The objective of the Project was to contribute to higher food production and productivity in target areas by improving farmers' access to critical agricultural inputs. The proposed instrument for the Project was an Emergency Recovery Operation processed under the GFRP guidelines and OP 8.00. In line with these procedures, the Project would support measures to mitigate or avert the potential effects of imminent or future emergencies as a result of price and production shocks. The proposed Project would have three components: (a) Improving access to agricultural inputs (fertilizer and seed), (b) Strengthening input supply chains, and (c) Project management and monitoring and evaluation (M&E).

2.7.3 AFSP targeting

The AFSP was initiated in October, 2008 in eleven regions of Iringa, Mbeya, Ruvuma, Rukwa, Mtwara, Lindi, Morogoro, Kigoma, Kilimanjaro, Tabora (Sikonge), and Mara (Tarime) as pilot regions. Later, nine more regions namely Dodoma, Mwanza, Shinyanga, Singida, Kagera, Tanga, Arusha, Manyara, and Pwani were added in the program. Currently AFSP operates in 96 districts of that 20 regions whereby subsidized inputs for maize and paddy was implemented while inputs for cotton seeds and pesticides was implemented in 10 regions (34 districts) of Tanzania Mainland**(**URT 2012).

2.7.4 AFSP cost (US$ millions)

According to AFSP programme document, the total project cost for the three components was US$ 299 million as detailed in Table 2.

Table 2: AFSP cost (US$ millions)

	IDA financing	Government of Tanzania financing	Total cost
Component 1: Improving access to agricultural inputs	**144.30**	**139.10**	**283.40**
(i) Scaling up NAIVS	139.10	139.10	278.20
(ii) Improving farmers' awareness, information, and participation	5.20		5.20
Component 2: Strengthening input supply chain	**12.18**		**12.18**
(i) Strengthening the agro-dealer network	6.00		6.00
(ii) Strengthening the national seed system	6.18		6.18
Component 3: Project management and M&E	**3.50**		**3.50**
(i) Project management	1.96		1.96
(ii) M&E	1.55		1.55
Total Project costs	**160.00**	**139.10**	**299.10**

Source: AFSP PIM document (2009)

2.7.5 Implementation of Accelerated Food Security Project at District Level

2.7.5.1 District agricultural input voucher scheme forum

A District Agricultural Input Voucher Scheme Forum (NAIVS-District Forum) in each participating district would meet twice a year, prior to the national forum, to discuss and endorse the annual work plan and to hear progress report of the implementation of scheme in the district. The membership of the District Forum would include LGA representatives, regional representative, private sector representatives (fertilizer companies, seed companies, agro-dealer association representatives, farmer organizations and CBOs, and NGOs. The each participating district would : (a) endorse the voucher share between targeted villages on the base of adopted guidelines and selection criteria for NAIVS implementation, (b) discuss and endorse proposed NAIVS annual work plan and budgets at the district level, and (c) review the implementation progress report and recommend changes or improvements to NVSC.

2.7.5.2 District voucher committee (DVC)

District voucher committee (DVC) would be established by LGAs in each participating districts that are identified to receive vouchers by the NAIVS-forum, with the following membership:

District Commissioner	Chairperson
District Member of Parliament	Members
District Council Chairperson	Member
Farmer Groups Representatives	Members
Agro-dealer Representatives	Members
Civil society and community-based organizations	Members
NMB representative	Member
District Agriculture and Livestock Officer (DALDO)	Secretary

2.7.5.3 The roles and responsibilities of DVC

The DVC would have the following roles and responsibilities:

(i) Collect and review information about maize and rice production, input use, and other related information for each village and ward;

(ii) Select wards and villages that would be included in the voucher scheme (those with high potential in terms of soils, low drought risk, and so on);

(iii) Estimate the number of farmers who grow maize and rice and the average holding size per farmer;

(iv) Adopt and use the criteria and formula to estimate how many vouchers would be allocated to target villages;

(v) Inform Village Governments about their respective voucher allocations and provide guidelines on setting up VCC, criteria for selecting committee members, and the code of conduct for VCC members;

(vi) Organize seminars for Village Governments and VCC members to create awareness and explain their role in NAIVS implementation;

(vii) Diffuse criteria for selecting the farmers who would qualify for the voucher/subsidy and support VCC in their use;

(viii) Assess the availability of inputs in the market, hold discussions with agro-dealers to resolve constraints that they may face in supplying inputs;

(ix) Encourage agro-dealers to position their supply points near farmers so that farmers' transport constraint can be minimized;

(x) Work closely with CSOs, microfinance institutions, and farmers' savings and credit institutions such as SACCOS, so farmers can access short-term credit to finance their share of the input price;

(xi) Monitor implementation of voucher scheme;

(xii) Compile progress reports from wards and villages on the implementation of voucher scheme and submit them to RVC and NVSC.

2.7.6 Implementation of accelerated food security project at village level

Villages are where the voucher scheme was actually implemented. Beneficiaries in each village would be selected based on clear criteria and a transparent selection process. The Village Assembly, in consultation with the Village Council, would organize the election of the Village Voucher Committee (three men and three women). The role and responsibility of the VVC was to recommend farmers to receive vouchers and, when endorsed by the VG, issue the vouchers to them.

2.7.6.1 The roles and responsibilities of the VVC

The roles and responsibilities of the VVC were to:

(i) Inform village farmers about the selection criteria and the procedures for selecting beneficiaries (with the help of the Village Extension Officer);

(ii) Prepare a list of farmers who cultivate not more than one hectare and who grow maize and/or rice;

(iii) Identify farmers who are diligent, operate their fields full-time, and meet the other criteria listed previously;

(iv) Select beneficiary farmers from the list to receive the total number of vouchers allocated to the village. Include a waiting list that is equivalent to 10 percent of the total number of vouchers;

(v) Submit names of beneficiary farmers to the Village Government and Council for approval;

(vi) Once the list is approved, inform farmers and request them to submit application forms;

(vii) Distribute vouchers to selected farmers who have completed the application form.

(viii) Monitor the use of inputs by voucher recipients;

(ix) Submit reports to the Village Council and Government.

2.7.6.2 The criteria that the VVC use to select farmers for receiving voucher

The criteria that the VVC would use to select farmers to receive vouchers would include:

(i) She/he was a full-time farmer residing in the village for at least five years;

(ii) She/he heads a household cultivating not more than one hectare of maize and rice (2.4 acres);

(iii) She/he grows maize and/or rice and was willing to use the voucher inputs on those crops while following recommendations provided by extension;

(iv) She/he was diligent and would be a good example for other farmers in the use of good agricultural practices;

(v) She/he was willing and able to co-finance the inputs purchased with vouchers;

(vi) Priority for accessing vouchers would be given to the female-headed households;

(vii) Priority for accessing vouchers would be given to farming households have used little or no fertilizer and improved seed with maize or rice over the last five years;

(viii) He/she has not been indicted of fraud, theft, or crime;

(ix) He/she has led or participated in development activities in the village and was well regarded;

(x) He/she was able to read and write;

(xi) He/she was able and willing to monitor and verify that the vouchers and inputs are used on his/her farm for their intended purpose;

The Village Government would inform the community about: (a) the names of the elected VVC members and their role and responsibilities, (b) the objectives of the voucher scheme, (c) the process and procedures used to select participants and (d) the implementation rules.

2.7.7 Voucher release process

Once the VVC identifies beneficiary farmers, the next step was to ensure that vouchers are released and used in a secure manner. Therefore, the voucher release process has to be designed and implemented to significantly minimize fraud and corruption. The voucher release process, illustrated in Figure 2, would be implemented as follows:

Beneficiary list: The Chairperson of the VCC sends the list of selected farmers, including basic information about each farmer (land holding, area under maize, and so on) to the Village Government and Council. The signature of all the VCC members would be included in the letter of transmittal and the list.

List approval by Village Assembly: The Village Assembly approves the recommended list. Observations or comments by members of the VC or VG would be discussed in a joint meeting in the presence of the VVC, and a final list would be unanimously agreed upon, including the names of farmers on the waiting list. The Village Assembly would

announce to the village residents the name of the selected farmers and those on the waiting list. The Village Assembly would also post the list in a public place so that all villagers know who is selected.

Application form: The VVC Chairperson would invite selected farmers to complete and submit a one-page application form. Farmers must meet this requirement before they can receive vouchers. The main purposes of the application form were to: (a) gather basic information about the farmer (for example, the farmer's name, household size, age, land ownership, estimated production of maize in previous years, percent of produce marketed, past use of inputs, source of inputs), (b) seek the farmer's commitment to finance the cost of the inputs beyond the voucher value and (c) notify the farmer of other terms and conditions to ensure that the vouchers and inputs are used for their intended purpose.

The final beneficiary list: After the application is received and verified by the VVC, a final list would be prepared and, along with the completed application forms, sent to the Village Government. Any selected farmers who fail to provide an application form or are not interested in participating in the scheme would be replaced by farmers from the waiting list. This list would be forwarded to the district by the Village Government and is the final list to be used in issuing vouchers.

Voucher distribution: The vouchers would have two signatories: the chairperson of the Village Government and the chairperson of the concerned VVC. Based on the final list, the two signatories would sit together, sign all the vouchers at once, register the voucher numbers against the names of the farmers, and each farmer would sign the registry for reception. The signing of the vouchers by the two signatories certifies that that the person in whose name the voucher is issued is the undisputed owner of the voucher.

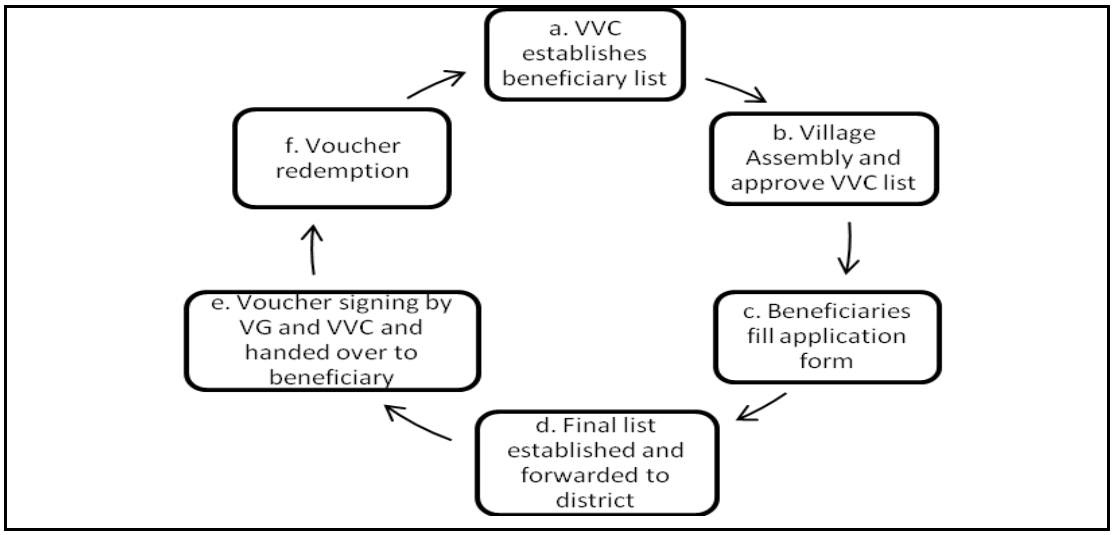

Figure 2: Voucher release process

Source: AFSP PIM document (2009)

2.7.8.Voucher redemption process

The voucher redemption process would have two stages. First, farmers redeem vouchers for agricultural inputs with agro-dealers. Second, the agro-dealers redeem the vouchers for cash with NMB (Fig.3).

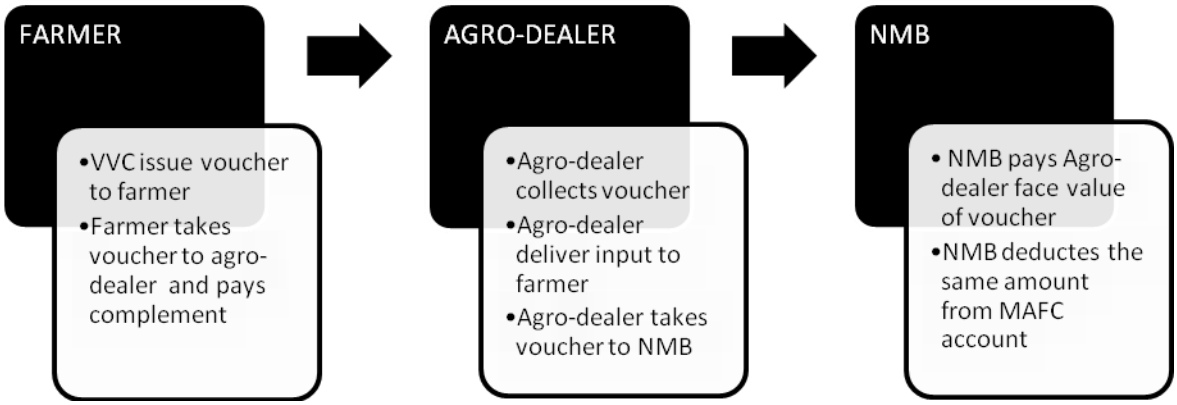

Figure 3: The voucher redemption process

Source: AFSP PIM document (2009)

2.7.8.1 Voucher redemption by farmers for agricultural inputs

Farmer who receives a voucher from the VCC can go to any registered agro-dealer, redeem the voucher, pay the difference between the voucher face value and the

commercial price of the inputs, and collect the inputs. Prior to handling vouchers, all agro-dealers that wish to participate in the scheme as registered dealers must complete the CNFA training and receive their certificate. Once the agro-dealer is certified, the local government cannot restrict his/her participation in the voucher scheme. Farmers were advised to go to the agro-dealers who accept vouchers and have a record of supplying inputs that meet recommended quality standards. If an agro-dealer doubts the authenticity of the vouchers, the farmer can refer the dealer to the VVC or to the Village Chairperson, who would have the names of farmers with voucher numbers issued under each name. The agro-dealer has the right to ask for identification from the person who presents the voucher to ensure that he or she is the owner of the voucher. The agro–dealer would register the voucher number and get the signature of the person who has presented the voucher before selling the inputs. This record has to be kept by the agro-dealer. Moreover, upon sale of the inputs and receipt of the voucher, the agro-dealer must check its authenticity with district authorities before redeeming it.

2.7.8.2 Voucher redemption by agro-dealers for cash

The agro-dealer may cash the voucher at any NMB Branch where he/she has an account. NMB requires agro-dealers who deal with vouchers and who have to redeem vouchers to open an account in one of its branches so that payment for redeemed vouchers is made directly to the account of the agro-dealer. The agro-dealer can withdraw the money from the account as and when needed. The vouchers have security features known to NMB, which can be checked on site when vouchers are submitted for redemption. Moreover, each voucher number is centrally registered. When a voucher is submitted for redemption, the number would be reconciled with the number at the central registry to ensure that no duplicate voucher or unregistered number is redeemed.

2.8 Research Gap

In 2002/03 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 kg in South-East Asia and 73 kg in Latin America (Crawford, 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 (Wiggins and Brooks, 2010).

Agricultural input intensity is very low in Tanzania, farmers use on average 8 kg/ha of fertilizers (below SSA average), and only 5.7% of rice farmers use improved seed varieties together with fertilizers. Agricultural productivity is low by international standards and relative to Tanzania's own potential as measured by research field tests and on-farm trials (World Bank, 2009). The government therefore argued that the best way to improve national food security in the face of high international food prices was to promote the use of agricultural inputs to raise productivity. The pilot subsidy programme initiated in 2008 and later expanded into the National Agricultural Inputs Voucher Scheme (NAIVS) in 2009 was launched by the Government of Tanzania in response to the high food and fertilizer prices which prevailed in 2007/08.

NAIVS is being implemented through Accelerated Food Security Project (AFSP) since June 2009. The goal of the project is to enhance national food security and avert the food crisis that could arise because of persistently high, volatile prices for food and agricultural inputs. The objective of the Project is to contribute to higher food production and productivity in target areas by improving farmers' access to critical agricultural inputs (URT, 2009).

The National Agricultural Input Voucher Scheme (NAIVS) in Tanzania is a very new and still an on-going programme launched in 2009. Therefore, little evidence is presently available on the general performance of programme (Pan and Christianensen, 2011). Currently it has not been proven whether NAIVS had reached its primary objective of increasing paddy yield.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Location

3.1.1 Geographical location

The study was conducted at the Kiroka Irrigation Scheme, Morogoro Rural District (Fig.4). Morogoro District is among the 6 Districts in Morogoro Region. The District is located on the North-East of Morogoro Region between 6º00' and 8º00' Latitudes South of Equator, and between Longitudes 36º00' and 38º East of Greenwich. It is bordered by Bagamoyo and Kisarawe Districts (Coast Region) to the east, Kilombero District to the south and Mvomero District to the north and west.

Kiroka Irrigation Scheme is located in Kiroka village, Kiroka Ward, Mkuyuni Division. It is bordered by Kisinga Village to the east, Kiziwa Village to the south, Mfumbwe Village to the west and Pangawe Village to the north. It is located 20Km along Morogoro-Matombo road.

3.2 District Land Area and Administrative Units

Morogoro District has a total area of 11 925 Km². That is 16.34% of the total area of Morogoro Region which is 72 973 Km². Initially Morogoro Rural District had the total land area of 19 250 Km² which was approximately the size of the whole Region of Mtwara Region or Kilimanjaro Region in its total area. That was the reason the Government decided to split the District into two districts namely: Morogoro District and Mvomero District. The new DED for Mvomero was appointed in 2005. Morogoro District was divided into 6 Divisions, 29 Wards, 142 Villages, 716 Neighbourhoods and 56 723 Households (Table 3).

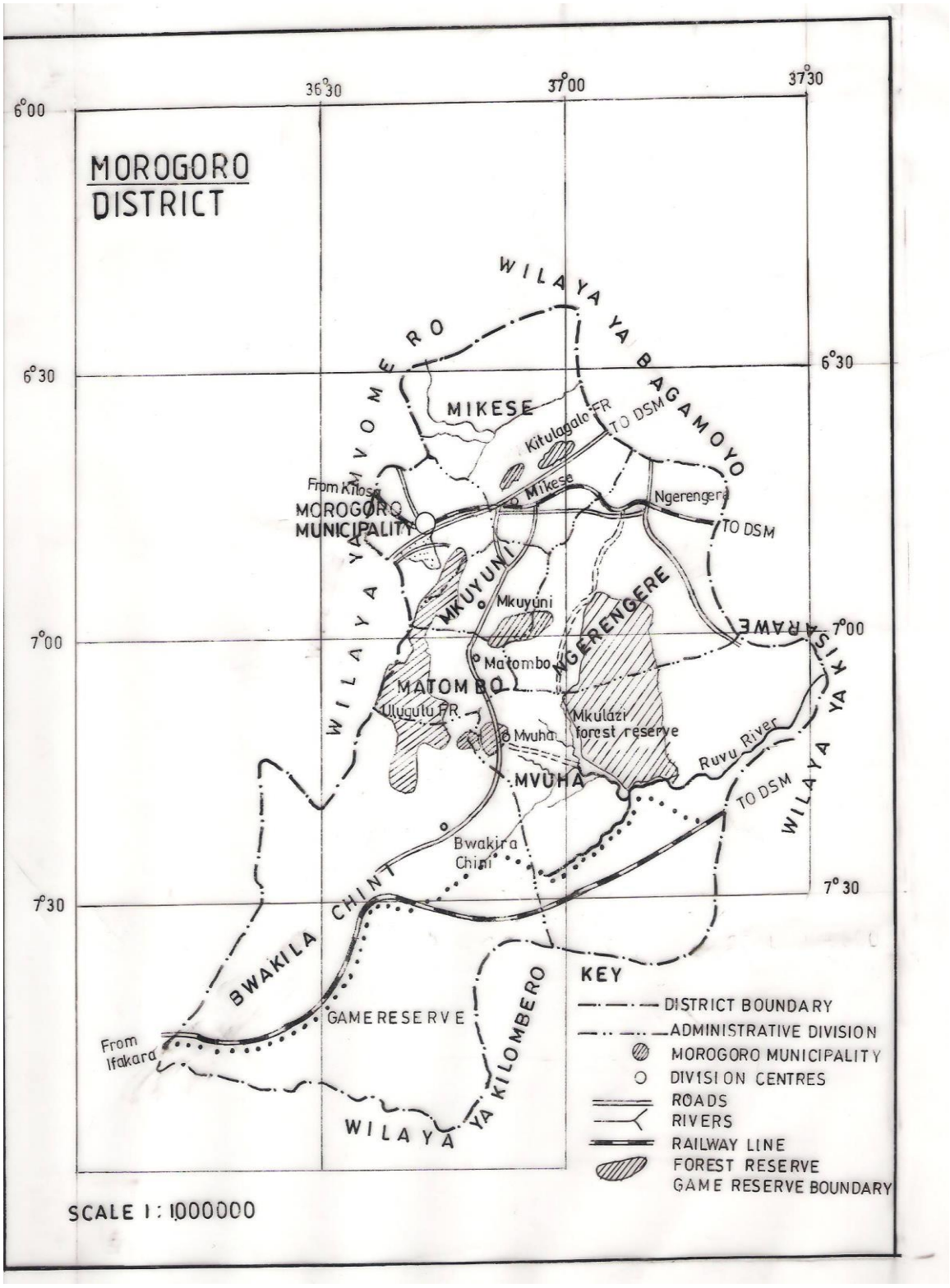

Figure 4: Morogoro District Map

Source: Morogoro District profile, 2010

Table 3: Distribution of Administrative Units in Morogoro District

No.	Division	Ward	Villages	Sub-village
1	Bwakira	5	20	121
2	Mvuha	5	26	154
3	Mikese	3	13	54
4	Mkuyuni	4	22	118
5	Matombo	7	34	170
6	Ngerengere	5	27	99
Total		**29**	**142**	**716**

Source**:** Morogoro District profile, 2010

3.3 Ethnicity

The indigenous people of Morogoro Region are of Bantu origin. The Dominant tribes in Morogoro District area: Waluguru, Wakutu, Wazigua and Wakwere. People who tend to concentrate on mountainous areas are the Waluguru, Wakaguru and the Wapogoro.

3.4 Population Size

The 2002 Population and Housing Census Morogoro District Population were 263 920 (Males 129 285, Females 134 635). Also during that period, the population of Kiroka village was 5 704 (Males 2 952, Females 2 752).

3.5 Population Density

The number of people per square kilometer of land area, or population density in Morogoro Rural is increasing. Population census of 2002 shows population density of 22 people per square kilometers from 25 people per square kilometers of 1988 and 15 people per square kilometers in 1967.

3.6 Climate and Soils

The temperature ranges from 20^0C to 30^0C. Rainfall ranges from 600mm in low lands areas up to 3 000mm on the mountainous areas. Heavy rain is in the month of March – May. January to February is a dry season while August – February is a hot season. There

are different types of soils namely: Sand soils in places like Ngerengere-Kisaki, Clay type of soils in a place like Ngerengere-Kidugalo, Loam Soil type in Ngerengere – Matuli.

3.7 Irrigated Agriculture

Kiroka Irrigation Scheme has potential area for irrigation of 300ha but the irrigated/cultivated area is 80ha. The sources of water for irrigation are from river Maembe and Mwaya.

3.8 Study Design

A cross sectional study design was used which allows data to be collected at a single point in time. This implies that the information collected from the respondents represents what is going on at one point in time (Babbie, 1990). In order to ensure that the study get good estimate of paddy yield given that some farmers do not keep record; information from Village and Ward Agricultural extension Officers about previous years harvest was used. This helps to compare farmers' response and the average paddy yield for the scheme.

Also the Conditional Outcome Model estimates the secondary impact of fertilizer subsidy on outcome of particular interest such land productivity with cross sectional data (where t=1) (Pitt and Khandker, 1998).

3.9 Sampling Procedures

The total farmer at the Kiroka irrigation scheme is 500. Matata *et al* (2001) argued that having 80-120 respondents are adequate for most social-economic studies in Sub-Saharan Africa. Therefore the sample size of this research was 120 input voucher users and 30 non-input users. Farmers who were registered under the scheme and received input vouchers for one, two and three years were used as sampling frame. The samples were selected using purposive and simple random sampling techniques to get sample size of

120 for input voucher users and 30 non-input voucher users ready for interview. This sample was chosen by considering the following points according to Kothari (2011): (a) the population of Kiroka Irrigation Scheme is heterogeneous-hence large sample would be required, (b) Standard of accuracy and acceptable confidence level. If the standard of accuracy or the level of precision is to be kept high, relatively larger sample should be required, (c) Availability of finance. In practice, size of the sample depends upon the amount of money available for the study purpose. Due to financial constraint, small sample for non-input users was used (d) time available for completion of the study. The time for completion of research was one year and hence small sample for control group was used.

3.10 Data Collection Techniques

Secondary and primary data were collected during the process of data collection which was conducted from December 2012 to January 2013. The primary data collection comprised of preliminary field survey as a reconnaissance/pilot the questionnaire and main field survey to administer the questionnaire to selected respondents and formal discussion with key informants such as village leaders, scheme leaders, extension Officers, and Village Voucher Committee using checklist. The main objectives of the preliminary survey were: (a) to familiarize with the area where the main survey would be conducted, (b) to pre-test the questionnaire and (c) to establish sampling frame and units. The objective of pre-testing the questionnaire was to test the validity of the instrument.

A structured questionnaire was designed to collect both qualitative and quantitative data required in achieving the objectives of the study. It consisted of both open and closed ended questions. Enumerators were trained to probe and how to ask each question to get relevant answers. Farmers were interviewed by means of a personal interview method. Interview was conducted at farmers' home, in field during bird scaring or at the village

office. Appointment for interview was made via scheme leaders and Ward Agricultural Extension Officers. Furthermore, a researcher was introduced to all selected farmers through Ward Agricultural Extension Officers. Before administer the questionnaire, the objectives of research were explained clearly to each respondent purposely for enhancing cooperation.

Secondary data were collected from MAFC, DALDO, VEO, WEO, SNAL and Internet. These data were collected to supplement data collected from the sample farmers. The type of data collected comprised of input voucher delivered to Kiroka irrigation scheme, farmers' level of contribution to the voucher value, paddy yield and paddy prices.

3.11 Data Processing and Analysis

The collected data were edited, coded, entered and summarized before quantitative analysis using Statistical Package for Social Science (SPSS) version 16.0 computer software. Editing is the process of examining the collected raw data to detect errors, omissions and extreme values and to correct these when possible. Also scrutiny the completed questionnaires to assure that the data are accurate, consistent with other facts gathered, uniformly entered, as completed as possible and have been well arranged to facilitate coding and tabulation. Coding refers to the process of assigning numerals or other symbols to answers so that responses can be put into a limited number of categories or classes. It is necessary for efficient analysis and through it the several replies may be reduced to a small number of classes which contain the critical information required for analysis.

3.12 Assessment Method Used

3.12.1 Before-and-after with control design

In this design, 120 input voucher users (test group) and 30 non- input voucher users (control group) were selected. Then paddy yield was collected in both groups before and

after the inception of NAIVS. The impact of using fertilizers and improved paddy seeds was determined by subtracting the change in the paddy yield in the control group from the change in the paddy yield in the test group. This design can be shown in this way:

	Before NAIVS		After NAIVS
Test group:	Paddy yield Input voucher users (X)	Fertilizers improved paddy seed	Paddy yield input voucher users (Y)
Control group:	Paddy yield Non-input voucher users (A)	→	Paddy yield Non-input voucher users (Z)

Therefore, the impact of using fertilizers and improved paddy seeds on paddy yield was determined by using this formula = (Y- X) – (Z - A) whereby:

Y = Paddy yield (t/ha) of input voucher users after NAIVS

X = Paddy yield (t/ha) of input voucher users before NAIVS

Z = Paddy yield (t/ha) of non- input voucher users after NAIVS

A = Paddy yield (t/ha) of non-input voucher users before NAIVS

This design is superior to the before-and-after without control design and After-only with control design because it avoids extraneous variation resulting both from the passage of time and from non-comparability of the test and control groups.

3.13 Analytical Tools

3.13.1 Descriptive statistics

Descriptive statistics such as frequencies, percentage were used to examine farmers' perception and response towards NAIVS at the Kiroka Irrigation Scheme and the implementation of NAIVS at the Kiroka Irrigation Scheme.

Qualitative variables included in the analysis were sex of the respondents, marital status, main occupation, awareness about NAIVS, inputs accessibility, quality of inputs and its identification, preferable time for inputs voucher distribution and its reasons, criteria for

selecting farmers, contribution of input voucher on food security, time when inputs vouchers were distributed to farmers, Market of inputs before NAIVS, Challenges encountered during implementation of NAIVS, other factors affecting rice production in the field, farmers suggestions for NAIVS to be successful, Input package received by farmers, variety of paddy seed, training on the use of inputs and its sources, market of inputs under NAIVS, means of transport and sources of funds for purchasing inputs.

Also the quantitative variables included in the analysis were level of education, level of contribution to the voucher value, assets, duration for receiving input vouchers, maximum area for inputs beneficiaries, distance from home to the procurement source before NAIVS, composition of VVC, farmers' level of contribution of the voucher value.

3.13.2 Conditional outcome model

Conditional Outcome Model (COM) was used to assess the impact of fertilizer and seed vouchers on rice production at the Kiroka Irrigation Scheme. Therefore the Conditional Outcome Model for rice output (Y_{ak}) on the level of fertilizer demand (F_{ij}) was given by;

$Y_{ak} = \alpha_o + \beta_1 FERT + \beta_2 DST + \beta_3 EXTNV + \beta_4 FMS + \beta_5 AG + \beta_6 EXP + \beta_7 FS + \beta_8 EDUC + \beta_9 POR + \beta_{10} PFER + \beta_{11} SEED + \beta_{12} PSEED + \varepsilon i$

Where:

Y_{ak} = Paddy yield in kg/acre

F_{ij} = Quantity of fertilizer used in kg/acre

AG = Age category of the respondents in years

EXP = Number of years respondents involved in farming activities

FS = Family size

EDUC = Number of years the respondents has been in school

EXTNV = Number of contact with extension officer to the farmer per year

DST = Distance in kilometre from the respondent home to procurement source

PFERT = Price of fertilizer in Tsh/ kg

POR = Price of Paddy in Tsh/ kg

SEED = Quantity of paddy seed used in kg/acre

α_o and $\beta_{i =}$ coefficients to be estimated and εi = error term, which is independent normally distributed with mean zero and variance.

The age and education dummies were introduced in the model so as to show which categories of age and education have more impact in paddy yield. Moataz's formula was used to interpret the dummy coefficients. According to Moataz's formula to interpret a dummy variable: In case of a positive relationship; People who have the one (1) characteristic of the independent variable tend to be more supportive of the maximum of the dependent variable. In case of negative relationship: People who have the one (1) characteristic of the independent variable tend to be less supportive of the maximum of the dependent variable.

R square tends to somewhat over-estimate the success of the model when applied to the real world, so an Adjusted R Square value was calculated which takes into account the number of variables in the model and the number of observations (participants) our model is based on. This Adjusted R Square value gives the most useful measure of the success of our model. Also it penalizes the addition of extraneous predictors to the model. Hence, Adjusted R Square values were used to select one model among the three models specified.

3.13.3 Paired-samples T-test

Paired-samples T-test was used to compare average paddy yield of input voucher users before and after NAIVS at the Kiroka Irrigation Scheme. Also to compare average paddy

yield of non-input voucher users before and after NAIVS at the Kiroka Irrigation Scheme in order to see if there is significant difference. In addition, the tool was used to test the hypothesis that rice produced by smallholder farmers before and after the application of fertilizers and improved seed is not statistically different.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Descriptive Statistic

4.1.1 Respondents characteristics

The interview involved 120 respondents received vouchers in the year 2009/10, 2010/11 and 2011/12. Characteristics of the input voucher users are as shown in Table 4.

Table 4: Characteristics of the input voucher users

Characteristics	Frequency	Percent
Sex of the respondents		
Male	48	40
Female	72	60
Age group		
18-45 years	88	73
46-80 years	32	27
Marital status of the respondents		
Married(Monogamous)	90	75
Divorced	10	9
Widowed	9	7
Single	7	6
Married (Polygamous)	4	3
Main occupation of the respondents		
Farming	93	78
Agriculture and business	24	19
Non-farming activities	2	2
Civil Servant	1	1
Level of education of the respondents		
High primary	91	76
No formal education	13	11
Lower primary	12	10
Secondary	4	3

Table 4 shows that 60% of the input voucher users are females while 40% are males. This reflects the fact that females are more involved in rice production than males. It is probably true due to the fact that in the 2011/12 cropping season, 103 out of 174 beneficiaries who received vouchers were females. According to NAIVS implementation

plan, priority was given to female-headed household. Furthermore, 73% of the input voucher users were aged between 18-45 years old while 27 % were aged between 46-80 years old. It was also indicated that the interviewees who are monogamous account for 75% while widowed was 7%. While 9% were divorced.

It was also found that 78% of the respondents are involved in farming activities mainly on rice production through irrigation during the rain and dry seasons. Furthermore, 19% of the respondents are engaged in both agriculture and business. Also 76% of the respondents have completed upper primary education and hence they know how to read and write. Unfortunately, there were 10% of respondents in the study area who could not read and write as a result they could not give relevant answers. Education is considered to be an important determinant in fertilizer and improved paddy seed adoption and use.

Table 5 indicates that 57% of the non- input voucher users are females while 43% are males. This implies that females are more involved in rice production than males. It was also shown that the interviewees who are monogamous accounts for 90% while single 10%. It was also found that 100% of the respondents are involved in farming activities mainly on rice production through irrigation during the rain and dry seasons. Also 87% of the respondents have completed primary education and hence they know how to read and write. Unfortunately, there were 13% of respondents in the study area who could not read and write. Moreover, 80% of the non-input voucher users were aged between 18-45 years old while 20 % were aged between 46-80 years old.

Therefore, the characteristics of input voucher users and non-input voucher users (control group) are almost the same.

Table 5: Characteristics of the non-input voucher users

Characteristics	Frequency	Percent
Sex		
Male	13	43
Female	17	57
Marital status		
Single	3	10
Married(monogamous)	27	90
Main occupation		
Faming	30	100
Level of education		
No formal education	4	13
Standard seven	26	87
Age group		
18-45 years	24	80
46-80 years	6	20

4.1.2 Farmers' perception and response towards NAIVS at the Kiroka Irrigation Scheme

4.1.2.1 Awareness about NAIVS

National Agricultural Input Voucher Scheme (NAIVS) has been introduced at the Kiroka Irrigation Scheme since 2009/10 cropping season to enable resource poor rice farmers to access fertilizers and improved paddy seed. The project has been implemented via Accelerated Food Security Project (AFSP). The study found that 100% of the interviewed farmers were made aware about Input Voucher Scheme. The sources of information about Input Voucher Scheme are as shown in Table 6. The survey findings in Table 6 indicate that farmers' sources of information about NAIVS was through village meeting (66%), extension officers (8%), Key Farmers (8%), other farmers (6%) and agro-dealers (5%) of the respondents respectively. Although farmers were made aware about NAIVS, there was bureaucracy in farmer's selection as reported by 15% of the respondents (Table 21). For instance vouchers were given to non-targeted farmers. According to Accelerated Food Security Project (AFSP), the eligible farmers have been required a full understanding of their entitlements, rights and obligations under the scheme. The Project

developed an "immediate" communication campaign to inform farmers, implementing agencies, agro-dealers, other private sector participants, agricultural research agencies, extension services, and the general public about the Input Voucher Scheme (URT, 2009).

Table 6: Sources of information about Input Voucher Scheme

Information sources	Frequency	Percent
Village meeting	79	66
Key farmers	10	8
Extension Officers	9	8
Other farmers	8	6
Agro-dealers	7	5
District Officials Training/seminar	3	3
Sub-village chairperson	3	3
Campaign by VVC	1	1
Total	**120**	**100**

4.1.2.2 The agricultural inputs accessibility before NAIVS

The study found that 91% of the respondents have never applied fertilizers and improved paddy seed before NAIVS. However, the reasons for Kiroka farmers not used improve inputs before NAIVS are as shown in Table 7.

Table 7: **Reasons for Kiroka farmers not used fertilizers and improved paddy seed before NAIVS**

Reasons for not use fertilizer and improved paddy seed	Frequency	Percent
Lack of knowledge on the use of fertilizers and improved paddy seed	85	64
The fertilizer and improved paddy seed were not easily available	33	25
High cost of inputs	6	5
Lack of capital	5	4
Belief on natural soil fertility	2	1
Lack of land	2	1
Total	**133**	**100**

The study found that 64% of the resource poor farmers have not been using improved inputs before NAIVS because of lack of knowledge on the use of fertilizers and improved

paddy seed. In addition, 25% of farmers reported that fertilizers and improved paddy seed were not easily available. Therefore during that time they used their local varieties and relied on natural soil fertility. Also it was found that 5% and 4% of the respondents in the study area had not used improved inputs before NAIVS because of high cost of inputs and lack of capital respectively. It was found that before NAIVS farmers who demanded fertilizer had to travel to Morogoro town, about 20Km from Kiroka Village.

These findings are inline with the baseline report which indicated that farmers used little fertilizer or improved seed because these inputs were hard to obtain. The marketing and supply chain infrastructure for agricultural inputs remains weak and inefficient and discourages many farmers from investing in inputs to increase crop production (URT, 2009). In addition this study support the findings by ACT (2010) who found that, the critical weaknesses of the rice subsector were limited production and distribution of improved seeds, low quality due to mixing of varieties, inefficient chains and insufficient input suppliers.

4.1.2.3 The quality of inputs

The quality of fertilizers and improved paddy seeds are important in rice production. Farmers' responses about the quality of inputs are as shown in Table 8. Among the respondents, 68% reported that the quality of inputs received via NAIVS was good although 2% said that MRP not good because its impact appeared in the next cropping season (Table 8). Thus, this problem was not serious at the Kiroka irrigation Scheme. However, these results are inline with URT (2012) who found that MRP and urea fertilizers had poor quality during the year 2011/12. It was observed that farmers have different skills for identification of the quality of inputs (Table 9). The survey findings in Table 9 show that 63% of interviewed farmers identified the quality of fertilizers after applying to the rice field and realized high yield.

Table 8: Farmers response about the quality of inputs

Farmer assessment	Frequency	Percent
Good	82	68
Very good	36	30
MRP impact appeared in the next cropping season	2	2
Total	**120**	**100**

Thirteen percent said that they observed many tillers after the application of fertilizers. Furthermore, 41% out of the interviewed farmers identified the quality of paddy seed when they realize high yield. However, 21% said that the quality of paddy seed could be identified by observing germination percentage. In the study area there is only one registered agro-dealer where targeted farmers received fertilizers and improved paddy seeds.

Based on these findings farmers need more training on the identification of the quality of agricultural inputs in order to identify fake fertilizers and improved paddy seeds. The risk involved, if farmers cannot determine quality of seed during purchase, could be low germination percent and as a result lead to less plant population and hence low yield. This is more risky for those farmers who get loan from financial institutions and also hired land for rice production. In order to minimize these risks the government of Tanzania should intervene by strengthening national seed system through financial support to Agricultural Research Institutes (ARI) and the Agricultural Seed Agency (ASA) to produce pre-basic and basic seeds. This intervention will ensure that seed supplied by private and Quality Declared Seeds (QDS) sectors are of high quality. In addition each agro-dealer should undergo training about agricultural inputs from the designated trainers as a minimum prerequisite to participate in NAIVS. Moreover, waiting until realization of good crop development and high yield may be a high risk to farmers.

Table 9: Farmers skills on identification of the quality of inputs

Skill	Frequency	Percent
Identification of the quality of fertilizers		
During purchase		
Physical appearance	10	7
Certification	4	3
Expiry date	7	5
Effects after planting/transplanting		
Enhance plant growth	6	4
High yield	90	63
Greenish colour of the plant	3	2
Plant grow fast	2	1
Many rice tillers	18	13
Effects after harvesting		
Large panicles	3	2
Identification of the quality of paddy seed		
During purchase		
Physical appearance	19	11
Certification	5	3
Expiry date	8	4
Before planting		
High germination percentage	38	21
Floatation test	10	6
After transplanting		
Many tillers	15	8
Resistant to diseases	1	1
After harvesting		
High yield	74	41
Good palatability	6	3
Larger grain	1	1
Do not break during milling	3	2

4.1.2.4 Preferable time for distribution of input voucher to farmers

The study found that the preferable time for distributing fertilizers and improved paddy seed to Kiroka Irrigation Scheme is January. This is due to the fact that 48% of the farmers reported that the voucher should be distributed in January before the beginning of rain season (Table 10). Farmers said that if they received inputs in January, it is possible to cultivate rice twice per year: that means ‘rain season rice’ and ‘dry season rice’. Also farmers have cash from selling paddy. Farmers who participated in NAIVS during 2008/09 reported that, they would prefer to have the vouchers immediately after the June–

July harvest, when most farmers have cash and find it easier to make the 50 percent co-payment for the input vouchers (URT, 2009).

Table 10: Reasons for distributing voucher in January

Reasons for distributing voucher on January	Frequency	Percent
Before the beginning of rain season	57	48
Time for land preparation	25	21
Cropping season	22	18
Intensive irrigation activities	7	6
Less diseases and rodents damage	4	3
To cultivate rice twice per year	3	3
Beginning of dry season cultivation	2	1
Total	**120**	**100**

4.1.2.5 The criteria for selecting farmers

The study found that 93% of the interviewed farmers indicated that the criteria for selecting farmers were transparent. These criteria were clearly explained during the time of awareness creation. Farmers were selected using the following criteria: (a) the person was a full-time farmer residing in the village, (b) the household does not cultivate more than one hectare of rice, (c) the household would use the inputs provided on rice while following the recommendations provided by extension officers, (d) farmers agree to be diligent and serve as good examples to other farmers on how to use good agricultural practices, (e) farmers would and could co-finance the purchase of the subsidized input package, (g) female-headed households have been given priority for accessing vouchers, and (h) priority for accessing vouchers would also given to farming households that used little or no fertilizer and improved seed for rice over the last five years. Farmers who fail to meet their obligations under the scheme, as assessed by the Village Voucher Committee (VVC) and endorsed by the Village Assembly, would be replaced by other eligible farmers from the same village (URT, 2009).

4.1.2.6 The farmers level of contribution to the voucher value

The study found that 55% of the interviewed farmers recon that farmers' level of contribution of the voucher value was high (Table 11).

Table 11: Farmers' response on the level of contribution of the voucher value

Response	Frequency	Percent
High	66	55
Very High	27	22
Average	15	13
Low	12	10
Total	**120**	**100**

Moreover, Table 12 indicates that farmers' levels of contribution of the voucher value were: 71.5%, 62.7%, 51.7% and 51% for UREA, DAP, MRP and paddy seed respectively in 2011/12 cropping season. But in 2009/10, farmers' level of contribution was less than 50% of the prevailing market price (Table 13). According to the project document, vouchers for each input were required to have a face value equivalent to 50 percent of the market price of the respective input, plus a "remoteness premium" that varies by the average distance of each district from the port (for urea and DAP) or point of production (for MRP and seed). The remoteness premium was incorporated in the voucher to compensate farmers in more remote locations for the added cost of transporting inputs. Because vouchers are printed before farmers buy their inputs, the level of subsidy reflected in the vouchers' face value is only an approximation, based on projected input prices when the vouchers are printed. If market prices moved higher than the projection, the level of subsidy to the farmer are less than 50 percent; if market prices moved lower, the level of subsidy is higher (URT, 2009).

Table 12: Farmers' level of contribution of the voucher value 2011/12 at the Kiroka Irrigation Scheme

Type of input	Subsidy (Tsh)	Farmers contribution(Tsh)	Market price (Tsh)	% farmers contribution
UREA (50kg)	18 500	46 500	65 000	71.5
DAP (50kg)	28 000	47 000	75 000	62.7
MRP (granule) 2 bag 50kg	28 000	30 000	58 000	51.7
Paddy seed (15kg)	12 000	12 500	24 500	51

Table 13: Farmers' level of contribution of the voucher value 2009/10 at the Kiroka Irrigation Scheme

Type of input	Subsidy (Tsh)	Farmers contribution(Tsh)	Market price (Tsh)	% farmers contribution
UREA (50kg)	17 000	15 000	32 000	46.9
DAP (50kg)	25 000	27 000	52 000	51.9
Paddy seed (15kg)	11 000	9 000	20 000	45

4.1.2.7 The Contribution of input voucher on household food security

The findings indicate that 99% of the respondents admitted that inputs vouchers enhanced household food security. This was due to increased paddy production resulting from using fertilizers (94%) and improved paddy seed (5%). It was found that the average quantity of paddy produced after NAIVS is 4.2 t/ha whereas before the NAIVS it was 1.7 t/ha. These findings are inline with Accelerated Food Security Project (AFSP) goal which aimed to enhance national food security and avert food crisis that could arise because of persistently high, volatile prices of food and agricultural inputs. Also with the objective of the AFSP which was to contribute to higher food production and productivity in target areas by improving farmers' access to critical agricultural inputs (URT, 2009). The government efforts to boost domestic food production, make food more widely available,

and increase the stability of food crop production were achieved in the study area. Therefore, the benefits of NAIVS should be scaled up to more resource poor rice farmers under irrigated agriculture. According to the AFSP document targeted farmers received input vouchers for a maximum of three years. Several input subsidy options were considered. These were assessed in terms of their likelihood to generate adequate cash-flow to enable farmers to accumulate sufficient assets to eventually participate in input markets without subsidies. The options included: (a) the same level of input subsidy for three consecutive cropping seasons, (b) a declining share of subsidy in the second and the third years (for example, a 50 percent subsidy in year one, 35 percent in year two, and 20 percent in year three), and (c) reduced quantities of subsidized inputs for the second and third year, respectively.

4.1.2.8 Contribution of input vouchers on farmers assets

The survey findings in Table 14 indicate that 88% of the farmers said that the use of fertilizers and improved paddy seed had increased farmers assets due to the fact that paddy production increased compared with before NAIVS. Table 15 indicates that 64% and 28% of the respondents have invested and acquired luxury goods respectively. It was observed that some farmers have invested on milling machine, renovated their houses, purchase land for building improved houses, land for rice production, iron sheets, cars, bicycles and motorcycles. In addition, respondents have invested on livestock enterprise like goats and local chicken. Also 5% of the farmers have procured electronic goods such as radio and television. On the other hand, a few farmers said that they managed to pay school fees for their children and access to better health services.

Therefore, in general, input voucher have led to improvement of welfare of resource poor rice farmers at the Kiroka Irrigation Scheme.

Table 14: Response on whether input vouchers increased farmers assets or otherwise

Response	Frequency	Percent
Yes	105	88
No	15	13
Total	**120**	**100**

Table 15: Reasons for input voucher increase famers' assets

Reasons	Frequency	Percent
Investment	109	64
Purchasing household Furnitures	48	28
Purchasing electronic goods	8	5
Purchasing clothes	3	2
Purchasing household appliances(Cookers)	2	1
Total	**170**	**100**

4.1.2.9 Sustainability of NAIVS

NAIVS is a package that includes access, timeliness, quality of inputs and price subsidy. This creates Public Private Partnership (PPP) in inputs supply. It was found that 100% of the interviewed farmers have requested the government of Tanzania to continue implementing Input Voucher Scheme. This is because 44%, 31% and 15% of the farmers reported that the reasons were to ease availability of inputs, to sustain increased paddy production, to benefit resource poor farmers (Table 16).

In addition, farmers in the study area said that a period of three years is not enough to save money for purchasing inputs themselves because the income obtained were only sufficient to improve their livelihoods. That means nothing is left for re-investment to the farm. Therefore the government should review their project exit strategies.

Table 16: Reasons why the government of Tanzania to continue to implement NAIVS

Reasons	Frequency	Percent
To ease availability of inputs	53	44
Increased paddy production	37	31
To benefit poor farmers	18	15
Government subsidize inputs and hence lower the price of inputs	5	4
To increase farmers income	4	3
To enable farmers to know the benefit of using inputs	1	1
No response	2	2
Total	**120**	**100**

4.1.3 The implementation of NAIVS at the Kiroka Irrigation scheme

4.1.3.1 Farmers selection

At the Kiroka Irrigation Scheme farmers were selected through Village Voucher Committee (VVC) composed of six members (3 men and 3 women) elected by Village Assembly to administer voucher scheme. Prospective beneficiaries were identified by the VVC in a participatory manner using established criteria. The list of selected farmers was then approved by the Village Assembly. The VVC was also responsible for distributing the vouchers and overseeing their use and redemption.

4.1.3.2 Input Voucher Distribution

The study found that inputs were distributed by registered agro-dealers called Shilingi in Soweto sub-village under the supervision of VVC. It was found that dates on which vouchers were received and distributed at the Kiroka Irrigation Scheme were as follows: (a) 2009/10 on 31/12/2009, (b) 2010/11 on 04/01/2011, (c) 2011/12 on 25/04/2012. This implies that for the first two cropping years, vouchers were timely delivered while in 2011/12 cropping season vouchers were delivered late. This was due to delayed voucher delivery by MAFC which then led to delayed input supply by agro-dealers. Moreover,

untimely ago-dealers payments after redeeming of vouchers to NMB may affect timely supply of inputs. Therefore, farmers prefer vouchers to be distributed in January.

The survey findings in Table 17 indicate that 70% of the farmers at the Kiroka Irrigation Scheme received three vouchers. One was for nitrogenous (N) fertilizer; a second was for phosphorous (P) fertilizer and third for Paddy seed. It was found that 66% of the interviewed farmers received MRP and Urea, 18% received MRP only and 11% received Urea only. Also 49% of farmers received SARO TXD 306 paddy variety.

Furthermore, the study found that farmers received vouchers in different years. Findings show that 57%, 28% and 15% of the farmers received vouchers for duration of two years, three years and one year respectively. These farmers recon that the input package received was sufficient for one acre and half acre (Table 17).

In addition, the study found that the quantity of vouchers received and distributed to Kiroka Irrigation Scheme were as follows (a) in 2009/10 farmers have received 200 voucher for DAP, 200 for Urea and 130 vouchers for paddy seed, (b) in 2010/11 farmers have received 700 voucher for DAP/ MRP, 700 for Urea and no vouchers for paddy seed, (c) in 2011/12 farmers have received 876 voucher for DAP/MRP, 876 for Urea and 74 vouchers for paddy seed (Table 18).

However, in 2011/12 cropping season village officials reported that 76 vouchers for DAP/MRP and 76 vouchers for Urea were returned to the Morogoro District office because of the required high level of contribution; targeted farmers failed to co-finance.

Therefore, measure of sustainability of NAIVS without enough government contribution to the voucher value farmers would fail to continue using improved inputs.

Table 17: Input Voucher distribution

Input Voucher distribution	Frequency	Percent
Input package		
Three voucher	84	70
Two voucher	31	26
One voucher	5	4
Types of fertilizers received		
MRP and UREA	78	66
MRP	21	18
UREA	13	11
MRP,UREA,YARAMILA	2	2
MRP,UREA,DAP and YARAMILA	2	2
UREA and DAP	1	1
UREA and YARA CEREAL	1	1
DAP,UREA and MRP	1	1
Variety of paddy seed received		
SARO TXD 306	56	49
SARO	42	37
SARO 5	16	14
Duration for receiving inputs		
Two years	68	57
Three years	34	28
One year	18	15
Required farm size		
One acre	70	58
Half acre	34	28
Three quarter of an acre	11	9
Quarter of an acre	5	4

Table 18: Quantity of voucher delivered to Kiroka Irrigation Scheme 2009/10-2011/12

Type of Voucher	Year		
	2009/10	2010/11	2011/12
DAP	200		
DAP/MRP	NIL	700	876
UREA	200	700	876
Paddy seeds	130	NIL	74

4.1.3.3 Training on the use of fertilizers and improved paddy seeds

The study found that 98% of the interviewed farmers received training on the use of fertilizers and improved paddy seeds. The Sources of training on the use of fertilizers and improved paddy seeds are as shown in Table 19.

Table 19: Sources of training on the use of fertilizers and improved paddy seeds

Sources of training	Frequency	Percent
Extension Officers	65	54
Key Farmers	30	25
Farmer Field School	11	9
Agro-dealer	11	9
MATI-Ilonga and KATC	3	3
Total	**120**	**100**

The survey findings in Table 19 indicate that 54%, 25%, and 9% of the farmers in the study area received training on the use of fertilizers and improved paddy seeds through extension officers, Key farmers, Farmer Field School and agro-dealer respectively. This implies that training enhanced inputs adoption and use. It was found that training on the use of fertilizers and improved paddy seed was conducted during land preparation and just after transplanting of rice seedlings.

4.1.3.4 Sources of funds for purchasing input vouchers

In the study area farmers have different sources of funds to top up input vouchers. The study found that 59% of the respondents said that the main source of fund was from selling paddy harvested in the previous season, while 18% said that was from off-farm business, for instance Kiosk, selling rice, butcher, food venders, shoes, clothes, mangoes, banana, tomatoes, sugar cane, coconuts, maize and cassava (Table 20).

Table 20: Sources of funds for purchasing input vouchers

Sources of funds	Frequency	Percent
Own income from paddy	75	59
Off-farm business	23	18
Other agricultural products	16	13
Financial institutions	5	4
Livestock	3	2
Family friends	3	2
Salary	1	1
Casual labour	1	1
Total	**127**	**100**

4.1.3.5 Challenges encountered during implementation of input voucher scheme

Although input voucher was implemented as per Project Implementation Manual, there were many challenges encountered at the Kiroka Irrigation Scheme during implementation as shown in Table 21.

The survey findings in Table 21 indicate that 42%, 24% and 14% of the respondents reported that the challenges observed during implementation of input voucher scheme were late delivery of input vouchers especially during the 2011/12 cropping season vouchers were delivered in April; high level of contribution of the voucher value and biasness/bureaucracy during farmers' selection. Also 9% of the respondents said that farmers' demands for inputs were not met because some farmers have been received fertilizer only or paddy seed only in some years. Likewise Ward Agricultural Extension Officer said that the Village Voucher Committee was not working properly due to lack of motivation in terms of Daily Subsistence Allowance (DSA) which might create chances of fraud or corruption.

Table 21: The challenges encountered during implementation of input voucher scheme

Challenges	Frequency	Percent
Late delivery of input vouchers	50	42
High level of contribution of the voucher value	28	24
Biasness/bureaucracy in farmer selection	17	14
Farmers' demands for inputs were not met	10	8
Lack of knowledge on the use of fertilizer to some farmers	6	5
MRP its results appear in the next season	4	3
No response	5	4
Total	**120**	**100**

Furthermore, the Village Voucher Committee reported that the challenges observed during implementation of NAIVS were as follows:

(i) Sometimes voucher and inputs were delayed which affect negatively the cropping calendar.

(ii) The impact of MRP appeared in the following farming season. Farmers harvested more paddy in the following year. Therefore, farmers prefer DAP than MRP because of its immediate response to paddy production.

(iii) VVC members were not given allowances during input voucher distribution to target farmers.

However, this study is inline with URT (2012) but the difference is that some agro-dealers are not trustworthy because they have been cheating on vouchers by buying vouchers from targeted beneficiaries and then re-sell to non-targeted beneficiaries. In addition, these results are similar with the challenges observed during 2008/209 baseline survey.

The challenges reported are as shown in Appendix 7.

(i) Not all eligible farmers could get vouchers, mainly due to financial constraints of the resource poor farmers;

(ii) Lack of extension staff limits the technical backstopping and supervision requires increasing farmers' fertilizer-use efficiency;

(iii) Delay of Vouchers in 2008/09 cropping season;

(iv) Few farmers had used Minjingu rock phosphate, initial uptake was low, and the powder form of Minjingu was less acceptable, but these attitudes started to change after farmers saw the crop response in the field especially in the following cropping season (URT, 2009).

Therefore, it is observed that some of the challenges reported during the baseline survey were still continuing after the implementation of NAIVS from 2009/2010 to 2011/2012, thus government interventions are needed to address the situation.

4.1.3.6 Other factors affecting rice production in the past three years (2009/10-2011/12)

Fertilizers and improved paddy seeds are important inputs in rice production. But farmers in the study area said that although they received fertilizers and improved paddy seed, there were field factors that have been affecting rice production in the past three years as shown in Table 22. The survey findings in Table 22 indicate that 32%, 21%, 20%, 14%, 10, 7% and 3% of farmers at the Kiroka Irrigation Scheme indicated that, other factors which affected rice production from 2009/10 to 2011/12 were: (a) shortage of water during the dry season, (b) Rice Yellow Mottle Virus (RYMV) disease, (c) Pests (Red eye shoot fly), (d) Rodents (e) Birds (Quelea quelea) and (f) the use of poor techniques. Farmers said that RYMV disease was most serious in the dry season mainly June to August. Plants became yellow and stunted growth and therefore failed to respond on fertilizer application. Red eye shoot fly damage rice seedlings two weeks after transplanting. They lay eggs on the growing points; then hatch into lava and feed on the growing point thus caused drying of the rice plant. Moreover, the interviewed farmers said that they use poor techniques in rice production such as use of hand hoe during land preparation and weeding instead using power tillers and push weeders. Therefore measures should be taken to incorporate pesticides, power tillers and push weeders in voucher scheme in order to strengthen the impact of the project.

These findings are inline with Ward Agricultural extension Officer (WAEO) who said that the factors affecting rice production at the Kiroka Irrigation Scheme after the introduction of vouchers were as follows (a) rodents, (b) shortage of water during the dry season, (c) Rice Yellow Mottle Virus disease, (d) the field was not well levelled which affect water distribution and utilization. Furthermore, URT (2012) found that among the factors that led to low rice productivity in 2011/12 was drought.

Table 22: Other factors which affected rice production in the past three years

Factors	Frequency	Percent
Shortage of water during the dry season	74	32
Diseases such as Rice Yellow Mottle Virus(RYMV)	48	21
Pests(Red eye shoot fly)	46	20
Rodents	31	14
Birds (Quelea quelea)	23	10
The use of poor techniques	7	3
Total	**229**	**100**

4.1.3.7 Farmers suggestions for the NAIVS to be successful

Based on the challenges encountered during project implementation and field factors affecting rice production, farmers in Kiroka Irrigation Scheme said that for the NAIVS to be successful in the next phases the following suggestions should be considered as shown in Table 23**.**

Table 23: Farmers suggestions for the NAIVS to be successful

Farmers suggestions	Frequency	Percent
Timely delivery of input vouchers	69	39
Lower the farmers level of contribution of the voucher value	27	15
Farmers demand for inputs should be more than one acre	26	15
Training on the use of fertilizers and improved paddy seed	23	13
Close supervision during input vouchers distribution	13	7
Complete the construction of the main canal	7	4
Rain water harvesting	4	2
Farmers to pay top up value after harvest	2	1
Market availability for paddy	2	1
Close supervision in water distribution	2	1
Availability of financial credit	1	1
Village Voucher Committee (VVC) members should be motivated e.g. given allowances based on their responsibilities.	1	1
Total	**177**	**100**

4.2 The impact of Fertilizer and Seed Vouchers on Rice Production at the Kiroka Irrigation Scheme

NAIVS was implemented via Accelerated Food Security Project (AFSP) from 2009/10 to 2011/12 cropping seasons aimed at contributing to higher food production and productivity in targeted areas by improving farmers' access to critical agricultural inputs (Appendix 9). Therefore this study was intended to assess the impact of using fertilizers and improved paddy seeds in paddy production under irrigation at the Kiroka Irrigation Scheme. Paired Samples T-test was used to assess the impact of using fertilizers and improved paddy seeds in paddy production.

4.2.1 Paired samples t-test output

4.2.1.1 Average paddy yield of input voucher users and non-input voucher users before and after NAIVS

The findings from paired samples t-test show that the average paddy yield of input voucher users after NAIVS is 4.2 t/ha while before NAIVS it was only 1.7 t/ha (Table 24). The mean difference between the yield of paddy produced before and after NAIVS of input voucher users is 2.5 t/ha which is significantly different at 1% level of significance. Also it was found that the average paddy yield of non-input voucher users (control group) after NAIVS is 1.3 t/ha while before NAIVS, it was only 1.0 t/ha. The mean difference between the yield of paddy of non-input voucher before and after NAIVS is 0.3 t/ha which is significantly different at 1% level of significance. This was due to the fact that, the control group never used fertilizers and improved paddy seeds. They relied on local varieties and believed that their soils are fertile. Therefore, the difference between the mean difference of paddy yield of input voucher users and non-input voucher users (difference of the difference) before and after NAIVS is 2.2 t/ha (that

is 2.5 t/ha minus 0.3t/ha = 2.2 t/ha). Therefore, this method of impact assessment concluded that the use fertilizers and improved paddy seeds increases paddy yield.

Therefore, the findings have failed to accept the null hypothesis at 5% level of significant that rice yield before and after the application of fertilizers and improved paddy seeds is not statistically different but support the alternative one that rice yield before and after the application of fertilizers and improved paddy seed is statistically different. This is also the evidence from 73% of the respondents who said that the use of fertilizer and improved paddy seeds increased paddy yield. Furthermore, it was found that before NAIVS farmers harvested an average of 8 bag /acre because they never used fertilizers and improved paddy seeds but after NAIVS paddy yield increased up to 40 bag /acre (Appendix 4).

Moreover, the finding is inline with Patel (2011) who found that Voucher recipients who used improved inputs harvested on average 994 kg/acre of paddy versus 739 kg/acre for non-input users.

These results are also inline with Mguruse (2007) and Mng'olage (2008) who found that there has been a significant increase in maize yield since the inception of the subsidy programme in Tanzania. In Malawi, there has been a progressive increase in yield from less than 1.0MT/ha to 2.04MT/ha (Luhanga and Sungani, 2007).

According to baseline survey conducted by URT (2009), the average rice yield in the NAIVS target area was 1.73 t/ha (Appendix 8) but after introducing the project paddy yield increased to 3.9 t/ha. Furthermore, the statistics by the UN Food and Agriculture organization indicated that the world's average rice yield was about 4.3 tones per hectare in 2009. This implies that rice production in the study area is closer to the world average.

Table 24: **Average paddy yield of input voucher users and non-input voucher users before and after NAIVS**

		Mean	N	Std. Deviation	Std. Error Mean	t	Sig. (2-tailed)
Pair 1	Average paddy yield in t/ha of input voucher users after NAIVS	4.2	120	1.96	1.18	16.79	0.000*
	Average paddy yield in t/ha of input voucher users before NAIVS	1.7	120	0.94	0.09		
Pair 2	Average paddy yield in t/ha of non-input voucher users after NAIVS	1.3	30	0.86	0.16	5.39	0.000*
	Average paddy yield in t/ha of non-input voucher users before NAIVS	1.0	30	0.75	0.14		

* represent level of significance at 1%

4.2.1.2 Average paddy yield trend of input voucher users before and after NAIVS

The distribution of paddy yield of input voucher users at the Kiroka Irrigation Scheme before and after the inception of NAIVS is as shown in Fig. 5. The findings in figure 5 show that paddy yield of input voucher users before NAIVS was lower than after NAIVS (as shown by blue colour) because the respondents never used fertilizers and improved paddy seeds. They relied on local varieties and believed that their soils are fertile. On the other hand, the higher paddy yield after NAIVS (as shown by red colour) was due to the use of fertilizers and improved paddy seeds (SARO TXD 306).

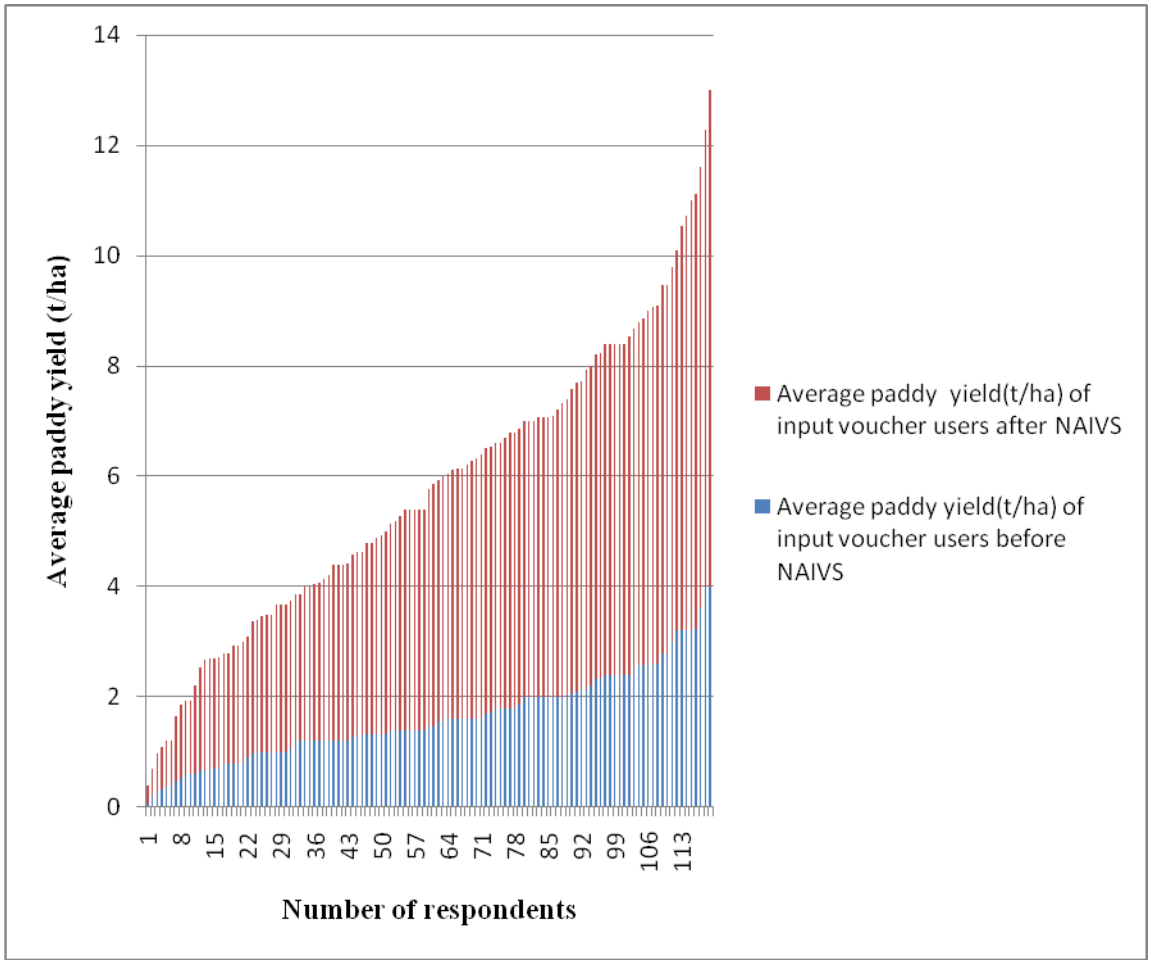

Figure 5: Average paddy yield (t/ha) trend of input voucher users before and after NAIVS

4.2.1.3 Average paddy yield trend of input and non input voucher users after NAIVS

The distribution of paddy yield of input and non input voucher users at the Kiroka Irrigation Scheme after the inception of NAIVS is as shown in Figure 6. The findings in figure 6 show that paddy yield of non input voucher users after NAIVS was lower than input voucher users (as shown by red colour) because the respondents never used fertilizers and improved paddy seeds. They used local varieties and believed that their soils are fertile. Furthermore, the higher paddy yield after NAIVS (as shown by blue colour) was due to the use of fertilizers and improved paddy seeds (SARO TXD 306).

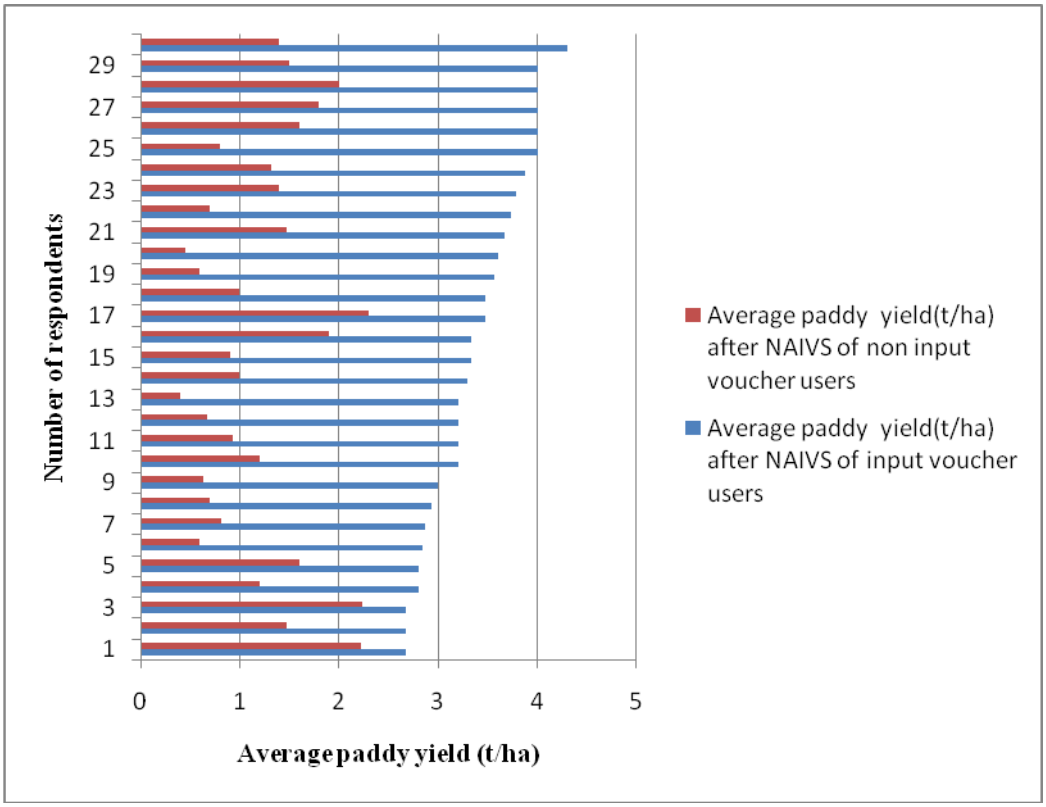

Figure 6: Average paddy yield (t/ha) trend of input and non input voucher users after NAIVS

4.2.1.4 Relationship between average paddy yield in t/ha of input voucher users after NAIVS and sex of the respondents

In Kiroka irrigation Scheme both male and female are involved in paddy production before and after NAIVS. The contributions of male and female in paddy yield after the inception of NAIVS for input voucher users are as shown in Table 25. The findings in Table 25 indicate that 72 females out of 120 respondents contributed more in the average paddy yield after NAIVS than males. Moreover, 20.8% of females contributed more to the paddy yield category of 2-2.9 t/ha than males. Also 20.8% of females contributed more to the paddy yield category of 5-5.9 t/ha than males.

Table 25: Relationship between average paddy yield in t/ha of input voucher users after NAIVS and sex of the respondents.

Average paddy yield in t/ha after NAIVS	Sex of the respondents				Total
	Male	Percent	Female	Percent	
0.3 - 0.9	2	4.2	4	5.6	**6**
1 - 1.9	1	2.1	5	6.9	**6**
2 - 2.9	11	22.8	15	20.8	**26**
3 - 3.9	9	18.8	7	9.7	**16**
4 - 4.9	10	20.8	13	18.1	**23**
5 - 5.9	4	8.3	15	20.8	**19**
6 - 6.9	8	16.7	8	11.1	**16**
7 - 7.9	2	4.2	2	2.8	**4**
8 - 8.9	1	2.1	3	4.2	**4**
Total	**48**	**100**	**72**	**100**	**120**

4.2.2 Conditional Outcome Model output

Conditional Outcome Model (COM) was used to assess the impact of fertilizer and seed vouchers on rice production at the Kiroka Irrigation Scheme. The variables were analysed through SPSS version 16.0. The three model specifications were established (Table 28) and analysed using Ordinary Least Square (OLS). Given the problem of multicollinearity in OLS using cross-sectional data diagnosis of multicollinearity was done. Multicollinearity occurs when two or more independent variables in a regression model are highly correlated to each other. Simon (2004) argued that many regression analysts often rely on Variance Inflation Factors (VIF) to detect multicollinearity because it is possible that the pair wise correlations are small, and yet a linear dependence exists among three or even more variables. The VIF quantifies how much the variance is inflated; it is a factor by which the variance is inflated.

A VIF of 1 means that there is no correlation among the k^{th} predictor and the remaining predictor variables, and hence the variance of b_k is not inflated at all. The general rule of thumb is that VIFs exceeding 4 warrant further investigations, while VIFs exceeding 10

are signs of serious multicollinearity requiring correction. Therefore, in this study the collinearity statistics from SPSS output shows that the VIF of each independent variable is less than four (Table 26) to indicate that there is no problem of multicollinearity.

Table 26: Collinearity Statistics

Predictor variables	Module 1 VIF	Module 2 VIF	Module 3 VIF
Fertilizer rate	2.514	2.472	2.822
Seed rate	2.469	2.465	2.790
Experience in farming activities	1.121	1.167	1.463
Age 18 - 45 years	1.064	1.066	1.602
Number of years in school			1.158
Primary and adult education	1.033	1.036	
Family size		1.118	1.248
Dependant ratio	1.105		
Number of contact with extension staff	1.053	1.047	1.053
Distance	1.220	1.225	1.095
Price of fertilizers	1.110	1.102	1.115
Price of paddy	1.166	1.170	1.129

The results are presented in three models after the introduction of dummy variables such as age and education categories in order to know which category has more impact on paddy yield. R square tends to somewhat over-estimate the success of the model when applied to the real world, so an Adjusted R Square value is calculated which takes into account the number of variables in the model and the number of observations (participants) our model is based on. This Adjusted R Square value gives the most useful measure of the success of our model. Also it penalizes the addition of extraneous predictors to the model.

Therefore based on adjusted R^2 levels, Model 3 (Table 28) estimates are used in this discussion because its value (Adjusted $R^2 = 0.635$) is relatively larger compared to Model 1(Adjusted $R^2 = 0.632$) and Model 2 (Adjusted $R^2 = 0.631$).

The definition of the variables used in the COM specification is as shown in Table 27

Table 27: Definition of the variables used in the COM specification

Variable name	Measurement	Expected sign/reasons
Paddy yield	Kg/acre-harvested in 2011/12 cropping season.	Dependent variable
Fertilizer rate	Kg/acre- applied in 2011/12 cropping season.	Positive given that there is positive response in increasing paddy yield.
Seed rate	Kg/acre- used in 2011/12 cropping season.	Positive given that there is positive response in increasing paddy yield.
Experience in farming activities	Years in rice production	Positive given that there is positive response in adoption and use of inputs.
Age between 18-45 years	Dummy (1=18 - 45years, 0 = 46 - 80years)	Negative given that they tend to be less supportive of the maximum paddy yield.
Number of years in school	Years	Positive given that there is positive response in adoption and use of inputs.
Primary and adult education	Dummy (1= Primary and adult education, 0=Secondary& no school)	Negative given that they tend to be less supportive of the maximum paddy yield.
Family size	Number of people in a household	Positive given that there is decrease in cost of hiring labour during labour peak requirement.
Dependant ratio	Number of dependants/family size*100	Positive given that there is decrease in cost of hiring labour during labour peak requirement.
Contact with extension staff	Number of contact in 2011/12 cropping season	Positive given that there is positive response in adoption and use of inputs.
Distance	Km	Negative given that there is increase in transaction cost.
Price of fertilizers	Tsh./kg in 2011/12 cropping season	Negative given that there is increase in cost of production
Price of paddy	Tsh./kg in 2011/12 cropping season	Positive given that there is increase in demand for inputs

Table 28: The Conditional Outcome Model specification

Predictor variables	Unstandardized Coefficients B (Model 1)	Unstandardized Coefficients B (Model 2)	Unstandardized Coefficients B (Model 3)
(Constant)	7507.168	6941.045	1670.541
	(1.536*)	(1.490*)	(0.529)
Fertilizer rate	0.926	1.116	0.574
	(0.224)	(0.272)	(0.168)
Seed rate	149.823	149.503	153.179
	(7.199***)	(7.183***)	(8.228***)
Experience in farming activities	-3.393	-2.742	26.895
	(-0.112)	(-0.089)	(0.864)
Age between 18-45years	-29.410	-28.579	-46.005
	(-0.556)	(-0.539)	(-1.678*)
Number of years in school			-4.009
			(-0.038)
Primary and adult education	-707.088	-703.702	
	(-2.878***)	(-2.857***)	
Family size		-58.194	47.409
		(-0.408)	(0.427)
Dependant ratio	-13.563		
	(-0.540)		
Number of contact with extension staff	534.439	-541.594	486.327
	(2.070**)	(-2.101**)	(2.568***)
Distance	-72.578	-74.665	-51.013
	(-0.366)	(-0.376)	(-0.316)
Price of fertilizers	-0.996	-1.020	-1.025
	(-1.437*)	(-1.476*)	(-2.002**)
Price of paddy	2.078	1.961	2.630
	(0.517)	(0.487)	(0.807)
Model 1:	**Model 2**:		**Model 3**:
R^2 = 0.677	R^2 = 0.676		R^2 = 0.667
Adjusted R^2 = 0.632	Adjusted R^2 = 0.631		Adjusted R^2 = 0.635

, * and ******* represent levels of significance at 10%, 5% and 1% respectively, ( ) represent t-ratios

Dependent variable: Paddy yield in kg/acre

The survey findings in Model 3, Table 28 indicate that the use of fertilizer and improved paddy seeds have positive impact in paddy yield. For every unit increase in fertilizer rate (kg/acre), a 0.6 kg/acre increase in paddy yield is predicted; holding other variables constant. Also for every unit increase in seed rate (kg/acre), a 153.2 kg/acre increase in paddy yield is predicted; holding other variables constant. The increase is statistically significant at 1%. This finding is inline with Patel (2011) who found that Voucher recipients who used improved inputs harvested on average 994 kg/acre of paddy versus 739 kg/acre for non-input users. Moreover, Model 3, Table 28 show that factors such age

between 18-45years of the respondents, number of contact with extension staff and price of fertilizers have significant impact in paddy yield.

According to Moataz's formula to interpret a dummy variable: In case of a positive relationship; People who have the one (1) characteristic of the independent variable tend to be more supportive of the maximum of the dependent variable. In case of negative relationship: People who have the one (1) characteristic of the independent variable tend to be less supportive of the maximum of the dependent variable.

Based on Moataz's formula to interpret a dummy variable, respondents who belong to age between 18-45 years tend to be less supportive of the maximum paddy yield and hence paddy yield decreased by 46 kg/acre. It is statistically significant at 10% because the ability to do farming activities decreases with age. Thus create negative response in adoption and use of inputs.

A unit increase in number of contact with extension staff, increased paddy yield by 486.3 kg/acre; holding other variables constant. This finding is inline with Mbata (1994) who found that contact with extension agents are important factor influencing fertilizer adoption and use among small scale farmers in Kenya.

Also Nkonya *et al.* (1997) argued that extension services focus on imparting key messages to farmers on each visit, with the complexity of these messages being increased in subsequent visits. Initial messages aim at improving basic production techniques, with attention being focused on land preparation, the timeliness of operations, crop spacing, plant population sizes, the use of better seed varieties and on weeding. After the simple

message, attention shifts to more complex messages such as those relating to fertilizer use.

The increase in price of fertilizer increases the cost of production. For every unit increase in price of fertilizer (TSH) it decreased paddy yield by 1.03 kg/acre; holding other variables constant because farmers failed to meet top up costs. As a result resource poor rice farmer fail to contribute to the voucher value. This finding is inline with Ekanayake (2006) who found that in the event of unavailability of substitutes for fertilizer, farmers tend to apply fertilizer with whatever difficulties to ensure the optimum yield levels. However, increase in fertilizer price could reduce farmers' profit since it increases cost of production.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The study found that NAIVS is a good system which enables resource poor paddy farmers at the Kiroka Irrigation Scheme to access agricultural inputs closer to the Village or Ward agro dealers at subsidized prices compared with the situation before NAIVS. The beneficiaries were appreciated the benefits of using fertilizers and improved paddy seeds.

NAIVS was implemented as per Project Implementation Manual but had encountered many challenges at the Kiroka Irrigation Scheme that needs to be intervened by the Ministry of Agriculture Food Security and Cooperatives, Morogoro District Council and Village leaders. These challenges were as follows: (a) late delivery of input vouchers, (b) high level of contribution to the voucher value, (c) biasness and /or bureaucracy during farmers' selection, (d) farmers demand for inputs were not met because some farmers received fertilizer only or paddy seed only in some years, (e) Village Voucher Committee members were not given allowances which might create chances of fraud or corruption, (f) The impact of MRP appeared in the following farming season.

Moreover, NAIVS had positive impact in paddy yield at the Kiroka Irrigation Scheme. The results from paired samples T-test indicate that the difference between the mean difference of paddy yield of input voucher users and non-input voucher users (difference of the difference) before and after NAIVS is 2.2 t/ha (that is 2.5 t/ha minus 0.3 t/ha = 2.2 t/ha). Therefore, the use of fertilizers and improved paddy seeds increases paddy yield at the Kiroka Irrigation Scheme. The increase was more than 2-folds moving closer to world

average of 4.3 t/ha. This implies that the primary objective of increasing paddy yield through input vouchers in the target area is achieved.

5.2 Recommendations

In view of the above discussion, this study recommends the following:

(i) The government should deliver input vouchers to the district before the beginning of rain season mainly in January to enable farmers to cultivate rice twice per year. This can be achieved by re-scheduling budgetary cycle from June to April so that the government can release funds by July each year. By doing so the procurement processes could be shortened. Also the government should find the possibility of printing voucher in year t for future use in year t + 1. Therefore, the adoption of this option will correct the problem of late delivery of voucher to the district.

(ii) The government should look for possibility of lowering farmers' level of contribution to the voucher value to be less than 50% because farmers are resource poor by reviewing the subsidy exit strategies.

(iii) The government should incorporate Pesticides and Rodenticides in Vouchers Scheme because pests and rodents cause damage to rice plant and ultimately reduce paddy yield. Also the government should make sure that farmers received full input package instead of fertilizer only or paddy seeds only.

(iv) Training on the use of fertilizers and improved paddy seeds should be strengthening to know type, when and rate of application. The government should set enough budgets for training farmers on the use of improved inputs through Farmer Field School in the irrigation scheme by close supervision from the Agricultural Extension Officers. Also the district through District Agricultural Development Plan (DADP) should incorporate farmers' training on improved technologies in the plan.

(v) The government should monitor the supply chain of input vouchers from MAFC to the beneficiaries in order to avoid corruption. This can be achieved through controlling whole-sellers and retail agro-dealers. The intervention will lower top up costs and increase sustainable use of full inputs package. Furthermore, Village Voucher Committee members should be given allowance based on their responsibilities in order to avoid corruption. During the time of voucher distribution they work normally twice per week (Mondays and Wednesdays).

(vi) The government should set aside enough funds to complete the construction of main canal at the Kiroka Irrigation Scheme so as to enhance water availability for all rice farmers under the scheme.

(vii) The government should look for possibility of investing in rain water harvesting as a measure to solve the problem of water shortage during the dry season.

(viii) Soil analysis should be conducted before the implementation of the project in the next phase in order to determine the recommended type of fertilizers in the study areas because farmers complained that the impact of MRP appeared in the following cropping season.

5.3 Areas for Further Research

Based on the achievement of NAIVS to increase paddy yield in the study area, I recommend future study on cost-benefit analysis of NAIVS.

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APPENDICES

Appendix 1: Questionnaire for input voucher users

Division_____

Ward _____

Village_____

Date of interview_____

Name of respondent_____

Title: Impact of National Agricultural Inputs Voucher Scheme on rice production at the Kiroka Irrigation Scheme, Morogoro District.

Respondents Characteristics

1. Sex of the respondent: 1=Male , 2=Female
2. Marital status of the respondent: 1=single, 2=married(monogamous), 3=married (polygamous), 4=widowed, 5=separated, 6=divorced
3. Main occupation of the respondent:1=self-employed (non-agric), 2=permanent employee, 3=work on own farm,4=others(specify)_____
4. Level of education of the respondent: 1=none, 2=standard four, 3=standard seven, 4=form four, 5=form six, 6=college, 7=university,8=form two, 9=others(specify)_____

Specific Objective No.1

To examine farmers' perception and response towards NAIVS at the Kiroka Irrigation Scheme.

1. Do you have full information about Voucher Scheme? 1= Yes, 2=No

2. Where did you get information about Voucher Scheme? 1=Leaflet/Brochures, 2=Radio, 3=Television, 4=Village meeting, 5= Campaign by VVC, 6= district official training/seminar

3. Did you use fertilizers and improved paddy seed before the project? 1=Yes, 2= No

   If not what are the reasons for not using improved inputs before the project?

   _____

4. Are fertilizer and seeds more available now than before NAIVS? 1=Yes, 2=No

   If the answer is yes/no give reason(s) _____

5. What do you say about the quality of inputs: 1= very Good, 2= good, 3= poor, 4=others(specify)_____

6. How do you identify the quality of fertilizers? 1=physical appearance, 2=certification, 3=expiry date, 4=others(specify)_____

7. How do you identify the quality of seeds? 1= physical appearance, 2=certification, 3=expiry date,4=others(specify)_____

8. When did you want the input voucher to be distributed in your area? _____

   Give reason(s) for your answer_____

9. Are the criteria for selecting farmers' transparency? 1=Yes, 2=No

   If the answer is no give reason(s) _____

10. What do you say about the farmers' level of contribution to the voucher value? 1=very high 2=high, 3=low

11. Is the Input Voucher enhancing food security at household level? 1=Yes, 2=No

    If the answer is yes/no give reason(s) _____

12. Do the Input voucher increases rice production? 1=Yes, 2=No

    If the answer is yes/no give reason(s) _____

13. Do you think that your income increases after using input voucher? 1=Yes, 2=No

    If the answer is yes/no give reason(s) _____

14. Do you think that your asset increases after using input voucher? 1=Yes, 2=No

    If the answer is yes/no give reason(s) _____

15. Before NAIVS, what is the distance from your home to the procurement source?

    _____

16. Where did you procure inputs before NAIVS? _____

17. Do you think that your asset increases after using input vouchers? 1=Yes, 2=No

    If the answer is yes/no give reason(s) _____

18. Should the government of Tanzania continue to implement IVS? 1=Yes, 2=No

    If the answer is yes/no give reason(s) _____

Specific Objective No.2

To assess the implementation of National Agricultural Inputs Voucher Scheme at the Kiroka Irrigation Scheme.

1. What is the composition of village voucher committee? _____
2. The input package consist of: 1=one voucher, 2=two voucher, 3=three voucher

3. What type of fertilizers did you received in the last three years?

   _____

4. What variety(s) of paddy seed did you received in the last three years?

   _____

5. For how long did you receive input voucher? 1=one year, 2=two years, 3=three years

6. The fertilizers and paddy seed obtained were sufficient for: 1=1acre, 2= 2 acre, 3=2.5 acre, 4=1/2acre, 5=3/3 acre

7. At what time vouchers were distributed to you? 1=October-November, 2=April-May, 3=July-August, 4=others (specify)_____

8. In which crop did you apply the fertilizers? _____

9. What was your level of contribution to the voucher value? 1=>50% of the market price , 2=50% of the market price, 3=<50% of the market price

10. Did you get training on the use of fertilizers and paddy seeds? 1=Yes, 2=No

11. Where did you get training on the use of fertilizers and paddy seeds?1=extension officers, 2=farmer Field School, 3=other farmers, 4=Nane nane agricultural show, 5=others (specify)_____

12. Where did you buy fertilizers and paddy seeds under NAIVS? 1=local shop, 2=town shop, 3=Primary cooperative societies, 4=village shop, 5=others (specify)

    _____

13. Which means of transport did you use to carry the input? 1=public transport, 2=bicycle, 3=by cart, 4=on foot , 5=others (specify)_____

14. Where did you get funds for purchasing input voucher?1=own income from rice, 2=SACCOS, 3=Bank, 5=others(specify)_____

15. Are the inputs under NAIVS available on time? 1=Yes, 2=No

    If the answer is yes/no give reason(s) _____

16. What are the challenges during implementation of Voucher Scheme?

    _____

17. What other factors affecting rice production in the past three years?

    _____

18. . What are your suggestions for the NAIVS to be successful?

    _____

Specific Objective No.3

To assess the impact of fertilizer and seed vouchers on rice production at the Kiroka Irrigation Scheme

1. How many paddy bags (each of 80 kg) were produced in the last season?

   _____

2. What is the quantity of fertilizers in bags (bag of 50 kg) used in the last season?

   _____

3. What is the distance in kilometres from you home to fertilizer procurement source? _____

4. How many visits/contact(s) were made by extension staff in the last season?

   _____

5. What is the size of your farm? _____

6. What is your Age? _____

7. How many years have you been in farming activities (experience)_____

8. What is the size of your family including the number of dependants? _____

9. How many years have you been to school? _____

10. What was the price of one bag (80kg) of paddy in the last season? _____

11. What was the price of fertilizers in the last season? _____

12. What was the quantity of paddy seeds (in kg) did you use in the last season? ____

13. What was the price of one bag (15kg) of paddy seeds in the last season? _____

14. What was the average quantity of paddy produced after using input voucher for the last three seasons?

Season	**Area cultivated in acres**	**Total output(bag/acre)**	**Average (bag/acre)**
2009/10			
2010/11			
2011/12			

15. What was average quantity of paddy produced before the introduction of NAIVS?

Season	**Area cultivated in acres**	**Total output(bag/acre)**	**Average (bag/acre)**
2008/09			
2007/08			
2006/07			

Appendix 2: Questionnaire for non- input voucher users

Division_____

Ward _____

Village_____

Date of interview_____

Name of respondent_____

Title: Impact of National Agricultural Inputs Voucher Scheme on rice production at the Kiroka Irrigation Scheme, Morogoro District**.**

Respondents Characteristics

1. Sex of the respondent: 1= Male , 2= Female
2. Marital status of the respondent: 1= single, 2= married(monogamous), 3= married (polygamous), 4= widowed, 5= separated, 6= divorced
3. Main occupation of the respondent:1= self-employed (non-agric), 2= permanent employee, 3= farming ,4= others(specify)_____
4. Level of education of the respondent: 1= none, 2= standard four, 3= standard seven, 4= form four, 5= form six, 6= college, 7= university,8= form two
5. What is your Age? _____

Specific Objective No.3

To assess the impact of fertilizer and seed vouchers on rice production at the Kiroka Irrigation Scheme

1. What is the size of your rice farm? _____

2. Did you grow rice in 2011/12 cropping season? 1= YES, 2= NO

3. If yes, what variety(s) of rice did you cultivate? 1=Local varieties, 2=improved varieties

4. Did you use non-subsidy fertilizers during 2011/12 cropping season? 1=YES, 2=No

5. What was the average quantity of paddy produced without using input voucher for the last three cropping seasons?

Season	**Area cultivated in acres**	**Total output(bag/acre)**	**Average (bag/acre)**
2009/10			
2010/11			
2011/12			

6. What was the average quantity of paddy produced before the introduction of input voucher for the last two cropping seasons?

Season	**Area cultivated in acres**	**Total output(bag/acre)**	**Average (bag/acre)**
2008/09			
2007/08			

Appendix 3: Time when vouchers were distributed to farmers

Time	Frequency	Percent
October-November	28	23
April-May	7	6
July-August	22	18
February	22	18
January-February	3	3
January	10	8
May	2	2
March	9	8
December	8	7
September	3	3
June-July	4	3
No response	2	1
Total	**120**	**100**

Appendix 4: Paddy production at the Kiroka Irrigation Scheme (Target and Actual)

Year	2009/10	2010/11	2011/12
Target (bag/acre)	35	35	45
Actual (bag/acre)	38	40	41

Appendix 5: Paddy price in the last three years

Year	2009/10	2010/11	2011/12
Quantity	80kg bag	80kg bag	80kg bag
Price(Tsh)	48 000	60 000	72 000/-90 000

Appendix 6: Market of inputs before NAIVS

Market	Frequency	Percent
Morogoro town	40	78
Never use inputs	2	4
Local agro dealer	4	8
Soweto	5	10
Total	**51**	**100**

Appendix 7: Benefits and challenges of implementing NAIVS in 2008/09

Benefits	Challenges
At the regional and district level	
Possible to know the number of farmers who received subsidies and quantities of fertilizer and seed subsidized per district	Very close follow-up of implementation at district level, which requires additional human and financial resources
Monitoring impacts is easier for the voucher scheme than for previous subsidy programs	Sufficient agricultural extension staff needed at local level to provide effective technical support for farmers
At the farmer level	
The voucher scheme improved input access for a large number of households (an average of 200 households per village, compared to 15-20 households under the previous system)	Not all eligible farmers could get vouchers, mainly due to financial constraints
Input shops are now present at the village level, whereas before farmers had to travel to district headquarters to get inputs	Lack of extension staff limited the technical backstopping and supervision to improve farmers' fertilizer-use efficiency.
With the high fertilizer prices in 2008/09, many farmers could not have afforded any inputs without the subsidy	Vouchers reached farmers either too near or even after the onset of the rains; proper timing of voucher distribution is critical
	Few farmers had used Minjingu rock phosphate, initial uptake was low, and the powder form of Minjingu was less acceptable, but these attitudes started to change after farmers saw the crop response in the field especially in the following cropping season.

Appendix 8: Rice yield in target areas (t/ha)

AFSP outcome indicators	Baseline	Year 1	Year 2	Year 3
Rice yield in target areas (t/ha)	1.73	2.3	2.5	2.7

Appendix 9: Results Framework for Emergency Accelerated Food Security Project

Project Development Objective	Project Outcome Indicators	Use of Project Outcome Information
To contribute to higher food production and productivity in targeted areas in Tanzania by improving farmers access to the critical agricultural inputs over the next three years.		
Production of rice in target areas	Rice production (t) Average rice yields (t/ha)	To inform policy makers on progress on achieving project document objective , To monitor food availability
Intermediate Outcomes	**Intermediate Outcome Indicators**	**Use of Intermediate Outcome Monitoring**
Component 1: Access to agricultural inputs (fertilizer and seed)		
Access of smallholder farmers to agricultural inputs in target areas	Percentage of farmers using improved seed and fertilizer	To validate the number of farmers using the vouchers/adopting the technology in target area.