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Strengthening National Comprehensive Agricultural Public Expenditure in Sub-Saharan Africa

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TANZANIA

PUBLIC EXPENDITURE REVIEW

NATIONAL AGRICULTURAL INPUT VOUCHER SCHEME (NAIVS)

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BILL & MELINDA GATES foundation

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ACRONYMS

ACT	Agricultural Council of Tanzania
AFSP	Accelerated Food Security Project
AG	Attorney General's Office
AGRA	Alliance for a Green Revolution in Africa
AIS	Agricultural Input Section
ASDP	Agricultural Sector Development Program
BOT	Bank of Tanzania
CNFA	Citizens Network for Foreign Affairs
CAG	Controller and Auditor General
CBO	Community-Based Organization
CSOs	Civil Society Organizations
DALDO	District Agriculture and Livestock Officer
DAP	Diammonium Phosphate
DVC	District Voucher Committee
ESRF	Economic and Social Research Foundation
GDP	Gross Domestic Product
HAIS	Head of Agricultural Input Section
LGA	Local Government Authority
MAFC	Ministry of Agriculture, Food Security and Cooperatives
MKUKUTA	National Strategy for Growth and Reduction of Poverty
MoFEA	Ministry of Finance and Economic Affairs
MRP	Minjungu Rock Phosphate
NAIVS	National Agricultural Input Voucher Scheme
NMB	National Microfinance Bank
NVSC	National Voucher Steering Committee
OPV	Open Pollinated Variety
PADEP	Participatory Agricultural Development and Empowerment Project
PCCB	Prevention and Combating of Corruption Bureau
PIM	Programme Implementation Manual
PMO-RALG	Prime Minister Office-Regional Administrative and Local Government
RC	Regional Commissioner
RVC	Regional Voucher Committee
TAFSIP	Tanzania Agriculture and Food Security Investment Plan
TASAF	Tanzania Social Action Fund
URT	United Republic of Tanzania
USAID	United States Agency for International Development
VA	Village Assembly
VEO	Village Executive Officer
VG	Village Government
VVC	Village Voucher Committee
WDI	World Development Indicator
WVC	Ward Voucher Committee

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EXECUTIVE SUMMARY

The National Agricultural Input Voucher Scheme (NAIVS) is a market smart input subsidy program designed in response to the sharp rise in global grain and fertilizer prices in 2007 and 2008. The main aim of the program is to raise maize and rice production, and thus preserve Tanzania's household and national food security. During the period from 2008 to 2013, approximately US$300 million has been invested in providing more than 2.5 million smallholder farmers with a 50 percent subsidy on a one acre package of maize or rice seed, and chemical fertilizer. Each targeted farmer was offered three vouchers (for seed, basal and top dress fertilizer) redeemable, with a 50 percent cash top-up payment, at a local retail outlet. After three years of subsidized assistance, targeted farmers were expected to graduate from the program with enough experience and income to continue to purchase fresh seed and fertilizer on their own. The redemption of the voucher through commercial agro-dealers encouraged the development and expansion of sustainable wholesale to retail input supply channels.

The input subsidy program helped Tanzanian smallholders harvest more than 2.5 million tons of additional maize and rice grain. These gains were large and consistent enough to encourage the government to lift a ban on grain exports in 2012, despite the existence of a sub-regional drought in eastern Africa. Independent surveys confirmed that farmers receiving subsidized maize seed and fertilizer increased their maize yields by an average of 433 kg per acre. Farmer receiving subsidized rice seed and fertilizer increased their average paddy yields by 263 kg per acre. Furthermore, more than 2800 agro-dealers were trained. Commercial seed and fertilizer companies expanded their investments in wholesale to retail distribution chains. More than 700 of these agro-dealers are now designated commercial sales agents for one or more input supply companies.

Nonetheless, the NAIVS program has encountered multiple challenges during its implementation. The program was originally designed to intensify grain production in 12 relatively high potential Regions. By the 2011/12 season, however, the program had effectively been extended to national coverage across 21 Regions, including many drier areas where the returns to improved maize and rice inputs are expected to be much lower. While many participants graduated after receiving three years of support, upwards to 60 percent of the households receiving vouchers in 2011/12 were obtaining these for a fourth or even fifth consecutive year. Some farmers claimed they had passed the vouchers to a son or daughter. Others complained that seed and fertilizer inputs were still expensive, thus justifying a continuing subsidy. In effect, an inducement to encourage the testing and adoption of new technologies became an income transfer to reduce production costs. The government has proposed the piloting of a subsidized credit program as a means to help farmers offset the high costs of inputs.

The NAIVS program also faced multiple logistical challenges. Many farmers received their vouchers late – sometimes well after the beginning of the planting season. In one season

(2011/12), the vouchers were so late that the government issued supplementary '*Certificates of Confirmation of Receiving Subsidized Agricultural Inputs*' in order not to miss the season altogether. This delayed the delivery and application of the improved inputs. The agro-dealers and associated seed and fertilizer suppliers were commonly paid late. While most vouchers were ultimately reimbursed, the process of collection from the agro-dealer, confirmation by district officials, and reconfirmation by a participating commercial bank, was slow. At times, there was no funding available in the project account to meet these payments. Originally, voucher payments were made to agro-dealers, but some of these retailers failed to resolve their debts with their seed and fertilizer suppliers. Therefore, in the later years of the program, the seed and fertilizer companies were mandated to collect the vouchers from their agents, and receive their reimbursement payments directly.

It is estimated than less than one percent of the vouchers may have been fraudulently redeemed. However, there were multiple rumors, and newspaper reports of district officials working with local agro-dealers to redeem vouchers for their own benefit. Some of these cases were confirmed, and correspondingly prosecuted by the police and anti-corruption agency. The number of complaints was larger in the earlier stages of the program than in later years.

Some observers complained that the vouchers failed to assist the poorest households. However, this was not the intention of the program. Instead, vouchers were offered to households who could afford the 50 percent cash top-up payment. Priority was then given to households who had not previously purchased seed and fertilizer, and to female-headed households. Voucher recipients tended to be marginally better endowed than the average farmer, but there was little sign of elite capture once the rules of allocation and village voucher committees were well established in 2009. The main challenge of the program was to achieve a successful graduation to commercial input purchases. Forty-seven percent of the graduates who had never tried improved inputs prior to the NAIVS continued to purchase seed on their own, and 19 percent continued to purchase fertilizer. In comparison, two-thirds of participating farmers who had previous experience with the improved inputs continued to purchase seed, and 44 percent continued to purchase fertilizer, after graduating.

The combination of high input costs at the farm gate, and the low prices for surplus grain, limited the profitability of fertilizer to most farmers. Those obtaining higher levels of fertilizer use efficiency, and thus higher yields per unit of input applied, found the investment profitable. However, fertilizer is not profitable for the majority of households obtaining lower yield gains. Additional assistance is needed to both further reduce input costs (e.g. through bulk purchases), assure correct application (e.g. through better targeting of nutrients, timeliness and improved weed control), and raise farmgate prices (e.g. through bulk and delayed seasonal sale of grain products). These challenges are being considered in the government's new *Big Results Now* initiative.

This report summarizes the results of an overview of the program, and the results of two major impact surveys independently conducted in late 2010 and late 2012. Chapter 1 places

the NAIVS in context, reviewing the status of the agricultural economy and the importance of grain production in the country. Chapter 2 provides an overview of the NAIVS program, including budget, expenditure and implementation rules. Chapter 3 briefly summarizes the impact survey results and highlights the financial and economic returns of the program. Chapter 4 discussed the challenges faced during implementation of the NAIVs, and Chapter 5 reviews the implications for further investment in this sort of input subsidy.

1.0 INTRODUCTION

1.1 Economic and Policy Context

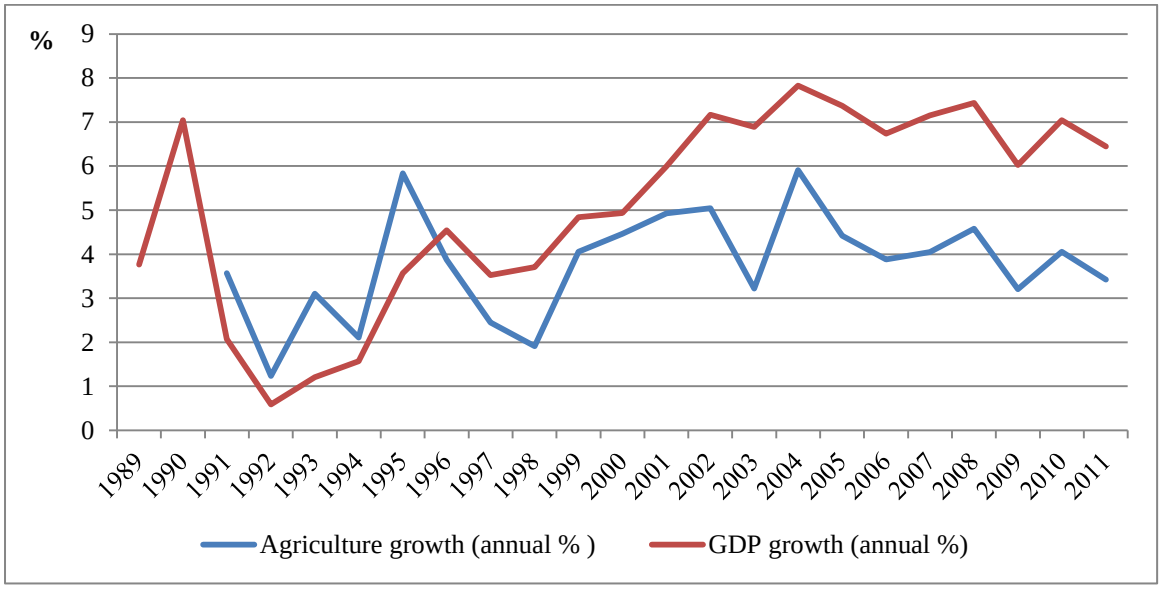
The United Republic of Tanzania is largely an agriculture-based economy. This sector accounts for over three-quarters of national employment, and approximately 25 percent of GDP (Table 1.1). Although annual per capita income has grown continuously for the past 2 decades, the 2012 per capita income in Tanzania of Tsh 1,025,038 ($652) places it among world's poorest countries. According to the Household Budget Survey Report 2011/12, 28.2% of people living in Mainland Tanzania fall below the basic needs poverty level. Further, 16.6 percent of the population is below the food poverty line, indicating extreme poverty. Agricultural value-added grew by an average of 4.4 percent per year between 1999 and 2012 (Figure 1.1). However, per capita income gains have been limited by the high population growth rate estimated in the latest 2012 census at 2.7 percent per year.

Table 1.1: Agriculture, Growth and Poverty in Tanzania, 2005-2012

	2005	2006	2007	2008	2009	2010	2011	2012
GDP at Current Prices Tsh mn (Tanzania Mainland)	15,964,294	17,941,268	20,948,403	24,781,679	28,212,646	32,293,479	37,532,962	44,717,663
Population mn (Tanzania Mainland)	36.2	37.5	38.3	39.5	40.7	41.9	43.2	43.6
Annual Per Capita Income (TSh)	441,063	478,100	547,081	627,787	693,470	770,464	869,436	1,025,038
Annual Per Capita Income (USD)	390	381	442	520	530	550	557	652
Agriculture Share to GDP (%)	27.6	26.2	25.8	25.7	25.4	24.9	24.6	23.7

Source: Ministry of Finance

Figure 1.1: Agriculture and GDP Growth Rates in Tanzania



Source: WDI (2012)

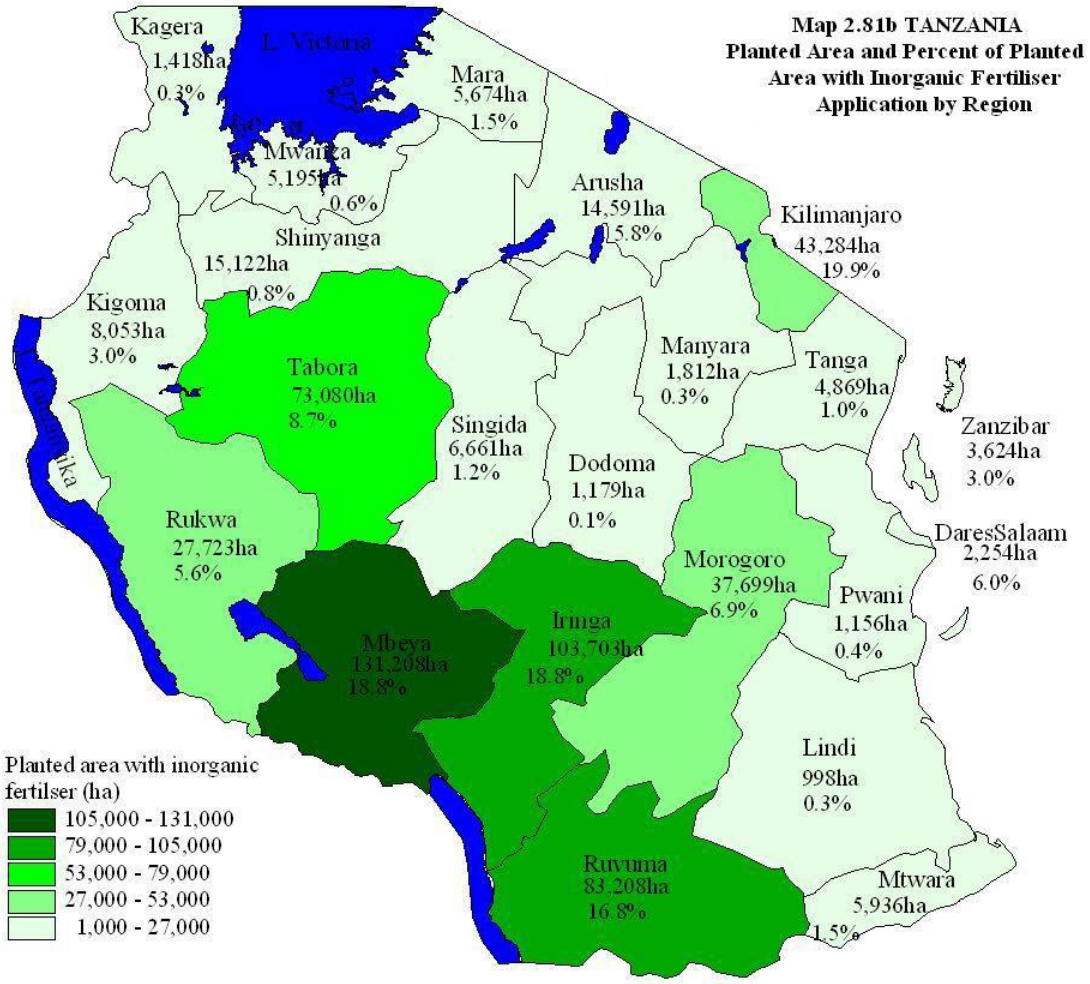
Aggregate national GDP has been growing at more than a 6.5 percent average annual rate, due largely to the rapid growth of mining, tourism and the service sectors. Correspondingly, the contribution of agriculture to GDP has declined by almost 50% since the 1990s.

Production of the major staple food crops (maize, rice, cassava, and beans) grew at an average rate of 3.5 percent, compared to 5.4 percent for cash crops. However, most of these gains have been derived from the expansion of cropped area. Only 26 percent of Tanzania's 50 million hectares of potentially arable land are currently farmed. A main constraint to the continuing expansion of cropped area is the speed of mechanization. Over 60 percent of smallholder households still rely on hand-hoe cultivation. Correspondingly, the average size of smallholder farm holdings remains small, with most holdings ranging from 0.2 to 2 hectares.

Average yields of major staple food crops such as maize and rice have changed little over the last 20 years. This reflects both the continuing expansion of planted area and the relative poverty of domestic farming systems. Estimates of input adoption rates vary. According to the 2007/08 Census Survey of Agriculture, less than 8 percent of all smallholder farmers used improved seed, and less than 3 percent used inorganic fertilizer, when the NAIVS was initiated. Much of this utilization was concentrated in the southern highlands (Mbeya and Iringa) and northern highlands area (Kilimanjaro) where population densities and rainfall are higher (Figure 1.2). In comparison, the 2008 National Panel Survey estimates that 20 percent of smallholder farmers used improved seed and roughly 12 percent used chemical fertilizer (National Bureau of Statistics, 2010. Tanzania National Panel Survey Report, Round 1, 2008-09). The average levels of use of chemical fertilizer use were estimated to be only around 9 kilograms per hectare (kg/ha), compared with 27 kg/ha in Malawi and 365 kg/ha in Vietnam

(Msambichaka et al., 2010). Correspondingly, average grain yields achieved by smallholders were only 20 to 30 percent of their potential (World Bank 2009).

Figure 1.2: Spatial Distribution of Inorganic Fertilizer Use



Source: Tanzania Agricultural Sample Census 2002-03 in Minot (2009)

In recent years the URT has raised the priority of agricultural sector development. This commitment was confirmed in late 1990s, in the country's long term vision of development , the Tanzania Development Vision 2025, which targets the acceleration of economic growth and reduction of poverty. The Vision highlighted the role of agriculture sector in national development and identified agriculture as the key driver of economic growth. These commitments were reconfirmed in the 2004 National Strategy for Growth and Reduction of Poverty, more commonly known under its Kiswahili acronym – MKUKUTA. This strategy prioritizes the following drivers of growth in agriculture: supporting physical infrastructure, water and irrigation infrastructure, financial and extension services, knowledge and information, value addition activities (crop production, livestock, fish processing, and mechanization), trade and export development services (World Bank, 2010).

In 2003, the Government committed under the Maputo Declaration to an objective of allocating 10 percent of its budget to the agricultural and rural development sector in the pursuit of a six percent annual average growth rate. In 2010, the government and agricultural sector stakeholders signed the Tanzania Compact for the Comprehensive Africa Agriculture Development Programme (CAADP) reaffirming this commitment. In late 2011, these same stakeholders endorsed the Tanzania Agriculture and Food Security Investment Plan (TAFSIP) outlining the form and levels of investment needed to achieve the target six percent growth rate.

Recent analyses of the agricultural sector budget indicate, however, that the Government has not yet been able to achieve this 10 percent budget allocation target (Table 1.2)[1]. The share of the budget allocated to the agricultural sector peaked in 2009/10 at just below 6.5 percent before falling to four percent in 2012/13. The absolute level of the agricultural sector budget peaked in 2010/11, dropping 12 percent two years later. The financial constraints affecting public sector institutions have been also been heightened by the fact that the various agricultural sector Ministries have not received their full appropriation.

Table 1.2: Agriculture sector spending as a share of total expenditure and GDP, 2009/10-2012/13

	2009/10	**2010/11**	**2011/12**	**2012/13**
Total agriculture expenditure, in Billion Tsh	587.4	638.9	455.9	560.1
Agriculture expenditure as a share in total expenditure, %	6.4	5.9	3.6	4.0
Agriculture expenditure as a share of GDP, %	1.6	1.8	1.2	1.2
Agriculture expenditure as a share of agricultural GDP*	7.9	7.7	4.8	4.8

Source: World Bank 2013. Rapid Budget Analysis

In 2011/12, the Ministry of Agriculture, Food Security and Cooperatives (MAFC) budget accounted for 57 percent of the total sectoral budget share. This declined to 42 percent in 2012/13 as a consequence of a sharp increase in local government expenditure associated with the country's commitment to decentralize government services. In 2012/13, input subsides made up approximately 42 percent of the total expenditure of the MAFC and about 19 percent of the government's total expenditure in the sector. The government has been supporting a number of input subsidies in recent years including the provision of free or subsidized inputs for cotton production, cashew production, sunflower, sorghum, cotton and tea. Subsidies have also been provided for the operation of dip tanks for livestock. However, at its peak in 2010/11, the NAIVS program accounted for approximately 86% of the total value of input subsidies in the sector.

[1] This analysis is based on the definition of agricultural expenditure proposed by the Organization for Economic Cooperation and Development. Some analyses include a wider range of rural development expenditures including rural roads, as well as health and education infrastructure.

1.2 Trends in Maize and Rice Production and Productivity

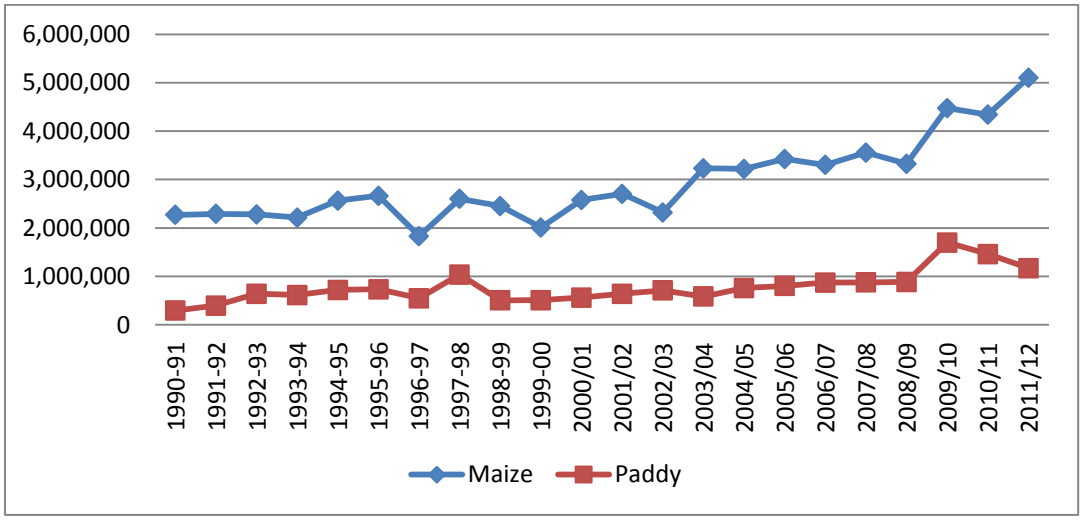
The concentrated commitment of support for maize and rice subsidies reflects the importance of these crops as food grains. Maize is considered the most important food crop in Tanzania covering 40 percent of total land area planted to crops and 67 percent of the area planted to cereal grains in 2011/12. Approximately 60 percent of all smallholder farm households grow this crop (Agriculture Sample Census 2008-09). Maize is sown in all Regions of the country, with the largest share of crop area found in Iringa, Shinyanga, Morogoro, Mbeya, and Kigoma, all areas originally targeted by the NAIVS program. The southern highlands (Iringa, Mbeya and Ruvuma) tend to produce surplus maize compared to consumption levels, while there tend to be deficits in the northern highlands, Dar es Salaam, and central regions.

Rice is the third most important cereal grain after maize and sorghum, offering an important source of food, employment, and income for many farming households. According to the 2008-09 Sample census of Agriculture 20 percent of all agricultural households grow rice. In 2011/12, paddy accounted for eight percent of food crop area and 13 percent of the area planted to cereals in the country. Over 60 percent of the country's rice production is concentrated in the regions of Arusha, Tabora, Morogoro, Mwanza, Shinyanga and Mbeya. Five of these six areas were originally targeted by the NAIVS program.

The national trends in maize as well as paddy production and productivity for the past two decades from 1990/91 to 2011/12 are shown in Figures 1.3 and 1.4. Production of maize and paddy has been increasing over time largely as a product of expanding crop area. This can be linked, particularly in the case of maize, with rising farm populations. In the case of paddy, production decisions are more closely linked with the market. According to available data, the area planted to paddy peaked in 2009/10, but then marginally declined.

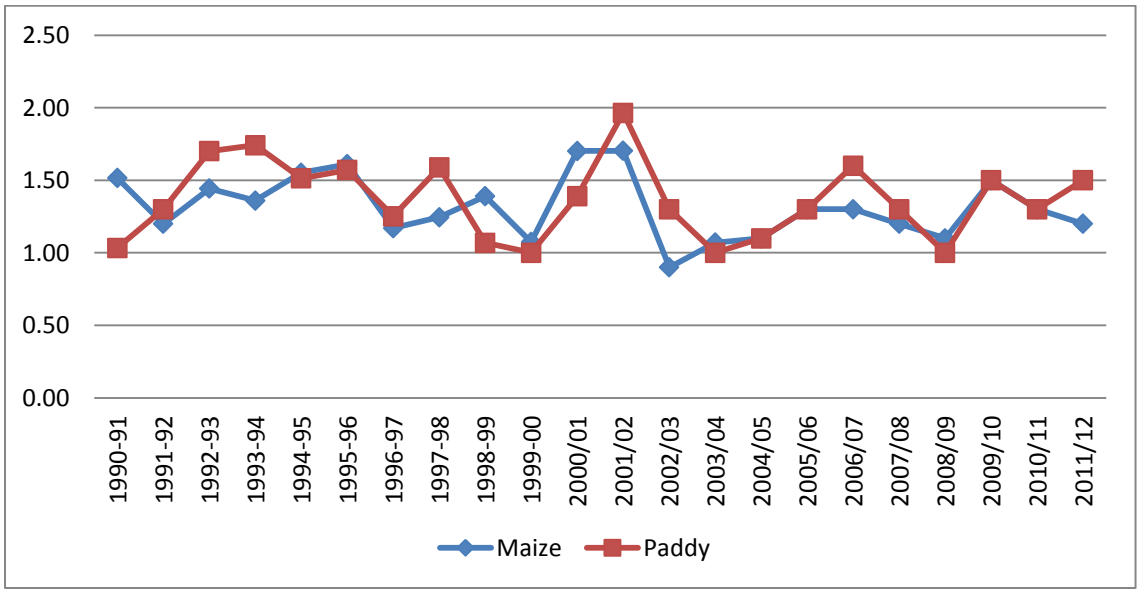
Both staple cereal grains have displayed almost no growth in productivity. This coincides with the limited rates of adoption of improved seed and chemical fertilizer. Almost all of the paddy production in the country is on irrigated or lowland fields, though most are small-scale informal irrigation schemes dependent on rudimentary water management systems during the rainy season. The country has expanded its formal irrigation systems to encompass almost 50% of the paddy area in recent years, and this is where the NAIVS targeted its support. Average yields on formal irrigation schemes are estimated to be two or three times higher than on informal schemes.

Figure 1.3: Trends in Maize and Paddy Production (mt)



Source: MAFC, Food Security Unit, various years.

Figure 1.4: Trends in Maize and Paddy Productivity (mt/ha)



Source: MAFC, Food Security Unit, various years.

1.3 NAIVS Program Motivation

The history of farm input subsidies in Tanzania can be traced back to 1967 when the Tanzanian *Villagization* programs were adopted to aggregate rural living units to facilitate the provision of rural population services as schools, health centers, piped water, electricity and access to roads (Coulson, 1982). Importation and distribution of agricultural inputs were state-controlled with highly subsidized input prices. The program was largely halted in 1982 due to the repeal of the village legislation. The economic crisis of the mid-1980s led to the commencement of an economic reform program in 1986, involving liberalization of agricultural markets and foreign exchange, removal of domestic price controls, and reform of

state monopolies. Agricultural market liberalization started with the food crop markets, and then cash crops market in early 1990s. Input subsidies were phased out between 1991 and 1994. Fertilizer subsidies decreased from 80 percent in 1990, to 55 percent in 1992, and to no more that 20 percent by mid-1992 (Putterman, 1995).

Ten years later, the government instituted a transport subsidy for fertilizer to encourage broader use of this input. However, debates about the cost effectiveness, targeting and distribution of benefits derived from this subsidy led to a redesign of the program around 2007. The transport subsidy was phased out, and replaced with a voucher based subsidy – the NAIVS - aiming to lift the buying power of targeted groups of smallholders with the greatest potential to expand maize and rice production. In 2007/08, the voucher based subsidy was piloted in two districts, and then expanded to encompass 53 districts distributed across 11 high potential Regions in 2008/09.

The main initial aim of the input subsidy was to increase maize and rice production, in order to improve both household and national food security. This aim was reinforced by the sharp rise in grain and fertilizer prices in 2007 and 2008. The country had faced a major drought, and significant rise in food prices in 2006, leading to the institution of a ban on grain exports. While rains improved in the following two years, the unexpected rise in international grain prices highlighted the concern to strengthen domestic production and grain stocks.

The second aim of the NAIVS was to introduce more farmers to the use of improved maize and rice seed and chemical fertilizer. Adoption rates and average yields were low, and relatively few farmers had ready access to these inputs. The subsidy, in effect, shared the costs of the farmer's own experimentation with these inputs, and encouraged farmers to re-evaluate the payoffs to improved inputs.

A third aim was to strengthen input supply chains for improved seed and fertilizer, by encouraging the establishment of agro-dealerships at the village level. By making the voucher redeemable at a local retail shop, and providing training to over 3855 rural agro-dealers, the designers promoted the expansion of input supply chains extending from national seed and fertilizer merchants, to regional wholesale facilities, and on to village based agro-dealers.

When the severity of the sharp rise in fertilizer and grain prices became apparent in 2008, the Government requested the World Bank to provide additional emergency funding for the NAIVS initiative. Available government resources were only adequate to cover 30 percent of the 2.5 million smallholder farm households believed eligible for the NAIVS program. Supplementary funding from the International Development Association (IDA) would allow the government program to benefit all eligible households on a three year rotating basis. The World Bank's Board of Executive Directors offered Tanzania a concessional loan of US$160 million (the Accelerated Food Security Project) over the three year 2009/10 to 2011/12 to expand the subsidy effort, and strengthen associated seed and fertilizer supply systems.

2.0 NAIVS IMPLEMENTATION AND COSTS

2.1 Overview of NAIVS

The primary aim of the NAIVS program was to improve household and national food security at a time when the costs of grain shortfalls and associated price of grain imports were particularly high. However, the program also sought a sustained gain in maize and rice productivity by encouraging farmers to try new seed varieties and experiment with the use of chemical fertilizers. Once convinced of the value of these improved inputs, farmers were expected to be able to continue to purchase improved inputs through a growing number of rural retail shops. The three year graduation strategy encouraged farmers to learn about the new technologies, and then begin purchasing these on their own.

2.1.1 Targeting of Regions

The NAIVS program was originally piloted in two districts and then expanded to 58 districts distributed across 11 Regions[2] in 2008/09. When the World Bank funding was requested, it was anticipated that the program would ultimately expand to 12 high potential maize growing Region. The rice subsidy would be directed to farmers growing rice in formal irrigation schemes in the same Regions.

By 2011/12, the peak year of voucher distribution, the NAIVS had effectively been expanded to become a nationwide program. While the dominant share of input subsidy vouchers continued to be distributed in the 12 Regions originally designated, every other rural Region in the country received at least small quantities of vouchers. The Ministry recognized that the level of productivity gain achieved through the distribution of improved inputs in many drier regions of the country would likely be lower than in the higher rainfall zones, but was under political pressure to make the program more universal.

2.1.2 Targeting of Farming Households

The NAIVS program primarily targeted a middle group of farmers with limited experience using improved seed and fertilizer, but with the farming resources needed to apply these inputs well. A complicated listing of qualification criteria was demarcated. To qualify, a farmer had to be a full time farmer in good repute, cultivating less than one hectare of maize or rice, willing to follow the advice of extension workers, willing to co-finance the inputs (pay 50 percent of the input cost), and willing to verify his or her use of the inputs. Preference was to be given, within this population, to female headed households and farmers who had purchased little or no inputs during the previous five years.

[2] Iringa, Mbeya, Ruvuma and Rukwa in the southern highlands; and Kilimanjaro, Arusha, Manyara, Kigoma, Tabora, Mara and Morogoro in the central and northern parts of the country. Pwani was to be added in 2009/10. Institutional Details of the NAIVS program are in Appendix 1

Farmers meeting these criteria were to be selected by a Village Voucher Committee established specifically to facilitate the distribution of the vouchers. This Committee was to be elected by the Village Assembly to include 3 men and 3 women. The decisions of this Committee were then verified by the Village Assembly.

In practice, the Village Voucher Committees first sought to identify farmers capable of providing the cash needed to make the 50 percent co-payment for the inputs. Secondly, they sought to pursue what they perceived to be a fair allocation to needy and deserving households. In villages with a large proportion of vouchers per population (e.g. some villages received enough vouchers for over 90 percent of all farmers) only households that could not afford the top up failed to benefit. In villages receiving fewer vouchers relative to the local farm population, many Village Voucher Committees aimed to distribute vouchers to a few farmers in each part of the community. Based on the evidence gathered during implementation support missions[3], farmers were generally satisfied with the distribution process, and complaints were limited. Unhappiness was more likely when there were few vouchers available relative to the size of the village. And many farmers did not understand or agree with the three year graduation strategy (discussed below).

In general, the Regional Government Officials met with MAFC staff once a year to discuss the allocation of vouchers by Region, and similar meetings were held at the regional level to decide on the district and village allocations. At each level of government, the aim was to allocate vouchers in proportion with local perceptions of the numbers of farmers who could 'make best use of these inputs'. In practice, voucher distribution was not proportional to population. In some districts, the majority of farmers received vouchers, while in neighbouring districts a much smaller proportion of farmers might benefit. The justification for these differences was not documented.

2.1.3 Input Subsidy Package

Each targeted farmer was expected to receive 3 vouchers. Roughly 80 percent of the vouchers were allocated to maize farmers. These included vouchers for 10 kg of either an improved open pollinated maize variety, or a maize hybrid, suitable for planting approximately one acre of land. District extension officers decided in advance whether a village would receive the voucher for the open pollinated variety or the hybrid seed. The remaining 20 percent of vouchers offered 15 kg of paddy seed – suitable for approximately one acre of irrigated rice.

The second voucher was for one 50 kg bag of diammonium phosphate basal fertilizer, or two 50 kg bags of Minjingu Rock Phosphate (MRP). Many farmers expressed dissatisfaction with the MRP in the earlier years of the program because this was received in the form of a

[3] Implementation support missions encompassing visits to Regions, districts and villages receiving vouchers were run at least twice yearly by World Bank and MAFC staff to review the implementation progress.

powder which was difficult to spread. Farmers also questioned the crop response to this input. The MRP was later replaced with similar product called Minjingu Mazao that was granulated with the addition of nitrogen. Depending on their location, farmers could alternatively obtain different basal formulations such as a superphosphate, though this choice was unusual.

The third voucher was for 50 kg of top dress fertilizer which was almost universally designated as urea. Farmers in a few areas were allowed to alternatively purchase ammonium sulphate. Details on the number of vouchers distributed by regions are available in Appendix 2-4.

The value of the three vouchers was agreed in discussions with regional officials and representatives of the seed and fertilizer companies prior to each season. This was targeted to assure farmers paid only 50% of the value of the inputs as a cash top up. However, in some years rising fertilizer prices, in particular, required that farmers pay 55 to 60 percent of the input cost. The government agreed with distributors that marginally higher prices would be offered in designated parts of the country considered more remote.

2.1.4 Selection of Agro-Dealers

The World Bank funding included support for the training of approximately 3,855 agro-dealers who registered interest in participating in the program. This training was provided just prior to the 2009/10 input distribution season. The trainees included many retailers who had not previously sold seed or fertilizer. However, not all of these later participated in the program.

Village and district officials were expected to jointly select the agro-dealers to participate in the program. This was to ensure the selection, where possible, of retailers known to, and trusted by, local communities. In practice, the district officials commonly took a dominant role in the selection of these dealers. It was anticipated that multiple agro-dealers would compete to provide inputs in each village. In practice, however, only one or two agro-dealers were designated as the 'reliable' providers of service.

In 2012/13, this arrangement was changed in response to complaints from seed and fertilizer companies who claimed they had provided inputs on credit to many designated agro-dealers, but then not been fully paid when the vouchers were redeemed. The seed and fertilizer companies sought a larger role in the selection of their designated agro-dealer agents in order to strengthen their commercial wholesale to retail supply chains. In addition, these dealers sought to be paid first in order to assure that seed or fertilizer provided on credit was fully funded.

2.1.5 Redemption of Vouchers

Farmers were expected to sign for their three vouchers, and then take them to the designated agro-dealer to exchange them, in conjunction with their cash payments, for the inputs. More

commonly, however, recipients were asked to sign their vouchers on the day the inputs were readily available from the designated suppliers. This was to avoid the loss of vouchers and facilitate their management. In many cases, the vouchers were signed by farmers, and then maintained by the village voucher committee for safekeeping, while the farmers completed their cash payments and collected their inputs. The Village Voucher Committee then facilitated the completion of signatures by the agro-dealer.

As originally planned, the agro-dealer collected the vouchers, and submitted these to the District Agricultural and Livestock Development Officer (DALDO) for verification. The vouchers were then submitted to the local branch of the National Microfinance Bank (NMB) for payment of the 50 percent subsidy. Later, vouchers were collected by the seed and fertilizer suppliers (or their designated agents) for verification, submission to the NMB and payment.

2.2 NAIVS Timeframe

The NAIVS program effectively began operation in 2008/09, with a plan to provide 2.5 million farm households each with three years of assistance on a rotating basis. By the third year of the program, the 730,667 households benefiting in the first season, would have received vouchers for three consecutive years (Table 2.1). The distribution of vouchers was scheduled to peak in 2010/11. Thereafter, the number of recipients would decline as the remaining targeted recipients graduated from the program. The overall commitment was expected to be completed during the 2013/14 cropping season.

Table 2.1: Household Beneficiaries for NAIVS

	Number of vouchers distributed					
	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Planned	740,000	1,500,000	2,040,000	1,800,000	1,000,000	500,000
Actual	730,667	1,511,900	2,011,000	1,779,867	940,783	932,100

Source: MAFC – Agricultural Input Section

In practice, two changes disrupted this planned schedule. First, the program was expanded from the coverage of 12 regions of the country, to become a nationwide program. As a result, the number of potential beneficiaries sharply expanded. Second, the graduation strategy was not consistently implemented. A significant number of farmers continued to receive input subsidy vouchers for a fourth, and even a fifth, consecutive year. While the majority of vouchers continued to be targeted toward the high potential zones originally selected, by 2012/13, roughly 40 percent of the vouchers were being distributed in other parts of the country.

The MAFC sought to maintain a primary focus on higher potential zones for maize and rice production, while arguing that the three year graduation strategy should not be consistently applied because inputs were still difficult for most farmers to afford, and some farmers needed additional experience with the use of these new inputs. However, the opportunity to test new seed varieties and fertilizer also needed to be provided to other farmers in the country. Ultimately, budget constraints limited the capacity of the MAFC to pursue its joint objectives of food security and expanding coverage. Correspondingly, the justification underlying the distribution of vouchers across regions, districts and villages became less clear.

The MAFC aims to phase out the distribution of input vouchers and promote the development of rural credit markets as a means to facilitate input purchases. Initially, given the high cost of inputs and lack of well functioning credit supply, the MAFC plans to subsidize this credit. Farmers may receive up to a 75 percent discount on their interest rate, but are expected to fully repay the loan. This proposal is being piloted during the 2013/14 cropping season.

2.3 Expenditure on NAIVS

The planned budget for the NAIVS targeted a subsidy cost of between US$60 million and US$100 million per year depending on the number of vouchers distributed. The unit cost of the subsidy vouchers for open pollinated maize and rice were estimated to be about US$42 per household (for seed and two bags of fertilizer) and the hybrid maize seed package was priced marginally higher at an estimated US$48 per household. In addition, the voucher printing was estimated to cost about US$0.90 per set of three, and the NMB was to be paid a four percent commission for managing the payment of agro-dealers.

In practice, the actual cost of the subsidy program was dependent on the shifting year to year cost of fertilizer imports. In 2011/12, the subsidy was valued at between Tsh 60,000 (US$38) and Tsh 68,000 (USD$43) depending on the receipt of hybrid maize seed (Table 2.2). The following 2012/13 season, the subsidy sharply increased in value to between Tsh 100,000 (US$63) for the open pollinated maize package to Tsh 110,000 (US$69) for the hybrid maize package (Table 2.3).

Table 2.2: Input prices in the southern highlands in 2011/12 (Tsh)

	Value of subsidy voucher	Top-up Payment Required	Total input cost
DAP (50 kg)	28,000	47,000-52,000	75,000-80,000
Urea (50 kg)	20,000	45-50,000	65-70,000
Hybrid maize seed (10 kg)	20,000	25,000-35,000	45,000-55,000
OPV maize seed (10 kg)	10,000	15-20,000	25-30,000
Rice seed (15 kg)	12,000	18,000	30,000

Source: MAFC – Agricultural Input Section

Table 2.3: Input prices in the southern highlands in 2012/13 (Tsh)

	Value of subsidy voucher	Top-up payment required	Total input cost
DAP (50 kg) (or 100 kg of Minjingu Mazao)	50,000	30,000	70,000
Urea (50 kg)	40,000	35,000	75,000
Hybrid maize seed (10 kg)	20,000	20,000	40,000
OPV maize seed (10 kg)	10,000	15,000	25,000
OPV Rice seed (15 kg)	12,000	15,000	27,000

Source: MAFC – Agricultural Input Section

Table 2.4 summarizes the planned and actual levels of NAIVS subsidy expenditures over the three year period between 2009/10 and 2011/12. These budget estimates are disaggregated into direct costs, indirect costs and complementary investments. The direct costs encompass the costs of the seed and fertilizer subsidy including the costs of the printing, distribution and redemption of the subsidy vouchers. The indirect costs include the overall costs of managing the implementation of the program, including awareness raising about program rules. These do not, however, encompass the wage costs of MAFC staff allocating time to program implementation. The complementary investments include the costs of strengthening agro-dealers' network, and strengthening the national seed system, as well as the costs of independent impact assessment surveys.

The large difference between the planned and actual expenditures in 2010-11 and 2011-12 primarily reflects the problem of delays in the allocation of government funding within the designated fiscal year. This led to delays in the payment of agro-dealers and associated delays in the payment of seed and fertilizer suppliers. The MAFC had to request a supplementary commitment of funding for the 2011-12 fiscal year to complete payments to agro-dealers due prior to the end of the 2010-11 fiscal year. Similar delays were experienced in 2011-12 and in 2012-13.

Correspondingly, the estimates of the direct cost of the subsidy per household do not coincide from the fiscal year expenditure data. These must instead be derived from available information on the voucher value, printing costs, estimated distribution costs and redemption costs. The variability of these estimates primarily reflects changes in the value of fertilizer from year to year, as well as adjustments in the proportion of input costs subsidized. In 2011-12, for example, a rise in fertilizer costs after the voucher value was set resulted in the MAFC subsidizing approximately 40 percent of the designated input costs. The following year, this increased to over 55 percent.

Under the original terms of the AFSP, the World Bank agreed to fund 50 percent of the subsidy costs for the three years (2009-10, 2010-11 and 2011-12) with the highest number of expected beneficiaries. Given the budget difficulties faced by the government in 2011, the World Bank agreed to pay up to 83 percent of the costs of the maize and rice input subsidy in 2011-12. The Bank also agreed to provide US$25 million in additional financing to assist the government with these subsidy costs during the 2012-13 cropping season.

Table 2.4: NAIVS Total Planned Budget and Actual Expenditure in USD

	2009-2010	2010-2011	2011-2012
Planned Budget			
Direct Costs	77,153,225	105,942,194	98,647,373
Indirect Costs	2,781,455	2,757,755	1,615,005
Complementary Investments	9,561,959	4,446,000	2,006,000
Total	**89,496,639**	**113,145,949**	**102,268,378**
Actual Expenditure			
Direct Costs	75,322,486	63,870,669	65,221,899
Indirect Costs	1,312,379	601,745	1,035,847
Complementary Investments	314,566	2,107,462	2,104,056
Total	**76,959,431**	**66,549,876**	**68,361,802**
HH Beneficiaries Reached	1,511,900.00	2,011,000.00	1,658,883.00
Direct CostsHH Beneficiary[a]	51.03	52.68	59.47
Indirect Costs/HH Beneficiary[b]	0.878	0.30	0.62

Source: MAFC – Agricultural Input Section

Based on the planned costs because actual financial year expenditures were highly dependent on the timing of payments from the Government to the NMB. These include the costs of vouchers, the input subsidies and the redemption payments. b Based on actual costs of organizing the distribution of vouchers, training, awareness raising, and monitoring program implementation.

3.0 MEASURING FINANCIAL AND ECONOMIC RETURNS

3.1 Analytical Approach and Study Population

This chapter estimates the NAIVS program impacts. It exploits the roll-out plan of the program to generate comparable treatment and counterfactual groups. Prior to the original implementation of the program, it was estimated that 2.5 million households were eligible, but the government distributed vouchers to only 1.5 million households in 2000/10 and 2 million households in 2010/11. Thus, each year there have been fewer vouchers distributed than the number of eligible farmers, and we used this shortage to create a comparison group of farmers made of non-beneficiary households within the same village. The treatment group is comprised of farming households that began receiving the subsidy for the first time in the 2009/11 planting season and the comparison group consisted of eligible farming households in the same village that had never received the subsidy. We note that differences in outcomes between beneficiaries and non-beneficiaries may be due to not only the voucher program but also the pre-existing differences between these two groups. We describe in Section 3.2 the strategies we use to attribute differences in yield gains or in fertilizer use to the voucher program, since, in principle, yields or input usage could have been different between these two groups even in the absence of the program.

Additionally, the analysis also compares outcomes between fourth-year beneficiaries – or graduates – that received the subsidy for the first time in 2008/09 with those that have received vouchers since 2009/10. Results are presented separately for the two main crops of the regions, maize and paddy.

The overall sample for the impact evaluation was selected from eight Regions that are representative of the NAIVS program area in the Southern and Northern Highland zones. These two zones, to which the majority of NAIVS vouchers were sent, have the highest potential for maize production. The study focused on 8 of these Regions, in particular those across Tanzania's grain belt known as the "big six" that covers the Southern Highlands (Ruvuma, Iringa, Rukwa, Mbeya) as well as some of the Western Zone (Kigoma) and Central Zone (Morogoro). The sample also included two Regions in the North: Arusha and Kilimanjaro. Morogoro, Arusha, and Kilimanjaro are distinct in that they experience bi-modal rainfall patterns, which result in a later start date for the main planting season as compared to southern areas with uni-modal rainfall. The sample was expanded in the 2012 follow up survey to include two additional regions – Dodoma and Tabora - that experience less rainfall to represent the country's "dry zones". These districts were added at the request of the Ministry of Agriculture to be able to measure and compare the cost-effectiveness of the program across a wider variety of climatic zones and soil types.

Table 3.1: Impact Evaluation Regions

Regions (Districts)	
Northern Highlands	*Southern Highlands*
Arusha (Meru)^	Morogoro (Ulanga)^
Kilimanjaro (Same)^	Ruvuma (Tunduru)
	Iringa (Kilolo & Njombe DC)
*Dry Zones**	Mbeya (Mbeya rural & Mbozi)
Tabora (Uyui)	Rukwa (Sumbawanga DC)
Dodoma (Kondoa)	Kigoma (Kasulu)

^ ***Experiences bi-modal rainfall and therefore a later planting season***
****Included only in the follow up (2012) survey***

3.1.1 Sample Selection

The later start date of the planting season in Arusha, Kilimanjaro, and Morogoro allowed for a series of village-level interviews conducted in the bi-modal Regions *prior to* the distribution of the 2010/11 vouchers. Given the timing of the evaluation, it was not possible to conduct similar interventions in the Southern and Western regions. Hence, a larger proportion of the study sample was from the three intervention regions (Morogoro, Arusha, and Kilimanjaro), assigning 40 villages to each Region with 10 households per village. The remaining 80 villages out of the 200 in total were spread evenly across the other 5 unimodal rainfall Regions, with 16 villages per Region and 10 households per village. Districts in each sample region were assigned weights based on the total number of eligible farming households and a rule was established to randomly sample 1 in 4 districts per Region. Using this rule, larger districts had a higher probability of selection and in Regions with up to 4 districts total, 1 sample district was selected, while in Regions with 8 or more districts, 2 districts were sampled. This resulted in 1 sample district for all regions except Iringa and Mbeya, where 2 sample districts were selected (the 16 villages allocated per Region were divided evenly between the two districts). Wards were randomly selected in each sample district and villages were randomly selected within the sample wards.

The follow-up survey revisited the same households and villages in the baseline study. However, in the follow-up survey, given difficulties in implementing the targeting interventions in 2 of the intervention Regions as mentioned before, the sample size per Region was altered for the follow-up survey in order to enhance the sample size where targeting interventions had been successfully implemented (see *Changes to the Sample* for additional details).

3.1.2 Data Collection

In preparation for the evaluation, existing data sets, such as Tanzanian Agricultural Census and Living Standards Measurement Survey were reviewed, but we found that they did not provide the geographic scope, plot-level detail, and programmatic questions required for program evaluation. Therefore, a set of 5 questionnaires (described below) were created and distributed across the 200 villages in both baseline and follow-up surveys. Baseline surveys were conducted in January and February of 2011 and follow-up data collection took place in July and August of 2012. In addition, two qualitative instruments (described below) were developed and utilized in two randomly selected districts in the Iringa Region of Tanzania, where NAIVS coverage was high in 2010/11.

3.1.3 Data Collection Instruments

Table 3.2: Summary of Quantitative Data Collection Tools

Survey	Brief description on instrument and population	Sample size	
		2010/11	2011/12
Household survey	Detailed questionnaire with modules covering household-level demographics, food security, plot-level crop production and marketing, NAIVS implementation, and 5 gender-related modules for women dealing with violence, power, relationships, and self-reported measures of health. Sample purposefully selected to include approximately one-half new beneficiaries and one-half eligible non-beneficiaries. In addition, this sample purposefully included approximately 50 percent female headed households.	2000	2040
Listing survey	Short questionnaire covering household-level demographics, crop production, and NAIVS implementation. Sample is a random subset of households in participating villages.	2720	2715
Graduate listing survey	Identical to Listing Survey (above). Sample is NAIVS program graduates (those that have participated in NAIVS for three years) in subset of villages.	NA	785
Village survey	Short questionnaire to collect village-level data and output indicators on NAIVS implementation. In all participating villages, one village leader sampled.	200	176
Agro-dealer survey	Short questionnaire to collect village-level data on input prices, availability, and NAIVS implementation. In all participating villages, 1-2 agro-dealers sampled.	88	144
VVC survey	Short questionnaire on village-level beneficiary selection process. Conducted with 1 male and 1 female VVC member in participating villages.	200	NA

3.1.4 Household Survey

In each study village, 10 households participated in the **household survey**, 5 of which were new beneficiaries and 5 eligible non-beneficiaries. Eligibility and beneficiary status were defined by the VVCs and households were sampled using VVC records. In the 5 uni-modal regions where voucher coverage was generally higher and new beneficiaries were difficult to find, the new beneficiaries sample consisted of 2 previous beneficiaries (i.e. households that began receiving vouchers either in the 2008/9 or 2009/10 voucher cycles) and 3 new beneficiaries. In order to investigate gender-related impacts of the NAIVS, women were oversampled such that 50 percent of the household survey sample in each village consists of female-headed households.

3.1.5 Listing Survey

In order to look at program-related topics over the entire population rather than just eligible households, the study also included a completely random selected subset of households in each sample village. A separate sample of 16 households in bi-modal regions (where villages are more concentrated geographically) and 10 households in uni-modal regions was randomly selected from one village to conduct a short household survey, referred to as the **listing survey**.

3.1.6 Other Surveys

Additionally, a **VVC survey** looking at voucher operations in the village was conducted with 1 male and 1 female member of the VVC. A **community survey** was conducted with the village executive officer (VEO) to record village-level characteristics, and finally an **agro-dealer survey** was conducted to all agro-dealers working in the village to understand the input supply side of the program.

3.1.7 Changes to the Sample

In the bi-modal regions, because targeting interventions were conducted as planned only in Arusha region, households in the 46 Arusha villages were oversampled (doubled) in the follow-up survey, resulting in a sample of 920 households. Households for the expanded sample were selected using the same mechanism utilized in the baseline household survey. Specifically, eligible beneficiaries were defined as those that began participating in NAIVS prior to the 2010/11 planting season and eligible non-beneficiaries were defined as those that were eligible to participate in 2010/11 but were not selected. The number of villages from Morogoro and Kilimanjaro were reduced to compensate for the oversampling in Arusha. This did not significantly change the overall sample size for the Northern regions, or for the overall household survey.

3.2 Empirical Model and Results

In this section we report the empirical model and evaluation results of the NAIVS program. First, we look at the impacts of NAIVS on fertilizer and seed use and productivity gains. Appendix 5 provides more detail on agricultural investments and food security. We conclude by studying the decision of graduates of the program who have been beneficiaries for at least three years to evaluate whether they were continuing to purchase improved inputs from the commercial market.

The effect of the program is estimated for several outcomes using the following Ordinary Least Squares specification:

$$Y_{ij} = \beta Benef_{ij} + \gamma X_{ij} + \varepsilon_{ij} \qquad (1)$$

Where Y_{ij} is a given outcome for household *i* in a specific region *j* (Main or New regions which are drier), $Benef_{ij}$ is a dummy variable that takes the value of 1 if the household is a beneficiary, X_{ij} is a set of household level variables, such as total landholding, the number of adult males in the household and age and years of education of household and education and ε_{ij} is a mean-zero error. The main outcome we consider is the household mean gross revenue per acre, computed using the yield per acre times the median market price in the district.
The inclusion of household variables partially corrects the potential imbalance between beneficiaries and non-beneficiaries making both groups more comparable so that the coefficient on $Benef_{ij}$ is more reflective of the impact of the program.[4] The results from these regressions are in Table 3.3 and are explained in the following subsections. Appendix 5 contains the analysis related to other outcomes.

3.2.1 Summary Statistics of Program Participants

Before we assess input usage and productivity gains between participants and non-participants of NAIVS, it is informative to compare the characteristics of beneficiaries to those that are not. Table 3.1 reports such differences from the random sample of the listing survey. In 2009/10, approximately 23 percent of the households in the listing survey had a beneficiary. One year later, this percentage increased to 38 percent with the expansion of the program. Therefore, non-beneficiaries in 2009/10 could have become beneficiaries by 2010/11, and would therefore appear in column (2) as non-beneficiaries in 09/10 and in column (4) as beneficiaries in 10/11. There were no beneficiaries in 09/10 that were not beneficiaries in 10/11. We consider household size, number of adults in the household, gender of household head, education, total landholdings, whether the household is

[4] Since we have baseline and follow-up data on a large sample of individuals, we can also run a differences-in-differences specification as an alternative to address the selection problem.

Table 3.3: Summary Statistics

Season:	2009/10 season			2010/11 season					
Number of years as participants:	0-2 year participants by 2010/11						3 year participants by 2010/11		
Sample:	B	NB	P-value of t-stat of (1)=(3)	B	NB	P-value of t-stat of (5)=(6)	Still B in 2011/12	Graduates	P-value of t-stat of (7)=(8)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Size of Household	6.2	5.6	0.00	6.1	5.7	0.00	6.5	6.3	0.40
Number of Adult Males in Household	1.4	1.2	0.00	1.3	1.2	0.00	1.4	1.6	0.02
Sex of household head (1= Male)	0.83	0.73	0.00	0.85	0.79	0.00	0.90	0.91	0.74
Age of Household head (Years)	43.9	30.9	0.00	47.0	46.7	0.60	45.3	49.1	0.00
Married (1= Yes)	0.79	0.71	0.00	0.79	0.75	0.02	0.76	0.88	0.00
Formal Education (1= Yes)				0.11	0.09	0.09	0.11	0.20	0.01
Works on own farm	0.92	0.97	0.00	0.97	0.96	0.16	0.95	0.98	0.05
Pct of households "connected" to Village heads	0.19	0.15	0.07	0.07	0.02	0.00	0.22	0.16	0.11
Pct of households "connected" to VVC	0.06	0.03	0.00	0.05	0.00	0.00	0.15	0.13	0.71
Housing Construction:									
Roof (corrugated tin)	0.86	0.63	0.00	0.79	0.61	0.00	0.84	0.91	0.02
Floor (cement)	0.49	0.23	0.00	0.42	0.26	0.00	0.35	0.64	0.00
Total land owned (in Acres)	6.1	4.6	0.00	7.7	4.9	0.00	13.0	7.8	0.01
Total land cultivated (in Acres)	5.6	4.4	0.00	7.3	4.7	0.00	12.2	7.9	0.02
Pct households with landholdings < 1.25 Acres (0.5 Ha)	0.12	0.16	0.06	0.10	0.14	0.00	0.05	0.13	0.00
Pct households with landholdings > 5 Acres (2 Ha)	0.37	0.29	0.00	0.43	0.31	0.00	0.60	0.44	0.00
Number of years in the program (2008 - 2010)	1.3	0.03	0.00	2.6	0.28	0.00	4.0	3.0	0.00
N. Observations	446	1457		732	1191		287	179	

Notes: A household is connected if the household head is a relative or has social interaction with a hamlet chairperson or VEO (village head) or any member of the VVC. B denotes beneficiary, NB denotes non-beneficiary. Graduate denotes a 3-year program participant that is no longer a beneficiary in 2011/12.

"connected" to village officials or members of the Village Voucher Committee (VVC) and years in the program (if beneficiary) as the household characteristics.

One variable of interest that is related to the extent of elite capture is whether households are connected to the elite. We use survey questions that ask about being a relative of, or having regular social interaction with, either the Hamlet chairperson or the village executive officer (VEO) both of which we label as village officials, or with any member of the VVC. As it turns out, beneficiaries appear to be more "connected" with either elite than non-beneficiaries, although the prevalence of being "connected" is low.

Similarly, beneficiaries appear to be better off than non-beneficiaries. Recall that the listing sample is random, and thus it includes non-beneficiaries there are both eligible and non-eligible. Among the non-eligible, there are those too rich to be eligible, those who cultivate more than one acre of maize, and those that are too poor to afford the top-up. Thus, given that the non-beneficiaries seem poorer than beneficiaries, the majority of non-beneficiaries should be the ones that cannot afford the top-up. Indeed, Table 3.1 reports that the percentage of households with landholdings lower than 0.5 Ha is 16 percent among non-beneficiaries and about 12 percent among beneficiaries.

Because of the differences between beneficiaries and non-beneficiaries, one cannot in principle attribute differences in yields and other outcomes solely to NAIVS. Indeed, as Tables 3.2 show, one suspects that revenue gains among beneficiaries compared to non-beneficiaries are perhaps larger than those induced by the program, and so the corrections discussed in the preceding subsection are warranted.

Columns 7 and 8 of Table 3.1 report the characteristics of individuals that by 2010/11 had been beneficiaries for three years, and thus should have graduated by 2011/12. The table suggests that 61 percent of households still claim to be beneficiaries, although this could be true if another household member had become the beneficiary. Interestingly, the households that were still beneficiaries in 2011/12 had larger landholdings than those that graduated. Similarly, when comparing the characteristics of beneficiaries that entered the program 3 years ago relative to those that have only been in the program for up to two years, we find that older beneficiaries are also better off. Interestingly, this group of program participants appears to be more "connected" to elites than subsequent program participants.

3.2.2 Impacts of Program on Input Usage and Yields

Table 3.2 report results from the listing survey of the impacts of being a NAIVS beneficiary on several outcomes. A beneficiary is defined as a respondent that claims to have received the set of three vouchers. Columns (1)-(4) of Table 3.2 use data from the baseline listing survey while columns (5)-(12) use data from the follow-up listing survey. Columns (1)-(8) report data collected from the regions where NAIVS was first rolled out while columns (9)-(12) report data from drier regions where the program was later expanded. Due to the small

number of households that grow paddy in these regions, we only report results for maize growers. As can be seen from the listing's random sample, there are fewer beneficiaries in the new regions than in the (main) regions where NAIVS was first rolled out.

Panels B and C are for maize and paddy cultivation, respectively. In the baseline listing sample (collected in 2010), we have 518 maize beneficiaries and 2,009 maize farmers that were not beneficiaries. Similarly, there were 108 paddy beneficiaries and 602 paddy growers that were not beneficiaries. In the follow-up survey, there were relatively more maize beneficiaries in the main areas (from 20 percent in the 2009/10 season to 40 percent in the 2010/11 season). For both maize and paddy it is clear that beneficiaries use more improved inputs (in at least one of their plots) than non-beneficiaries.

While we expect that all beneficiaries would use improved inputs from the vouchers, only about 70 percent of paddy beneficiaries in 2009/10 and an even lower percentage in 2010/11 do so. In contrast, around 90 percent of the maize beneficiaries use improved inputs, as the program intended. In fact, out of the total of three vouchers received, they tend to redeem 2.5 for maize and 2.2 for paddy. This partly reflects the willingness of beneficiaries to share vouchers with the neighbors. Some of the households receiving shared vouchers may have been classified as beneficiaries, and a small number of non-beneficiaries report cultivating with vouchers. Lower redemption rates also reflect the late delivery of vouchers and inputs. probably because they were given or bought inputs from beneficiaries.

This increased input usage translates into better yields overall. Production questions in the survey were asked about cultivation with and without inputs from vouchers. The overall group of beneficiaries, regardless of the number of vouchers redeemed, achieved significantly higher average yields for both maize and paddy on plots receiving these inputs.

Table 3.4: Input Usage and Yields across regions (Only beneficiaries 1-3 years)

Region:		Main Regions							New regions			
Season:		2009/10 season			2010/11 season				2010/11 season			
Sample:	Obs.	B	Obs.	NB	Obs.	B	Obs	NB	Obs	B	Obs	NB
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Input Use												
Use of Improved Inputs before 2009 (1=Yes)	531	0.50	2186	0.19	1245	0.52	1268	0.22	76	0.12	242	0.07
Use of Improved Seeds (1 = Yes)	531	0.80	2185	0.24	782	0.90	1265	0.21	76	0.91	242	0.10
Use of Chemical Fertilizer (1 = Yes)	531	0.80	2185	0.22	782	0.88	1265	0.14	76	0.68	242	0.07
Panel B: Maize Production and Yield												
Use of Improved Seeds (1 = Yes)	518	0.82	2009	0.26	770	0.91	1188	0.22	76	0.89	230	0.10
Use of Chemical Fertilizer (1 = Yes)	518	0.80	2009	0.23	770	0.88	1188	0.13	76	0.68	230	0.07
Number of vouchers received and used in own plots	531	-	2186	-	770	2.5	1265	0.00	76	2.1	242	0.00
Households cultivated with inputs from vouchers (1=Yes)	531	0.91	2186	0.08	782	0.96	1265	0.06	76	0.93	242	0.04
Land cultivated in 2010/11 (acres) [1]	483	1.9	1883	1.9	750	2.3	1135	4.2	71	2.4	225	3.3
Production in 2010/11 (kg)[1]	483	1411.6	1883	749.0	750	1193.6	1135	803.2	71	1475.4	225	1007.1
Yield (kg/acre) in 2010/11[1]	461	830.2	1675	435.0	717	925.0	972	453.6	56	732.3	189	386.5
Panel C: Rice Production and Yield												
Use of Improved Seeds (1 = Yes)	108	0.65	602	0.09	128	0.08	269	0.02				
Use of Chemical Fertilizer (1 = Yes)	121	0.77	708	0.20	139	0.54	314	0.08				
Number of vouchers received and used in own plots	531	-	2186	-	139	2.19	1265	-				
Households cultivated with vouchers (1=Yes)	531	0.13	2186	0.01	782	0.12	1265	0.00				
Land cultivated in 2010/11 (acres) [1]	68	1.6	691	2.4	90	1.7	310	3.0				
Production in 2010/11 (kg)[1]	68	1736.5	691	1919.2	90	1633.0	310	1437.2				
Yield (kg/acre) in 2010/11[1]	68	965.9	691	818.3	90	1113.4	310	733.4				

Notes:[1] Columns 2, 6 and 10 use data on land cultivated, production and yields only from plots cultivated with inputs from the program. Columns 4, 8 and 12 use data from plots that do not use inputs from program. Data come from the Listings survey. Main regions refer to the regions primarily targeted by the program and interviewed at baseline. New regions refer to the regions with lower productivity added during the follow-up. Please refer to the sampling document for more details. B columns refer to Beneficiaries, ie individuals that received vouchers. NB columns refer to non-beneficiaries, ie individuals that did not receive vouchers.

Table 3.3 reports revenue gains for both the 09/10 and 10/11 seasons in each district using the listings survey. Column 1 reports the number of observations, column 2 reports the household gross revenue per acre among non-beneficiaries in 1,000 TZS, and column 3 reports the median producer price of maize per Kg.[5] Column 4 reports the coefficient and robust standard errors of being a beneficiary from the regression (1), including the household variables discussed. Thus, in Arusha becoming a beneficiary leads to an increase in revenue per acre of about 188,815 TZS. Columns 5-8 report the analogous information for paddy. Columns 2, 3 and 4 (and similarly for columns 6-8) show that increases in revenue per acre vary substantially due to the geographical dispersion in yields and prices.

Revenue gains from paddy are less precisely estimated than those of maize, despite the fact that the magnitudes of gain are large in some districts. These estimates control for household characteristics to make beneficiaries and non-beneficiaries more comparable.

As expected, the inclusion of controls for household characteristics makes a difference to the estimates, suggesting that household level differences also affect the differences in yields. Average maize yield gains per acre in 09/10 and 10/11 are about 420.31 kg/acre when household controls are not included, and about 348.89 kg/acre when they are included.

Another estimate comes from comparing the yields in plots where subsidized inputs were used to the yields in plots where subsidized inputs were not used. The advantage of this estimate is that one can net out household-level differences, but the disadvantage is that it will be biased if pre-existing differences in plot characteristics or complementary investments between the plots with and without subsidized inputs are important. This estimate produces a maize yield gain of 432.84 kg/acre.[6] Average paddy yield gains are about 286.51 kg/acre without the inclusion of household-level covariates and 176.16 Kg/Acre with the inclusion. These gains in Table 3.3 have to be compared to the costs both direct and indirect of the program to get a rough sense of its cost-effectiveness (See next subsection for more details).

Table 3.4 reports the behavior of individuals that have been beneficiaries of the program for at least three years by 2010/11, that is, individuals that should have graduated after the 2010/11 season. The data come from a random sample of graduates from the regions where the program was originally rolled out, and had been in existence for three years. As mentioned when describing Table 3.1, around 60 percent of graduate households still claimed to receive the vouchers in the 4th year. This may have been because the beneficiary was now another household member. Or the beneficiary simply failed to graduate.

[5] Appendix 5 reports the consumer and producer prices collected at the village level. We rely on the market producer price for the calculation of revenues.

[6] The maize yield estimates computed using the differences-in-differences estimator are lower at 189.60 kg/acre. However, the panel used in the estimation is unbalanced since there are many observations with only baseline or follow-up information, as explained earlier in Section 3.1.7.

The majority of NAIVS graduates are procuring inputs on their own, in the first year of no longer benefiting from the voucher subsidy. Approximately 70 percent of these graduates had used improved inputs at some point in the past, though it is not evident whether these were purchased or received through a relief or development program. Since there is no information about the history of input purchases, it is impossible to estimate the level of displacement of purchases by the NAIVS program. However, some displacement likely occurred.

More interestingly, around 64 percent of the households that did not use inputs prior to the program, and that are no longer receiving vouchers, now claim to use improved seeds purchased from the market. The corresponding percentage for fertilizer purchases is 50 percent. The yield differences between households receiving vouchers for the fourth year, and those that are no longer in the program are not statistically significant. It is also noted that graduates tend to have higher yields than beneficiaries of the program in their first three years. This could be due to experience gained with inputs through the program, or the fact that the current graduates (i.e. the first wave of participants in the program) were among the most productive farmers.

The survey also asked the third year participants in 2010/11 season whether improved inputs had been purchased commercially. The percentages are lower than the usage question among non-beneficiaries in 2011/12. In particular, about 57 percent purchased seeds commercially and 37 percent report purchased fertilizer commercially. Most of these commercial purchases are done by individuals that reported using inputs prior to the program. For those that had not used improved inputs prior to the program these percentages drop to 47 percent for seeds and 19 percent for fertilizer. Only three percent of beneficiaries in 2011/12 made commercial input purchases. Subsidy beneficiaries did not purchase additional inputs when they redeemed their vouchers.

Table 3.5: Impact of Voucher Scheme on yields by region (Household-Level Data) using the Listings Survey

	Maize				Paddy			
	Obs	Mean Household Gross Revenue per Acre among Non-Beneficiaries ('000 TSh)	Median price per Kg	Increase in Gross Revenue per Household/Acre ('000 TSh)	Obs	Mean Household Gross Revenue per Acre among Non-Beneficiaries ('000 TSh)	Median price per Kg	Increase in Gross Revenue per Household/Acre ('000 TSh)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Main Regions								
Arusha	1363	318.862	400	188.815***	42	1161.825	800	-109.659
				(12.318)				(218.152)
Kilimanjaro	700	227.596	600	131.121***	153	609.825	600	199.599***
				(23.108)				(62.250)
Morogoro	701	170.815	600	141.863***	670	427.333	600	125.898**
				(35.068)				(55.740)
Ruvuma	288	141.096	360	108.455***	189	289.396	600	98.033***
				(27.001)				(36.588)
Iringa	299	102.13	350	115.326***				
				(13.238)				
Mbeya	305	162.074	280	140.041***				
				(16.808)				
Rukwa	119	190.595	300	261.810***	44	1152.121	840	579.568
				(24.134)				(396.920)
Kigoma	308	193.749	467	143.022***				
				(18.535)				
Panel B: New Regions								
Dodoma	126	145.314	400	164.862***				
				(42.177)				
Tabora	291	95.464	400	99.862				
				(60.259)				

Notes: Each cell in columns 4 and 8 come from an OLS regression of gross revenues computed from yields times the median price. The regression includes the following household controls for the following

Table 3.6: Input Usage and Yields among 4th year participants

Sample:	All				
	Obs.	Still B in 2011/12	Obs.	Graduates	P-val of t-test (2)=(4)
	(1)	(2)	(3)	(4)	(5)
Panel A: Input Use in 2011/12					
Used improved inputs before 2009	287	0.70	179	0.73	
Use of Improved Seeds (1 = Yes)	287	0.90	179	0.70	0.00
Use of Chemical Fertilizer (1 = Yes)	287	0.94	179	0.63	0.00
Panel B: Maize Production and Yield					
Use of Improved Seeds in 2011/12 (1 = Yes)	284	0.89	174	0.71	0.00
Use of Chemical Fertilizer in 2011/12 (1 = Yes)	284	0.92	174	0.61	0.00
Number of vouchers received and used in own plots	284	2.58	174	0.00	0.00
Total land cultivated in 2010/11	284	2.79	174	2.68	0.37
Total produced in 2010/11	284	3032.1	174	2320.9	0.30
Total yield (kg/acre) in 2010/11	284	1188.8	174	880.9	0.32
Panel C: Rice Production and Yield					
Use of Improved Seeds in 2011/12 (1 = Yes)	78	0.11	28	0.07	0.45
Use of Chemical Fertilizer in 2011/12 (1 = Yes)	78	0.32	28	0.43	0.20
Number of vouchers used in own plots	78	2.53	3	0.00	-
Total land cultivated in 2010/11	78	2.31	28	1.91	0.72
Total produced in 2010/11	78	1973.9	28	1367.1	0.68
Total yield (kg/acre) in 2010/11	78	867.6	28	836.6	0.64
Buys seeds with vouchers 2011-12	287	0.86	179	0.07	0.00
Buys seeds without vouchers 2011-12	287	0.03	179	0.57	0.00
Buys fertilizers with vouchers 2011-12	287	0.89	179	0.08	0.00
Buys chemical without vouchers 2011-12	287	0.03	179	0.37	0.00

Sample:	Bought improved inputs before 2009				
	Obs.	Still B in 2011/12	Obs.	Graduates	P-val of t-test (7)=(9)
	(6)	(7)	(8)	(9)	(10)
Panel A: Input Use in 2011/12					
Used improved inputs before 2009	200	1.00	131	1.00	
Use of Improved Seeds (1 = Yes)	200	0.90	131	0.73	0.01
Use of Chemical Fertilizer (1 = Yes)	200	0.95	131	0.68	0.00
Panel B: Maize Production and Yield					
Use of Improved Seeds in 2011/12 (1 = Yes)	198	0.9	127	0.73	0.05
Use of Chemical Fertilizer in 2011/12 (1 = Yes)	198	0.94	127	0.66	0.00
Number of vouchers received and used in own plots	198	2.56	127	0.00	-
Total land cultivated in 2010/11	198	2.92	127	2.68	0.61
Total produced in 2010/11	198	3326.5	127	2574.8	0.60
Total yield (kg/acre) in 2010/11	198	1258.3	127	958.7	0.50
Panel C: Rice Production and Yield					
Use of Improved Seeds in 2011/12 (1 = Yes)	45	0.10	18	0.08	0.28
Use of Chemical Fertilizer in 2011/12 (1 = Yes)	45	0.29	18	0.56	0.13
Number of vouchers used in own plots	45	2.42	18	0.00	-
Total land cultivated in 2010/11	45	1.85	18	2.03	0.34
Total produced in 2010/11	45	1845	18	1459.4	0.92
Total yield (kg/acre) in 2010/11	45	934	18	796.3	0.53
Buys seeds with vouchers 2011-12	200	0.83	131	0.07	0.00
Buys seeds without vouchers 2011-12	200	0.05	131	0.60	0.00
Buys fertilizers with vouchers 2011-12	200	0.88	131	0.08	0.00
Buys chemical without vouchers 2011-12	200	0.04	131	0.44	0.00

Sample:	Did not buy improved inputs before 2009				
	Obs.	Still B in 2011/12	Obs.	Graduates	P-val of t-test (12)=(14)
	(11)	(12)	(13)	(14)	(15)
Panel A: Input Use in 2011/12					
Used improved inputs before 2009	86	0.00	47	0.00	
Use of Improved Seeds (1 = Yes)	86	0.88	47	0.64	0.02
Use of Chemical Fertilizer (1 = Yes)	86	0.90	47	0.49	0.00
Panel B: Maize Production and Yield					
Use of Improved Seeds in 2011/12 (1 = Yes)	85	0.88	46	0.65	0.02
Use of Chemical Fertilizer in 2011/12 (1 = Yes)	85	0.87	46	0.48	0.01
Number of vouchers received and used in own plots	85	2.64	46	0.00	-
Total land cultivated in 2010/11	85	2.50	46	2.69	0.31
Total produced in 2010/11	85	2380.7	46	1605.3	0.14
Total yield (kg/acre) in 2010/11	85	1017.2	46	652.7	0.39
	32				
Panel C: Rice Production and Yield					
Use of Improved Seeds in 2011/12 (1 = Yes)	32	0.12	10	0.02	1.00
Use of Chemical Fertilizer in 2011/12 (1 = Yes)	32	0.34	10	0.20	0.91
Number of vouchers used in own plots	32	2.66	10	0.00	-
Total land cultivated in 2010/11	32	2.97	10	1.70	0.71
Total produced in 2010/11	32	2165.7	10	1201.0	0.70
Total yield (kg/acre) in 2010/11	32	775.6	10	909.2	0.12
Buys seeds with vouchers 2011-12	86	0.92	47	0.06	0.00
Buys seeds without vouchers 2011-12	86	0.01	47	0.47	0.00
Buys fertilizers with vouchers 2011-12	86	0.92	47	0.11	0.00
Buys chemical without vouchers 2011-12	86	0.00	47	0.19	0.00

Notes: This table includes only individuals that in 2010/11 were 3rd year beneficiaries and thus in their last year of eligibility. Col (2) reports the averages for individuals who in 211/12 still received vouchers in their 4th year. Column (3) reports the averages for individuals who in 2011/12 no longer received vouchers and have thus graduated. Note that a large percentage of graduates still claim to have received vouchers after graduation.

3.2.3 Benefit-Cost Analysis

It is difficult to calculate a rate of return on the program investment without additional information relating to the displacement of commercial purchases, and the true rate of new, sustained adoption of improved seed and fertilizer technologies. However, an approximate estimate of these returns can be derived from the examination of average costs and returns across regions. This reveals that the program has offered a positive return on investment for the average maize producer in most of the regions where data were collected. The returns to the rice subsidy are more variable and lower.

Table 3.5 summarizes the results of the benefit-cost analysis based on data from the 2009/10 and 2010/11 seasons. On the cost side, column 3 reports the direct costs of the program per household in different regions (from Appendix 10) while column 4 includes the direct costs and complementary investments per household from Table 2.4. On the benefit side, we take the revenue per household from Table 3.3, column 4 for maize and column 8 for paddy. To compute the benefit cost ratios reported in columns 8 and 9 we subtract the top-up amount needed to purchase the inputs using the three vouchers from the revenue per household, amounting to 50 percent of the subsidy, and divide this measure of net revenue by the all-in costs of the program per household of column 4.

The results in Panel A suggest positive but variable benefit-cost ratios for maize in all regions, where revenues are positive and significant. We note, however, that in two of the 8 main regions, the benefit-cost ratios are less than 100 percent, suggesting that for every TZS invested in the program, the return is less than one TZS. The subsidized inputs are financially profitable to the farmer, but economically unprofitable to the government. For paddy, revenues are only positive and statistically significant in three out of the 5 rice-growing regions in the study. Even when they are significant, the benefit-cost ratio reveals modest returns.

Panel B reports the results for new regions with poorer agro-climatic conditions. The returns to the program for maize are positive and significant in Dodoma but not in Tabora. The revenues per household for paddy are not statistically significant.

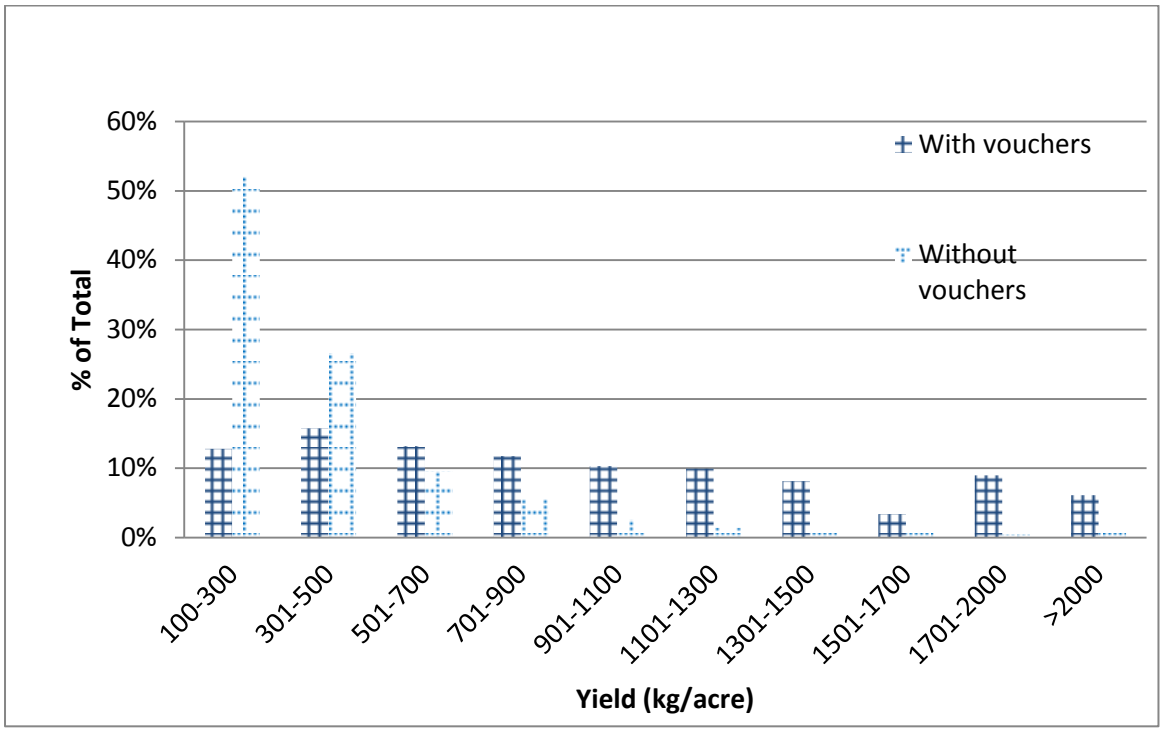
Columns 10 and 11 compute the benefit-cost ratio if the subsidy was removed altogether. The benefit-cost ratio in this case is the revenue net of the full cost of the inputs divided by the full cost of the inputs. Table 3.5 suggests that while maize is profitable even without subsidy in 7 of the 10 regions, paddy is only profitable in one region.

Overall, the benefit-cost ratio for maize across all regions is 130.05 percent. However, this hides the substantial variability in investment returns. The returns to any given farmer or region, depend heavily on the level of yield gains achieved, as well as the value of the additional production. The two regions with the lowest benefit-cost ratios for maize, also experience the lowest combination of average yield gains and prices. As a result, the improved seed and fertilizer inputs are not profitable for the average farmer. Input use efficiency or market efficiency must improve.

A sense of the magnitude of gains possible can be seen in the distribution of yield gains achieved by farmers participating in the program. Figure 3.1 highlights the improvement in average yields obtained by farmers receiving the vouchers. But it also highlights the fact that a large proportion of these farmers are still obtaining very low yield gains; almost 30 percent are producing less than 500 kg per acre even with the addition of improved inputs. Depending on the level of grain prices in the market, those farmers achieving average yield over one ton per acre will likely profit from commercial, full cost purchases of improved seed and fertilizer. Those obtaining lower average yield would likely find the fertilizer, at least,

[7]unprofitable. Fertilizer use efficiency must improve before commercial purchases of these inputs make sense.

Figure 3.1. Frequency distribution of maize yields achieved by beneficiaries and non-beneficiaries of input vouchers, 2010/11 cropping season.



Source: NAIVS Impact Surveys, 2011.

The overall benefit-cost ratio for paddy is only 65.83 percent. By corollary, the application of improved inputs to rice are not profitable to the average farmer, nor to government. As with maize, however, there is substantial variability in this result across regions and farmers. Those achieving higher levels of fertilizer use efficiency will find fertilizer profitable. But according to the impact survey data, the majority of rice farmers in almost all regions will not find the inputs profitable without the subsidy.

In sum, the impact survey data highlight the contribution of the NAIVS to expanding national maize and rice production. Average yields increased and aggregate levels of production correspondingly rose. Participating households cite improvements in their own food security. The record of continuing purchases of improved seed and fertilizer after farmers graduate from the program suggests the NAIVS has contributed to improving adoption rates for these

[7] Because the relative cost of improved seed is small, particularly for open or self-pollinated varieties which can be replanted the following season, this input is much more likely to be profitable even with small yield increments.

technologies. But the averages hide the substantial challenges remaining to improve the levels of input use efficiency for the majority of smallholder farm households.

Table 3.7: Benefit-cost Analysis (Listings Survey)

Region	N. of HH	Direct Cost of Program per HH	All in Cost of Program per HH	Revenue per HH		Benefit Cost Ratio at current subsidy level		Benefit Cost Ratio at zero subsidy level	
				Maize	Paddy	Maize	Paddy	Maize	Paddy
(1)	(2)	(3)	(4)	(6)	(7)	(8)	(9)	(10)	(11)
Panel A: Main Regions									
Arusha	101,863	64,500.00	66,594.34	188,815.00	-	186.68%		46.37%	
Kilimanjaro	142,289	64,295.00	66,389.34	131,121.00	199,599.00	100.66%	204%	1.97%	50.32%
Morogoro	140,706	60,996.00	63,090.34	141,863.00	125,898.00	128.18%	103%	16.29%	-0.22%
Ruvuma	203,412	67,866.00	69,960.34	108,455.00	98,033.00	58.02%	43%	-20.10%	-29.94%
Iringa	336,635	64,405.00	66,499.34	115,326.00	-	76.57%		-10.47%	
Mbeya	317,012	64,379.00	66,473.34	140,041.00	-	113.82%		8.76%	
Rukwa	157,647	67,860.00	69,954.34	261,810.00	-	277.25%		92.90%	
Kigoma	92,941	66,924.00	69,018.34	143,022.00	-	110.26%		6.85%	
Panel B: New Regions									

Dodoma	24,776	60,117.00	62,211.34	164,862.00	-	168.37%	37.12%
Tabora	56,942	58,105.00	60,199.34	-	-		

Notes: Data in column 3 is taken from Table 2.7. Column 4 reports the sum of direct costs from column 3 and per capita indirect costs and complementary investments from Table 2.4.

4.0 NAIVS DESIGN AND IMPLEMENTATION ISSUES

Many design and implementation factors influenced the financial and economic payoffs to the input subsidy. These range from decisions about the targeting of household beneficiaries, to the targeting of inputs, and the delivery of complementary services needed to assure these inputs are used well.

4.1 Households Targeting and Displacement

4.1.1 Households Targeting

The NAIVS program targeted a middle class of households who could afford to pay the top-up, and ultimately continue to purchase improved seed and fertilizer inputs on a commercial basis. The exclusion of poorer households was assured by the demand that farmers pay 50 percent of the value of the inputs in cash. Some households borrowed cash for these payments, and some agreed with neighbours to jointly invest in paying the top-up and share the inputs.

The main proxy variable limiting the participation of wealthier households was the 1 hectare limit of cultivated area of maize or paddy. During implementation, however, it was realized that this area limit was not appropriate in all parts of the country. In many areas with relatively lower population density, including many parts of the southern highlands, a large proportion of households cultivated more than one hectare.

As Table 4.1 indicates, if the land and top-up criteria had been strictly enforced, only a small minority of households (31 percent in the southern highlands and 35 percent in other surveyed regions) would have been eligible for participation in the NAIVS subsidy program.

Table 4.1: Targeting Results from Listing Survey (2010/11 voucher cycle)

	Southern Highlands Regions (SHR)		Other Regions (OR)	
	N	percent of Total	N	percent of Total
Cultivated 1 Ha or less of Maize (2009/10)	639	59.0	2,078	74.6
Could Afford the Top Up in 2010/11	639	53.8	2,078	47.8
Maize Eligibility (Land + Top Up Criteria)	639	30.5	2,078	34.5
Beneficiary 2010/11	639	44.6	2,078	19.5
Beneficiaries who are not eligible	215	62.3	441	49.0

Note: SHR = Ruvuma, Iringa, Rukwa and Mbeya, and OR = Arusha, Kilimanjaro, Morogoro and Kigoma

Source: NAIVS Impact Surveys, 2011.

In practice, however, some discretion over the selection of beneficiaries was placed in the hands of the Village Voucher Committee, an elected grouping of village representatives. The members of these Committees were trained about the objectives of the program, and the need to target participation. During implementation support missions, it became evident that these Village Voucher Committees more commonly sought to define a *fair* allocation of vouchers, than to strictly follow the long list of criteria defined during the program design. In villages receiving larger numbers of vouchers, a larger proportion of the farm population received assistance. In villages receiving a smaller number of vouchers relative to their population, each sub-village would receive what was perceived to be an equitable share of vouchers. Rather than enforcing the three year rule, vouchers were rotated such that different households obtained an opportunity to receive subsidized inputs each year.

A main concern justifying the establishment and training of the Village Voucher Committee was to reduce the chances of elite capture of vouchers. In practice, this effort seems to have been largely successful. The few members of the Village Voucher Committee (6 per village) were more likely to receive vouchers themselves[8], however the vast majority of beneficiaries had no connection to members of the Voucher Committee or to the Village executive (Table 3.1). Such connections did not significantly increase the chances a household would receive a voucher[9]. The main complaints encountered during the program were that there were not enough vouchers, or that the three year graduation period was too short.

4.1.2 Displacement

The NAIVS sought to avoid the allocation of vouchers to farmers normally purchasing improve d seed or fertilizer. In effect, the MAFC did not want the voucher to displace commercial input purchases. Correspondingly, the selection criteria allocated priority to "farming households [who] have used little or no fertilizer and improved seed with maize or rice over the last five years".

Table 4.2 presents the percentage of beneficiaries that had used seed or chemical fertilizer inputs in the years prior to becoming beneficiaries. At the beginning of the program in 2008, about half of beneficiaries had tried improved seeds and about 40 percent of beneficiaries had used chemical fertilizer in the previous 5 years. But it is not possible to tell from these data whether the household had received the input as a gift, or purchased it. Nor is it possible to distinguish a household who may have occasionally purchased a small quantity of input from a household that consistently purchased improved seed and fertilizer as a seasonal

[8] Some likely viewed this as an entitlement because they were not otherwise paid for their services. Many complained during implementation review missions about the lack of payment.

[9] This record stands in contrast to the findings of Pan and Christiaensen (2010) highlighting the fact that 60 percent of elected officials in Kilimanjaro received vouchers in 2008/09. When funding was initiated friom the World Bank, in 2009/10, training and supervisory support were considerably strengthened.

investment. As a result, these data probably over-estimate the possible level of displacement of commercial input purchases that may have occurred.

Table 4.2: Beneficiaries used input in years before the start of NAIVS

Beneficiaries	Improved Seeds (in percent)	Chemical Fertilizer (in percent)
2008 beneficiaries	49	40 percent
2009 new beneficiaries	42	31 percent
2010 new beneficiaries	15	18 percent

Source: NAIVS Impact Surveys, 2011.

With each subsequent voucher cycle, the percentage of beneficiaries who had previously used improved inputs declined. Many Village Voucher Committees stated their concern to initially target households that would 'make good use of the inputs' implying that better than average households tended to obtain the first vouchers allocated, but over time, a larger proportion of relatively poorer households, or those with less experience with these inputs, started to benefit.

4.2 Programme Knowledge and Graduation Strategies

The initial household survey encompassing current and prospective beneficiaries highlighted good knowledge of the overall NAIVS program, but much more limited knowledge of the detailed rules of program implementation (Table 4.3). While three-quarters of the farmers knew of the program, less than one-half understood their eligibility status, and only six percent understood the three year graduation strategy. Most of these households seem to have assumed that the subsidy was offered as a means to reduce the high costs of improved seed and fertilizer. They assumed this assistance would last indefinitely.

Table 4.3: Awareness of NAIVS (Dec 2010-Feb 2011)

	Households	
	N	%
Awareness of existence of NAIVS	2,000	76%
Awareness of 3-year duration of subsidy	1,520	6%
Awareness of own eligibility status	1,520	43%
Awareness of eligibility criteria	1,520	46%

Source: NAIVS Impact Surveys, 2011.

Correspondingly, the three year graduation rule was not consistently applied. The impact surveys conducted in 2011-12 reveal that 60 percent of all households receiving vouchers that year were benefiting from a fourth year of assistance. As the NAIVS continued to expand into new parts of the country, many farmers were still only receiving vouchers for the first

time. In some areas where the number of vouchers distributed was small relative to the local population, the three year graduation strategy was applied, but in others, local Village Voucher Committees decided it was fairer to rotate the allocation of vouchers each year to a new set of households.

The decision about whether or not to enforce the three year graduation strategy partially reflects a difference of opinion about the objective of the program. The logic of the three year commitment was to introduce farmers to these new inputs, and allow them to gain enough experience both to recognize their value and build a small capital base for continuing commercial purchases. The three year commitment would also encourage the development of local input stockists. In effect, both an information constraint and an access constraint would be resolved. However, many farmers and some government officials argue that the subsidy should be maintained because these inputs remain too expensive. Many farmers also continue to face severe capital constraints.

4.3 Participation of Trained Agro Dealers in the Program

In order to improve the accessibility of seed and fertilizer inputs the NAIVS mandated that vouchers should be redeemable through registered agro-dealers with shops within the village. This commitment was backed by a large-scale program of agro-dealer training organized on contract by the Citizens Network for Foreign Affairs (CNFA). Table 4.4 summarizes the initial outcome of this training. Approximately 3,855 potential agro-dealers received training in seed and fertilizer management and business practice. The majority of these trainees were not originally agro-dealers. Many were general retailers selling groceries, and some owned no retail shop to begin with. As a result, a number of those trained were not selected to participate in the program. Only 2,335 of these agro-dealers participated in the NAIVS during 2010/11 cropping season, and 2,010 participated the following 2011/12 cropping season.

Table 4.4: Participation of Agro-dealers in NAIVS (2010/11 and 2011/12)

Region	Total No of Trained Agro-dealers	Trained and Participated Agro-dealers (2010/11)	Trained but Not participated (2010/11)	Not Participated as percent of Trained (2010/11)	Trained and Participated Agro-dealers (2011/12)	Trained but Not participate (2011/12)	Not Participated as percent of Trained (2011/12)
Arusha	196	149	47	24	116	80	41
Kilimanjaro	182	173	9	5	146	36	20
Morogoro	275	207	68	25	143	132	48
Iringa	514	390	124	24	395	119	23
Mbeya	518	376	142	27	351	167	32
Ruvuma	268	205	63	24	154	114	43
Rukwa	201	105	96	48	138	63	31
Manyara	88	51	37	42	34	54	61
Kigoma	193	176	17	9	117	76	39
Tabora	100	60	40	40	92	8	8
Mara	119	91	28	24	60	59	50
Tanga	127	26	101	80	35	92	72

Shinyanga	219	87	132	60	27	192	88
Kagera	252	19	233	92	30	222	88
Mwanza	183	103	80	44	80	103	56
Lindi	82	23	59	72	25	57	70
Singida	89	18	71	80	3	86	97
Dodoma	117	18	99	85	21	96	82
Pwani	51	20	31	61	13	38	75
Mtwara	81	38	43	53	30	51	63
Total	**3,855**	**2,335**	**1,520**	39	**2,010**	1845	48

Source: MAFC – Agricultural Input Section.

The fact that only 50 percent of the trainees participated in the NAIVS could be viewed as a waste of resources – too many people were trained relative to the requirements of the program. But this may also be viewed as a means to help identify which trainees were serious about investing in the commercial supply of agricultural inputs. Others presumably benefited from components of the business training that could be applied to other commercial initiatives.

Seed and fertilizer companies took a much more active role in the selection of agro-dealers starting in 2012/13. In the process, agro-dealers who had failed to repay their loans to the suppliers, or who had provided poorer services to local communities were weeded out. The remaining 1,600 agrodealers were now designated as agents of the seed and fertilizer companies. Several of the input suppliers started to more actively train their agents and supervise the the flow of inputs. Some encouraged their agents to begin running demonstration trials and to provide technical advice to potential customers – both the recipients of the NAIVS subsidy as well as neighboring commercial buyers. Commercial relationships along the seed and fertilizer supply chain strengthened.

The total number of agro-dealers in the country appears to have considerably increased as a result of the NAIVS program. Input supply chains have been strengthened, particularly in higher potential regions and areas closer to major business centres. The challenge remains to continue to build these supply chains in drier and outlying regions of the country.

4.4 Delayed Delivery of Vouchers and Inputs

One of the main challenges underlying the NAIVS was the timely delivery of both vouchers, and the subsidized inputs. Farmers commonly complained about the late delivery of the vouchers. Many received their vouchers after the planting rains had already begun. This contributed to a delayed planting of their crops. But many also complained that they did not know whether they would receive a voucher until too late. This probably contributed to delays in the initiation of commercial input purchases by farmers not targeted to receive assistance. This problem was particularly difficult in the 2011/12 cropping season when the vouchers sat in the port of Dar es Salaam until January because of a tax dispute. The MAFC

distributed *Certificates of Confirmation of Receiving Subsidized Agricultural Inputs* as a temporary replacement for the vouchers in order to allow targeted farm households to obtain their inputs. However, these were not consistently accepted by the designated agro-dealers.

Even if vouchers were available within the village, these were not necessarily distributed to the targeted households until the seed and fertilizer inputs were available. The delivery of these inputs was sometimes constrained by the failure of the agro-dealer to raise enough capital to purchase the inputs from available wholesalers. While some agro-dealers were able to obtain seed or fertilizer on concession from the supplying companies, many with limited or unfavorable credit histories had to purchase and deliver the inputs as cash became available. In some cases, agro-dealers supplied seed and basal fertilizer, but the top dress fertilizer could only be supplied at a later date.

These sorts of delays undoubtedly reduced the yield gains obtainable with the improved inputs. The profitability of using improved seed and chemical fertilizer declined, undermining the probability of success of graduation and sustainability of the input market.

4.5 Delayed Payment of Seed and Fertilizer Suppliers

The delay in the delivery of inputs was reinforced by the delay in the payment of seed and fertilizer suppliers. In 2011, 2012 and 2013, a significant share of the vouchers were still being redeemed by agro-dealers or seed and fertilizer suppliers more than six months after the inputs had been provided. The primary reason for this problem was that the government struggled to provide its funding for the input subsidy on a timely basis. In addition, there were multiple delays in the process of submitting vouchers for redemption and completing payments through the NMB. Vouchers had to be organized as a set, and submitted to the DALDO for countersignature prior to their submission to the NMB. The NMB refused to accept vouchers if there was not enough funding to complete all payments due within any particular district. The NMB also refused to accept vouchers for redemption in districts differing from their targeted distribution. If serial numbers were mixed in the original allocation, it could take weeks to sort out the mistake during voucher redemption. Finally, the NMB encountered problems with the sorting of vouchers and verification for payment.

The long delay between the timing of the provision of inputs, and the payment for these inputs, had several consequences. Agro-dealers struggled to obtain enough capital on a timely basis to assure the completion of their input deliveries. Some agro-dealers took a loss on the program and dropped out, because of the high interest rates on outstanding input loans. Some obtained late payments and used these to pay other debts, rather than paying their debts with seed and fertilizer suppliers. The combination of high interest rates on outstanding loans, and the uncertainty of payments, likely contributed to increasing the costs of both seed and fertilizer inputs available to the NAIVS program. Again, these problems undermined the sustainability of the program.

4.6 Evidence of Misuse of Vouchers

While there were many rumors about the misuse of vouchers, and numerous press reports about misuse in the earlier years of the program, it is difficult to estimate the actual levels of fraud. In some cases farmer complaints about their failure to receive vouchers were justified, while in others these were not.

The NAIVS program was subject to an annual audit by the National Audit Office (NAO). This audit highlighted numerous problems of voucher administration, but no serious cases of corruption. Table 4.5 highlights the common audit concerns being raised. These largely concern the problems of weak tracking of voucher flows, and poor documentation of the reconciliation of vouchers. This increases the difficulty of identifying and tracking missing or misallocated vouchers.

Table 4.5: Common audit concerns

No.	Audit Concerns
1	Non reconciliation of approved input vouchers to be redeemed between the Ministry of Agriculture, Food Security and Cooperatives and the National Microfinance Bank
2	Weak reconciliation of redeemed vouchers at NMB and at districts levels
3	Weak communication between the project coordination unit and regional secretariats
4	Delays in the distribution of vouchers to the beneficiaries;
5	Missing supporting documents on the receipts and distribution of agricultural inputs
6	Failure to keep unused vouchers inventoried and locked in safes

Source: MAFC – Agricultural Input Section.

When specific questions of misallocation arose, the MAFC commonly sent an investigation team to the district, and in severe cases, investigations were initiated by the Prevention and Combating of Corruption Bureau (PCCB). When fraud was suspected, cases were referred to the police and courts. The redemption process was stopped and vouchers were withdrawn. A number of MAFC officials suspected of fraud lost their jobs and some were jailed. The MAFC listing of cases of potential misuse in 2010-11 is outlined in Table 4.6. Similar listings were produced most years and discussed with members of Parliament.

Table 4.6: Cases of possible misuse of NAIVS vouchers under investigation for 2010/2011

REGION /DISTRICT	VILLAGE	STOLEN VOUCHERS	LOST VOUCHERS	PERSON INVOLVED	ACTION TAKEN
Kilimanjaro/ Siha	Tindigani	60 vouchers were stolen	60 vouchers	Village Chairman	He has already taken to the court in April,2011 and was charged in case number 151/2011
Kilimanjaro/ Moshi Rural	Mvuleni	1029 vouchers	1029 vouchers	Village Executive	VEO run away and Police are still looking

				Officer (VEO)	for him.
Morogoro/ Mvomero	Msongozi, Mkata, Maharaka, Tangeni and Sagamaganga	Farmers were Bribed 10,000/= each in order to sign three vouchers but no inputs were supplied to them.		VEO, Agro dealers, Village Voucher Committee Members.	The Case Number CC 4/2011 were reported to Dakawa Police Station and Morogoro District Court for hearing.
Morogoro/ Kilombero	Mofu Ward			Three people were accused of stealing vouchers.	The case was reported to Police CC.No. 177 pending for investigation.
Morogoro/ Kilosa	Rudewa Ward.	2,700 vouchers	900 Urea, 900 DAP, 500 Maize Hybrid and 400 maize OPV.	Ward Executive Officer (WEO).	Police are handling the case number KM/RB/130/2011 and the investigation is still on.
Morogoro/ Morogoro Municipal Council	Kichangani Ward	254 vouchers	85 DAP, 85 UREA, 61 Maize Hybrid and 23 Maize OPV	Ward Executive Officer (WEO).	Police are handling the case number Moro/RB/1892/2011 and the investigation is still on.
Coast/ Bagamoyo	Kibindu, Kwarohombo, Kikaro and Malivundo.	Cheating and Dishonesty		Seven (7) VEO's, Six (6) Agro dealers	The alleged have been taken to court and the case has been adjourned for further investigations.
	Tukamisasa	300 vouchers	100 Improved maize seed vouchers and	VEO and Village Voucher Committee	The case is still under investigation in collaboration with Village Community.
Mbeya Region	2 Cases – Rungwe DC. 4 Cases - Mbozi D.C 2 Cases – Chunya D.C 2 Cases – Ileje D.C 2 Cases - Mbarali D.C 4 Cases –Mbeya Municipal Council 2 Cases - Mbeya D.C	Cheatings and Dishonesty		VEO's , Village Vouchers Committees and Agro dealers	All cases were reported to Police and are still under investigation.

NOTES:

1.0 Where vouchers have been stolen or lost, the villages have been instructed to immediately report to the police and the nearest National Microfinance Bank and the respective District Authorities. The Bank immediately reports to its Headquarters and the respective District Authorities also reports immediately to the Ministry. A joint effort is made by blocking the lost voucher numbers for payment for the whole country by instructing all bank branches and for the Ministry, all regions are notified with the voucher details so that they cannot be sent for redeeming anywhere.

2.0 The voucher numbers for each region and district are submitted to the Bank headquarters who distribute the list to their respective branches to ensure that vouchers from one district are not redeemed to another district.

3.0 Within the district, voucher numbers for each village are assigned by the district hence no voucher from one village can be submitted for redemption.

Source: MAFC – Agricultural Input Section.

Multiple rumors that farmers were selling their vouchers could not be corroborated. Evidence of such sales was extremely limited in both the formal impact surveys, and in informal spot checks with the farm communities. It appeared more likely that farmers who could not afford a top up would sell a voucher to another farmer, rather than selling this for items other than inputs.

A number of cases were cited, whereby farmers were asked their sign their vouchers, but failed to receive all of their inputs. It was common that targeted farmers were asked to sign all of their vouchers on the day the inputs were delivered to the village. They then queued to pay their top up and collect their inputs from the agro-dealer. In some cases a farmer might not collect a specific input they did not like (e.g. MRP). In other cases the agro-dealer would run out of inputs, and have to collect these from a distant wholesaler. Some farmers complained that agro-dealers then returned late or failed to return to the village.

The impact surveys sought to reconcile the receipt of the vouchers with the application of the inputs. In most cases these records were congruent. However, these data also indicate that many farmers did, in fact, fail to receive or redeem their stipulated three vouchers (Table 4.7). In 2010-11, 13 percent of all households only redeemed one voucher and 15 percent only redeemed two vouchers. On average, only 2.6 vouchers were redeemed by each participating household. The proportion of households redeeming fewer than the expected three vouchers was higher in lower rainfall zones.

Table 4.7: Number of vouchers received and used by recipient households, 2010/11 season

	All households (n=1321)	**Households in lower rainfall areas (n=76)**
1 voucher 2 vouchers 3 vouchers	12.5% 15.3% 71.8%	31.5% 22.4% 44.7%
Average no of vouchers received Percentage of vouchers used	2.6 85.5%	2.17 70.6%
Percentage of vouchers shared, sold, given away	1.3%	0.9%

Source: NAIVS Impact Surveys, 2011.

This relationship may be partly explained by the late delivery of vouchers after the start of the rainy season, and partly by the decision of some relatively poorer households to share their vouchers with neighbors in order to share the costs of the top-up payment. A limited portion of vouchers may well have been sold. Others were simply never redeemed and returned unused, or lost. Ultimately, approximately 92 percent of all vouchers were redeemed and paid out that season.

4.7 Sustainability

Farmers in the country are becoming accustomed to the use of improved maize and rice seed and chemical fertilizer. But they have also become more accustomed to receiving input subsidies. As the number of vouchers distributed, and households targeted declined, calls were voiced for the continuation of the program, because inputs were still expensive. Many farmers continue to view the input subsidy as an entitlement.

The impact survey data suggest, nonetheless, that many households were successfully graduating to commercial input purchases. Roughly 47 percent of the voucher graduates who had not used improved seed prior to the start of the program continued to purchase improved seed after graduating. This is an unexpectedly high number given that a significant share of the improved seed was of open pollinated varieties allowing seed to be retained from the previous season's harvest.

The survey data suggest a much smaller proportion of voucher graduates (19 percent) who had not used fertilizer before the program, decided to purchase this on their own in 2011/12. This is nonetheless a significant gain. In complement, approximately 44 percent of the voucher graduates who had previously tried seed or fertilizer before 2009 decided to purchase chemical fertilizer on their own in 2011/12. Overall, about 57 percent of the graduates continued to buy improved seed. This coincides with comments received from both fertilizer and seed companies that their commercial sales were increasing in the aftermath of the subsidy program.

The significance of these numbers is reinforced by continuing questions about the profitability of investments in improved seed and chemical fertilizer. As noted above, the returns to investment in the combination of improved seed and fertilizer were highly variable. While the maize input package was clearly profitable for the top 30 percent of households, these inputs offered little or no profits for the bottom 50 percent or so of targeted farmers. Paddy producers experienced a similar distribution of benefits. If these seed and fertilizer inputs were not profitable, farmers cannot be expected to continue to purchase them at full cost on their own.

Multiple justifications can be cited for this relatively flat distribution of yields obtained with the vouchers. Vouchers were often received late. Not all farmers redeemed all their vouchers. Both MAFC officials and farmers cited the need to improve the targeting of fertilizer. Some areas of the country needed more phosphorous, some needed relatively more nitrogen, and in some areas the provision of sulfur was important. Farmers complained about being given seed of maize varieties they already had. The levels of extension support associated with the NAIVS were limited. The initial impact survey report (Patel, 2011) revealed that only 25 percent of these farmers had access to extension support, and only 20 percent directly received advice.

In sum, there remain substantial opportunities for improving input use efficiency, and fertilizer use efficiency, in particular. Greater yields per unit of improved input improved profitability, and the likely sustainability of these investments.

The profitability of investments in improved seed and fertilizer is also highly dependent on the farmgate price of the grains produced. Tanzania is characterized by long distances between the farmer and market, and correspondingly high transport costs. The impact surveys highlight the low levels of farmgate price being obtained by most program participants. While maize was selling for over Tsh550 per kg in Dar es Salaam or Arusha, most NAIVS participants were receiving only 300 to 400 per kg for their grain. While rice was selling for over Tsh1000 per kg in Dar es Salaam, farmers were commonly receiving only Tsh 600 to 800 per kg. The NAIVS did not include any program to facilitate grain sales and improve farmgate prices.

The investment programs proposed in the Big Results Now laboratories[10] primarily target the objective of making maize and rice production more profitable. The maize program principally targets the improvement of production returns by helping farmers make use of warehouse based crop storage systems that facilitate the exploitation of price seasonality and the opportunities for achieving better farmgate prices through bulk sales. These warehouse operations can also be used to facilitate the bulk purchase of crop inputs.

The Big Results Now proposal for paddy seeks a combination of improvements in production and market productivity through the pursuit of better crop management through block farming as well as a similar warehousing arrangement as that proposed for maize. This is expected to improve input used efficiency and and marketing opportunities. If farmers obtain higher yields and higher farmgate prices , they will find the crop more profitable and the input investment more acceptable.

There are similarly multiple ways to help farmers resolve the cash flow constraint in the face of limited credit markets and high borrowing costs. These include various opportunities to link input purchases more closely with crop sales – so that when a farmer has the money from crop sales, he or she can immediately allocate a portion of this to purchasing the next season's inputs. There is also a growing interest in alternative types of rural savings schemes that may allow a farmer to commit a part of their savings to input purchase ahead of time. And there is a new wave of experimentation with cellphone based money transfer programs that improve the linkages between input buyers and sellers – potentially further reducing these transaction costs, and assuring that purchase are possible when money is available. These options merit further evaluation.

[10] The agriculture sector is among the six key sectors selected for accelerating delivery of results under the Government's new "Big Results Now" (BRN) initiative. Specific investment programs were defined for improving the production and profitability of maize and rice.

4.8 Expansion to Lower Rainfall Zones

While the NAIVS was originally designed to assist farmers in higher rainfall zones in order to link the expanding adoption of improved technologies with the improvement of national grain supplies, political imperatives encouraged the expansion of the voucher distribution into drier and more drought prone parts of the country. The average yield gains achieved in these drier regions were lower than the gains achieved in areas of more reliable rainfall. Farmers could expect less grain per unit of improved seed or fertilizer applied. However, the common view that fertilizer is a waste of money in drier regions is not necessarily correct. In many drier areas, fertilizer is more limiting than water in many years. Fertilizer application can help plants extend their roots more quickly into deeper parts of the soil profile where water is available. These plants are then better able to withstand drought.

In addition, the lower average yield gain may be partly offset by the fact that average cereal grain prices may be higher in these areas because of their food deficits. As well, the costs of delivering food aid in Tanzania's drought prone regions are high. Therefore, the value of an additional bag of grain produced in some drought prone and food insecure regions may be higher than the value of two extra bags of grain in an area where farmers commonly produce a grain surplus. Importantly, this gain accrues most directly to relatively poorer and more food insecure households. A rough estimate of this relationship is found in Table 4.8.

Table 4.8: Average yield gain of farmers with and without vouchers by higher and lower rainfall district

	Higher Rainfall District	**Lower Rainfall District**
Average maize yield without vouchers (kg/acre)	453.6	386.5
Average maize yield with vouchers (kg/acre)	925	732.3
Yield gain obtained from the use of vouchers (kg/acre)	471.4	345.8
Average farmgate price of grain (Tsh)	300	550
Value of yield gain (Tsh) at farmgate prices	141,420	190,190
Average cost of food aid imports (Tsh/kg)	-	800
Value of yield gain (Tsh) at food aid prices	-	276,640

Note: Survey results were gathered from the higher rainfall districts (Ruvuma, Iringa, Rukwa, Mbeya, Kigoma, Morogoro, Arusha and Kilimanjaro) and lower rainfall districts (Tabora and Dodoma) for the 2011/12 crop seasons.

Source: NAIVS Impact Surveys, 2011.

5.0 CONCLUSIONS AND RECOMMEDATIONS

The NAIVS program was originally designed with three major goals. The first was to raise domestic grain production levels in order to increase national grain supplies in the face of rising global prices for grains and fertilizer. This objective was essentially fulfilled. The country produced at least 2.5 million mt of additional grain over the 2009/10 to 2011/12 period, eliminated its ban of exports, and exported maize to neighboring countries affected by drought. This has encouraged Tanzania to consider a strategy of expanding its production of basic grains in order to expand exports into regional east African markets.

A second major objective of the NAIVS program was to encourage smallholder farmers to try new seed and chemical fertilizer. In effect, the government shared the risks of such experimentation with new technologies. The three year graduation strategy allowed farmers to see the value of these inputs in a diversity of cropping seasons with variable rainfall. The strategy assumed that once farmers recognized the value of improved inputs, and built up sufficient farming capital, they would continue to invest on their own. These farmers would successfully graduate to the commercial market. In practice, most graduates of the program are continuing to use improved seed. The majority of these farmers are purchasing improved seed on the retail market, and many are continuing to plant improved open pollinated varieties with seed obtained from their own harvests. This part of the program has been clearly successful.

The NAIVS program has displayed a more mixed record in promoting the sustained adoption of chemical fertilizer. Only 37 percent of the graduates continued to purchase fertilizer inputs with their own resources. The majority of these farmers had tried fertilizer at some point in the past. This gain is lower for two reasons. First, chemical fertilizer is much more expensive than improved seed, and second, the yield gains achieved have been highly variable. Farmers obtaining higher yield gains, and better rates of fertilizer use efficiency, are more likely to continue to purchase fertilizer in the market. Less efficient farmers are not achieving the yield gains needed to earn a profit. Most of these farmers will use fertilizer when it is subsidized, but will stop using it when the subsidy is withdrawn.

The main challenge underlying government programs to further promote the adoption of improved technologies is to improve fertilizer use efficiency. The yield distribution data highlights the substantial opportunities for future gains. These may be derived from better targeting of fertilizer nutrients to local soil conditions, assuring fertilizer is available on a timely basis, and through complementary improvements in crop management such as timely weed control and improved water management.

The NAIVS program has undoubtedly contributed to improved accessibility of seed and fertilizer in some parts of the country. In outlying regions, these inputs are more likely to be available in district centers. In regions with larger levels of commercial agricultural investment, improved seed and fertilizer are more likely to be found closer to the farm gate.

The shift from DALDOs leading the selection of participating agro-dealers toward selection by seed and fertilizer companies has strengthened the efforts of some seed and fertilizer companies to invest in developing sustainable input supply chains.

The continuing delays in the payment for seed and fertilizer supplied to the NAIVS has likely increased the costs of these inputs, and jeopardized the financial viability of some of the smaller companies. If upwards to 50 percent of the costs of inputs being supplied through the NAIVS are not paid for at least six months, these companies have little choice but to integrate a risk or interest rate margin into their cost structure. The prices of inputs available to this government program rise, and there may be associated increases in the prices of seed and fertilizer flowing through commercial channels.

The profitability of the improved inputs has also been affected by the price received for the grain product. Tanzanian farmers commonly experience large differences between producer and consumer prices, and large variability in grain prices across seasons. This implies opportunities for facilitating bulk sales to processors, or storage for sale later in the season when prices have increased. Both objectives have been identified as major opportunities to be exploited under the new Big Results Now initiative. The introduction of a warehousing program for maize is proposed to facilitate bulk purchase of seed and fertilizer inputs, as well as the bulk sale of the grain product when prices are favorable. A similar initiative for rice adds a component of technical assistance aimed at improving the efficiency of irrigated crop management systems, and thus fertilizer use efficiency.

Regardless, many small-scale farmers continue to complain about high input costs with the expectation that the government ought to provide on-going input subsidies. While these complains partly reflect the low returns to fertilizer achieved by farmers obtaining low yields (which can be resolved with improved technical advice), these concerns also reflect the persistence of cash flow constraints at the start of the cropping season. Many farmers struggle to save cash earned on crop sales given their pressing needs for cash to pay other household needs. Similarly, cash constraints are encountered when farmers seek to hold a significant portion of their crop for later sale when consumer prices are rising. This implies the need for some combination of improved savings arrangements allowing farmers to quickly set aside cash, once available, for their next season's inputs, or improved credit supply. The difficulty with the latter is that investments in agricultural inputs decline in profitability as interest rates rise. Formal agricultural lending is uncommon because of the high risks and transaction costs of providing credit to large numbers of smallholders. And commercial interest rates are commonly viewed prohibitive. While there is growing interest in solutions such as selling inputs at harvest time, and the collateralization of warehouse receipts, most such schemes have yet to prove commercially sustainable.

The MAFC has proposed to continue subsidizing agricultural inputs through a combination of vouchers and interest rate subsidies for the foreseeable future. This investment would have a negative rate of return if it simply pays part of the costs of commercial seed and fertilizer purchases that would have otherwise occurred. In effect, the MAFC should be encouraging

the development of self-sustaining commercial input markets, and encouraging farmers to use these markets wherever possible. The primary opportunity to assist smallholder who are already successfully commercializing is to continue to improve the efficiency of input usage itself, or of grain markets. In effect, rather than investing in subsidizing inputs, the government should be investing in improving access to newer seed and fertilizer technologies, improving the efficiency of the management of these technologies, and strengthening grain markets.

Targeted assistance is also still likely required to encourage the further development of input supply chains in outlying regions that are under-serviced by seed and fertilizer suppliers. The challenge remains to assure any public assistance supports the development of a sustainable commercial investment. Following the logic of the NAIVS, vouchers may be used, with stronger technical advice, to encourage broader experimentation by a shifting array of farmers unfamiliar with improved seed varieties and chemical fertilizer. But this also implies the need to institute major improvements in the timeliness of voucher distribution, input supply, and subsidy payments, much stronger efforts to improve the technical efficiency of input use, and the stricter enforcement of both targeting and graduation processes. In effect, the main objective would not be to improve food security per se, but rather to increase the productivity of grain production. As the growing evidence of the NAIVS reveals, if farmers find the inputs profitable, they will continue to invest on their own. Similarly, if seed and fertilizer companies perceive a growing demand for their products, they will invest more in building sustainable input supply chains.

Finally, there may be justification for specialized support for speeding the adoption of a much wider array of new seed varieties of limited interest to commercial suppliers. Too many varieties are released each year by crop breeders, but never multiplied on significant scale. Yet the costs of multiplication and distribution are small relative to the potential gains if a new open or self-pollinated variety is distributed even once. If farmers like the variety, they can select quality seed from each previous year's harvest and continue to plant this. Any productivity gain achieved persists. Even a five percent productivity gain may be large enough to repay the full costs of the initial multiplication and distribution effort. Many recipients of paddy seed under the NAIVS commented on the fact that they were seeing new rice varieties for the first time. A number of maize farmers complained that they were receiving the same open pollinated varieties they were already using. They wanted new varieties. As smallholder farmers become accustomed to looking for new varieties, they are also more likely to consider complementary improvements in their management practices.

Ultimately the MAFC faces a difficult challenge in the allocation of its scarce resources. Should the Ministry continue to invest 30 to 40 percent of its budget in input subsidies? Or should these resources be better invested in strengthening extension support, or more specifically in improving the technical efficiency of seed and fertilizer use? Should such subsidies be provided to a broad 'middle class' of farmers, or should the target evolve to encompass poorer farmers, or those in outlying regions where commercial input purchases are less likely to be displaced? Should greater emphasis be placed on speeding the adoption

of new seed varieties long released by national breeders, but still largely unknown to most farmers? Or should fewer farmers be assisted with larger packages of seed and fertilizer?

The impact assessment surveys underlying much of this analysis highlight the need first to improve the efficiency of program implementation, if the subsidy is to be maintained. This includes the need for timely implementation, better targeting and stronger technical support. In line with the original strategy, graduation toward commercial purchases, and a reduced reliance on government subsidies should be encouraged. The subsidy should not become an income transfer to more skilled farmers. Beyond this, there remains much room for experimentation with alternative measures to promote sustained improvements in technology adoption, crop productivity and market efficiency.

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APPENDICES

Appendix 1: Institutional Arrangement

The design of NAIVS, officially implemented by the Ministry of Agriculture and Food Security (MAFC) on behalf of the Government of Tanzania, consists of an extensive institutional arrangement. At the apex there is NAIVS national forum which is mandated to endorse the voucher share between targeted districts based on the adopted guidelines and selection criteria guidelines for NAIVS implementation, discuss and endorse proposed NAIVS annual work plan and budgets; and review implementation progress report and recommend changes/improvements to the National Voucher Steering Committee (NVSC), which is the next level of the institutional arrangement.

NVSC is set up by the MAFC and is chaired by the Permanent Secretary of MAFC (URT 2009). This committee is mandated to oversee a number of functions including development of policies, guidelines and procedures for the implementation of the NAIVS, particularly the agricultural input vouchers, submit the criteria for allocation of vouchers to regions, ensure that the scheme is fully financed and funds are released on time, and review progress reports and take corrective measures where needed. Within the Directorate of Crop Development Department of the MAFC, Agricultural Input Section (AIS) is responsible for day-to-day management of the Project and coordination of activities.

At regional level, the Regional Voucher Committee (RVC) is to determine the share of vouchers between districts and supports districts and monitor the implementation of the voucher scheme in the respective region (URT 2009). Similarly, Voucher Committee is also set up at district, ward and village level to monitor and make follow up of implementation of input voucher scheme. Moreover, like the National Forum, District Agricultural Input Voucher Scheme Forum (NAIVS-District Forum), is mandated to endorse the voucher share between targeted villages based on the adopted guidelines and selection criteria guidelines for NAIVS implementation, discuss and endorse proposed NAIVS annual work plan and budgets at district level and review implementation progress report and recommend changes/improvements to NVSC. Detailed information regarding each agency is as follows:

a) NAIVS National Forum

At the apex there is NAIVS national forum which draws 5 members from the National Public services; 1 district representative from one of the target regions; 9 members from the private sector (fertilizer companies (3 representatives), seed companies (3 representatives), and agro-dealer association (3 representatives)); 15 members from farmer organizations and Community Based Organizations (CBOs); and lastly 5 members from NGOs. This forum is mandated to endorse the voucher share between targeted districts based on the adopted guidelines and selection criteria guidelines for NAIVS implementation; discuss and endorse proposed NAIVS annual work plan and budgets; and review implementation progress report and recommend changes/improvements to the National Voucher Steering Committee

(NVSC), which is the next level of the institutional arrangement. Chaired by the Minister of Agriculture, Food Security and Cooperatives (MAFC) the NAIVS National Forum is supposed to meet twice a year.

b) National Voucher Steering Committee (NVSC)

Immediately after the apex body (NAIVS National Forum) there is a National Voucher Steering Committee (NVSC) which was set up by the MAFC and is chaired by the Permanent Secretary of MAFC (URT, 2009). It comprises of 1 representative from each of the Ministry of Finance, Prime Minister's Office, Regional Administration and Local Government (PMO-RALG), and the National Micro-Finance Bank. In addition there are 4 representatives of Farmer Groups, 2 members from agribusiness, MAFC Directors from relevant Departments, 2 members from Civil Society Organizations (CSOs), and Head of the Agricultural Inputs Section at MAFC who is also a secretary to the NVSC. This committee is mandated to oversee a number of functions including development of policies, guidelines and procedures for the implementation of the NAIVS, particularly the agricultural input vouchers; submit the criteria for allocation of vouchers to regions; ensure that the scheme is fully financed and funds are released on time; and review progress reports and take corrective measures where needed.

(c) Agricultural Input Section (AIS)

This is a section within the Directorate of Crop Development Department of the MAFC. It is responsible for day-to-day management of the Project and coordination of activities. The Head of Agricultural Input Section (HAIS) serves as NVSC Secretary. He is assisted by staffs that are assigned from other departments and sections of MAFC including the Planning officer, Fertilizer and soil nutrition management specialist, Monitoring and Evaluation officer, and Accounting Officer, Procurement Officer, and Communication specialist. The detailed role and responsibilities of Agricultural input section and the Head of the unit are clearly spelt out in the AFSP Project Implementation Manual (PIM) (URT, 2009).

(d) The Regional Voucher Committee (RVC)

The Regional Voucher Committee (RVC) is a regional apex body. Each target region has its own RVC and it is chaired by the Regional Commissioner (RC). It draws 3 members from the Regional Secretariat. These are the RC, the Regional Administrative Secretary (RAS), and the Regional Agricultural Advisor (RAA); 4 members from Farmer Groups; 2 members from Agribusiness; 2 members from the Civil Society Organizations (CSOs); and 1 member from the National Microfinance Bank (NMB) located in the respective region. The main role and responsibilities of the RVC is to determine the share of vouchers between districts. The RVC also supports districts and monitor the implementation of the voucher scheme in their respective region (URT, 2009).

(e) The District Agricultural Input Voucher Scheme Forum (NAIVS-District Forum)

Each target district has a District Agricultural Input Voucher Scheme Forum (NAIVS-District Forum) with membership drawn from LGA representatives (5 members); fertilizer companies (3 members), seed companies (3 members), agro-dealer association (3 members); farmer

organizations and CBOs (15 members); and NGOs (5 members). Like the National Forum, NAIVS District Forum is mandated to endorse the voucher share between targeted villages based on the adopted guidelines and selection criteria guidelines for NAIVS implementation; discuss and endorse proposed NAIVS annual work plan and budgets at district level; and review implementation progress report and recommend changes/improvements to NVSC.

(f) District Voucher Committee (DVC)

Each target district has a District Voucher Committee (DVC) which is chaired by the District Commissioner. Committee members include the District Commissioner; District Members of Parliament; District Council Chairperson; 6 representatives of the Farmer Groups; 2 Agro-dealer Representatives; 2 representatives of the Civil Society Organizations; and 2 members from Community Based Organizations.

Others are a representative from NMB located in the respective district and the District Agriculture and Livestock Officer (DALDO). Roles and responsibilities of DVC are presented in URT (2009). They include, collect and review information about maize and rice production, input use and other related information for each village and ward; select wards and villages that will be included in the voucher scheme (high potentials in terms of soils, low weather risks, etc.); estimate the number of farmers that grow maize and rice and the average size of holdings per farmer; and adopt and use the formula/criteria to estimate vouchers allocated to targeted villages.

(g) Ward Voucher Committee (WVC)

The Ward Voucher Committees (WVC) has been created in the entire target Wards to monitor and make follow up of implementation of input voucher scheme in selected wards. WVC is also responsible for distributing the vouchers to selected villages. The membership of WVC includes the Ward Executive Officer (Chairperson), Ward Extension Officer (Secretary), Ward Community Development officer, and 1 Farmer Group representative.

(h) The Village Voucher Committee (VVC)

This is the last administrative unit at the lower level. It is formed by the Village Council in consultation with the Village Assembly (VA). VVC has 6 members (3 men and 3 women). It is also responsible for recommending beneficiary farmers and, after the endorsement by the VA, issuing the vouchers to the beneficiaries. Eligibility criteria for VVC membership, roles and responsibility of VVC are clearly stated in UTR (2009).

Appendix 2: Number of vouchers distributed to regions in 2010/11 crop season

Region	**No of HHs**	***Hybrid Maize***		***Open Pollinated Maize Variety***		***Paddy***		***Fertilizer - Phosphate***		***Fertilizer Nitrogen***		***Grand Total Value***
		No of Voucher	***Total Cost/ Value***	***No of Voucher***	***Total Cost/ Value***	***No of Voucher***	***Total Cost/ Value***	***No of Voucher***	***Total Cost/ Value***	***No of Voucher***	***Total Cost/ Value***	
Iringa	336,635	332,635	*6,652,700,000*	-	-	4,000	*48,000,000*	336,635	*8,752,510,000*	336,635	*6,227,747,500*	21,680,957,500
Mbeya	317,012	312,431	*6,248,620,000*	851	*8,510,000*	3,730	*44,760,000*	317,012	*8,242,312,000*	317,012	*5,864,722,000*	20,408,924,000
Ruvuma	203,412	200,012	*4,000,240,000*	-	-	3,400	*40,800,000*	203,412	*5,288,712,000*	203,412	*4,475,064,000*	13,804,816,000
Rukwa	157,647	157,647	*3,152,940,000*	-	-	-	-	157,647	*4,098,822,000*	156,647	*3,446,234,000*	10,697,996,000
Morogoro	140,706	41,706	*834,120,000*	89,000	*890,000,000*	10,000	*120,000,000*	140,706	*3,658,356,000*	140,000	*3,080,000,000*	8,582,476,000
Kigoma	92,941	82,940	*1,658,800,000*	10,000	*100,000,000*	-	-	92,941	*2,416,466,000*	92,941	*2,044,702,000*	6,219,968,000
Dodoma	24,776	10,000	*200,000,000*	13,776	*137,760,000*	1,000	*12,000,000*	24,776	*644,176,000*	24,776	*495,520,000*	1,489,456,000
Singida	25,731	10,000	*200,000,000*	10,000	*100,000,000*	5,731	*68,772,000*	25,731	*669,006,000*	25,731	*566,082,000*	1,603,860,000
Tabora	56,942	-	-	53,942	*539,420,000*	3,000	*36,000,000*	56,942	*1,480,492,000*	56,941	*1,252,702,000*	3,308,614,000
Shinyanga	53,192	-	-	53,192	*531,920,000*	-	-	53,192	*1,382,992,000*	53,192	*1,170,224,000*	3,085,136,000
Mwanza	53,596	26,596	*531,920,000*	27,000	*270,000,000*	-	-	53,596	*1,393,496,000*	53,596	*1,179,112,000*	3,374,528,000
Kagera	53,192	-	-	53,192	*531,920,000*	-	-	53,192	*1,382,992,000*	53,192	*1,170,224,000*	3,085,136,000
Mara	63,596	54,798	*1,095,960,000*	8,800	*88,000,000*	-	-	63,597	*1,653,522,000*	63,596	*1,399,112,000*	4,236,594,000
Pwani	10,981	-	-	2,981	*29,810,000*	8,000	*96,000,000*	10,981	*285,506,000*	10,981	*203,148,500*	614,464,500
Mtwara	24,000	-	-	21,019	*210,190,000*	2,981	*35,772,000*	24,000	*624,000,000*	24,000	*480,000,000*	1,349,962,000
Lindi	21,197	10,299	*205,980,000*	9,000	*90,000,000*	1,898	*22,776,000*	21,197	*551,122,000*	21,197	*423,940,000*	1,293,818,000
Arusha	101,863	101,863	*2,037,260,000*	-	-	-	-	101,863	*2,648,438,000*	101,863	*1,884,465,500*	6,570,163,500
Manyara	84,000	84,000	*1,680,000,000*	-	-	-	-	84,000	*2,184,000,000*	84,000	*1,554,000,000*	5,418,000,000
Kilimanjaro	142,289	138,641	*2,772,820,000*	-	-	3,648	*43,776,000*	142,289	*3,699,514,000*	142,289	*2,632,346,500*	9,148,456,500
Tanga	47,292	11,514	*230,280,000*	33,596	*335,960,000*	2,182	*26,184,000*	47,292	*1,229,592,000*	47,292	*874,902,000*	2,696,918,000
TOTAL	**2,011,000**	**1,575,082**	**31,501,640,000**	**386,349**	**3,863,490,000**	**49,570**	**594,840,000**	**2,011,001**	**52,286,026,000**	**2,009,293**	**40,424,248,000**	128,670,244,000

Notes: Unit cost for Hybrid Maize is TZS 20,000; for Open Pollinated Maize Variety is TZS 10,000; for paddy is TZS 12,000; for fertilizer phosphate is TZS 26,000; and for fertilizer UREA is TZS 18,500

Appendix 3: Number of vouchers distributed to regions in 2011/12 crop season

Region	No of HHs	*Hybrid Maize*		*Open Pollinated Maize Variety*		*Paddy*		*Fertilizer - Phosphate*		*Fertilizer Nitrogen*		*Grand Total Value*
		No of Voucher	*Total Cost/ Value*	*No of Voucher*	*Total Cost/ Value*	*No of Voucher*	*Total Cost/ Value*	*No of Voucher*	*Total Cost/ Value*	*No of Voucher*	*Total Cost/ Value*	
Iringa	231,000	*227,000*	*4,540,000,000*	-	-	*4,000*	*48,000,000*	*231,000*	*6,468,000,000*	*231,000*	*4,273,500,000*	*15,329,500,000*
Mbeya	300,000	*269,711*	*5,394,220,000*	*380*	*3,800,000*	*5,530*	*110,600,000*	*275,621*	*8,400,000,000*	*300,000*	*6,000,000,000*	*19,908,620,000*
Ruvuma	192,469	*190,069*	*3,801,380,000*	-	-	*2,400*	*48,000,000*	*192,469*	*5,389,132,000*	*192,469*	*3,849,380,000*	*13,087,892,000*
Rukwa	146,000	*144,875*	*2,897,500,000*	-	-	*1,125*	*13,500,000*	*146,000*	*4,380,000,000*	*146,000*	*3,212,000,000*	*10,503,000,000*
Morogoro	177,541	*82,448*	*1,648,960,000*	*55,093*	*550,930,000*	*40,000*	*800,000,000*	*177,541*	*4,971,148,000*	*177,541*	*3,284,508,500*	*11,255,546,500*
Kigoma	160,000	*150,000*	*3,000,000,000*	*10,000*	*100,000,000*	-	-	*160,000*	*4,800,000,000*	*160,000*	*3,520,000,000*	*11,420,000,000*
Dodoma	24,776	*10,000*	*200,000,000*	*12,776*	*127,760,000*	*2,000*	*24,000,000*	*24,776*	*693,728,000*	*24,776*	*458,356,000*	*1,503,844,000*
Lindi	21,197	*10,000*	*200,000,000*	*10,299*	*102,990,000*	*898*	*10,776,000*	*21,197*	*593,516,000*	*21,197*	*392,144,500*	*1,299,426,500*
Tanga	47,292	*11,514*	*230,280,000*	*33,596*	*335,960,000*	*2,182*	*26,184,000*	*47,292*	*1,324,176,000*	*47,292*	*874,902,000*	*2,791,502,000*
Tabora	60,138	*7,500*	*150,000,000*	*49,638*	*496,380,000*	*3,000*	*60,000,000*	*60,138*	*1,804,140,000*	*60,138*	*1,323,036,000*	*3,833,556,000*
Shinyanga	53,192	-	-	*53,192*	*531,920,000*	-	-	*53,192*	*1,595,760,000*	*53,192*	*1,170,224,000*	*3,297,904,000*
Mwanza	54,201	*26,596*	*531,920,000*	*27,000*	*270,000,000*	*605*	*7,260,000*	*54,201*	*1,626,030,000*	*54,201*	*1,192,422,000*	*3,627,632,000*
Kagera	53,192	-	-	*53,192*	*531,920,000*	-	-	*53,192*	*1,595,760,000*	*53,192*	*1,170,224,000*	*3,297,904,000*
Mara	63,596	50,498	*1,009,960,000*	*12,398*	*123,980,000*	*700*	*8,400,000*	*63,596*	*1,907,880,000*	*63,596*	*1,399,112,000*	*4,449,332,000*
Kilimanjaro	74,289	*70,641*	*1,412,820,000*	-	-	*3,648*	*43,776,000*	*74,289*	*2,080,092,000*	*74,289*	*1,485,780,000*	*5,022,468,000*
TOTAL	**1,658,883**	**1,250,852**	**25,017,040,000**	**317,564**	**3,175,640,000**	**66,088**	**1,200,496,000**	**1,634,504**	**47,629,362,000**	**1,658,883**	**33,605,589,000**	**110,628,127,000**

Notes: Unit cost for Hybrid Maize is TZS 20,000; for Open Pollinated Maize Variety is TZS 10,000; for paddy is TZS 20,000; for fertilizer phosphate is TZS 28,000; and for fertilizer UREA is TZS 20,000

Appendix 4: Number of vouchers distributed to regions in 2012/13 crop season

Region	No of HHs	Hybrid Maize			Open Pollinated Maize Variety			Paddy		
		No of Vouchers	Value of Vouchers	Total Cost/Value	No of Vouchers	Value of Vouchers	Total Cost/Value	No of Vouchers	Value of Vouchers	Total Cost/Value
Iringa	61,854	33,525	20,000.00	670,500,000.00	20,597	10,000.00	205,970,000.00	7,732	12,000.00	92,784,000.00
Njombe	37,400	37,400	20,000.00	748,000,000.00	-	10,000.00	-	-	12,000.00	-
Njombe	24,811	17,823	20,000.00	356,460,000.00	4,862	10,000.00	48,620,000.00	2,126	12,000.00	25,512,000.00
Mbeya	61,165	33,680	20,000.00	673,600,000.00	19,839	10,000.00	198,390,000.00	7,646	12,000.00	91,752,000.00
Ruvuma	48,775	26,436	20,000.00	528,720,000.00	16,242	10,000.00	162,420,000.00	6,097	12,000.00	73,164,000.00
Rukwa	41,000	35,875	20,000.00	717,500,000.00	-	10,000.00	-	5,125	12,000.00	61,500,000.00
Katavi	41,000	22,222	20,000.00	444,440,000.00	13,653	10,000.00	136,530,000.00	5,125	12,000.00	61,500,000.00
Morogoro	88,911	30,658	20,000.00	613,160,000.00	48,889	10,000.00	488,890,000.00	9,364	12,000.00	112,368,000.00
Kigoma	46,944	25,444	20,000.00	508,880,000.00	15,632	10,000.00	156,320,000.00	5,868	12,000.00	70,416,000.00
Shinyanga	6,000	3,252	20,000.00	65,040,000.00	1,998	10,000.00	19,980,000.00	750	12,000.00	9,000,000.00
Mwanza	8,000	4,336	20,000.00	86,720,000.00	2,664	10,000.00	26,640,000.00	1,000	12,000.00	12,000,000.00
Geita	22,000	11,923	20,000.00	238,460,000.00	7,327	10,000.00	73,270,000.00	2,750	12,000.00	33,000,000.00
Kagera	25,000	13,551	20,000.00	271,020,000.00	8,324	10,000.00	83,240,000.00	3,125	12,000.00	37,500,000.00
Mara	35,000	18,970	20,000.00	379,400,000.00	11,655	10,000.00	116,550,000.00	4,375	12,000.00	52,500,000.00
Dodoma	35,641	11,960	20,000.00	239,200,000.00	19,226	10,000.00	192,260,000.00	4,455	12,000.00	53,460,000.00
Singida	2,000	-	20,000.00	-	-	10,000.00	-	2,000	12,000.00	24,000,000.00
Tabora	55,282	-	20,000.00	-	48,372	10,000.00	483,720,000.00	6,910	12,000.00	82,920,000.00
Pwani	14,981	-	20,000.00	-	7,983	10,000.00	79,830,000.00	6,998	12,000.00	83,976,000.00
Mtwara	36,500	31,937	20,000.00	638,740,000.00	-	10,000.00	-	4,563	12,000.00	54,756,000.00
Lindi	37,000	32,375	20,000.00	647,500,000.00	-	10,000.00	-	4,625	12,000.00	55,500,000.00
Arusha	55,000	30,810	20,000.00	616,200,000.00	18,315	10,000.00	183,150,000.00	5,875	12,000.00	70,500,000.00
Manyara	60,000	43,200	20,000.00	864,000,000.00	10,800	10,000.00	108,000,000.00	6,000	12,000.00	72,000,000.00
Kilimanjaro	60,519	43,563	20,000.00	871,260,000.00	10,891	10,000.00	108,910,000.00	6,065	12,000.00	72,780,000.00
Tanga	36,000	6,815	20,000.00	136,300,000.00	24,810	10,000.00	248,100,000.00	4,375	12,000.00	52,500,000.00
Jumla/TOTAL	940,783	515,755		10,315,100,000.00	312,079		3,120,790,000.00	112,949		1,355,388,000.00

Fertilizer - Phosphate			Fertilizer - Nitrogen			Grand Total
No of Voucher	Value of Vouchers	Total Cost/Value	No of Voucher	Value of Voucher	Total Cost/Value	
61,854	40,000.00	2,474,160,000.00	61,854	30,000.00	1,855,620,000.00	5,299,034,000.00
37,400	40,000.00	1,496,000,000.00	37,400	30,000.00	1,122,000,000.00	3,366,000,000.00
24,811	50,000.00	1,240,550,000.00	24,811	40,000.00	992,440,000.00	2,663,582,000.00
61,165	50,000.00	3,058,250,000.00	61,165	40,000.00	2,446,600,000.00	6,468,592,000.00
48,775	50,000.00	2,438,750,000.00	48,775	40,000.00	1,951,000,000.00	5,154,054,000.00
41,000	50,000.00	2,050,000,000.00	41,000	40,000.00	1,640,000,000.00	4,469,000,000.00
41,000	50,000.00	2,050,000,000.00	41,000	40,000.00	1,640,000,000.00	4,332,470,000.00
88,911	40,000.00	3,556,440,000.00	88,911	30,000.00	2,667,330,000.00	7,438,188,000.00
46,944	50,000.00	2,347,200,000.00	46,944	40,000.00	1,877,760,000.00	4,960,576,000.00
6,000	50,000.00	300,000,000.00	6,000	40,000.00	240,000,000.00	634,020,000.00
8,000	50,000.00	400,000,000.00	8,000	40,000.00	320,000,000.00	845,360,000.00
22,000	50,000.00	1,100,000,000.00	22,000	40,000.00	880,000,000.00	2,324,730,000.00
25,000	50,000.00	1,250,000,000.00	25,000	40,000.00	1,000,000,000.00	2,641,760,000.00
35,000	50,000.00	1,750,000,000.00	35,000	40,000.00	1,400,000,000.00	3,698,450,000.00
35,641	40,000.00	1,425,640,000.00	35,641	30,000.00	1,069,230,000.00	2,979,790,000.00
2,000	40,000.00	80,000,000.00	2,000	30,000.00	60,000,000.00	164,000,000.00
55,282	40,000.00	2,211,280,000.00	55,282	30,000.00	1,658,460,000.00	4,436,380,000.00
14,981	40,000.00	599,240,000.00	14,981	30,000.00	449,430,000.00	1,212,476,000.00
36,500	40,000.00	1,460,000,000.00	36,500	30,000.00	1,095,000,000.00	3,248,496,000.00
37,000	40,000.00	1,480,000,000.00	37,000	30,000.00	1,110,000,000.00	3,293,000,000.00
55,000	40,000.00	2,200,000,000.00	55,000	30,000.00	1,650,000,000.00	4,719,850,000.00
60,000	40,000.00	2,400,000,000.00	60,000	30,000.00	1,800,000,000.00	5,244,000,000.00
60,519	40,000.00	2,420,760,000.00	60,519	30,000.00	1,815,570,000.00	5,289,280,000.00
36,000	40,000.00	1,440,000,000.00	36,000	30,000.00	1,080,000,000.00	2,956,900,000.00
940,783		41,228,270,000.00	940,783		31,820,440,000.00	87,839,988,000.00

Appendix 5: Technical Details of the Impact Evaluation

This appendix complements Chapter 3 and describes some of the more technical aspects of the evaluation. It also reports on key outcomes constructed from the household survey. The results reported are calculated at the plot level with standard errors clustered at the household level.

1. Sample Size and Power Calculations

Power calculations were conducted only for the household survey, which would be used to determine program impacts. Based on the calculations using both the 2003 Agricultural Census and 2008 National Panel Survey data, the necessary sample size for the household study was estimated to be approximately 200 villages with 10 observations (farming households) per village, or 2,000 households in total. This sample size allows the detection of a change in yields of at least 34 percent between treatment and control groups. In order to maximize power in comparisons between treatment and controls, approximately 120 villages were sampled in the 3 regions where targeting interventions were conducted, and 80 villages were sampled in the other regions.

Additional power calculations were conducted following the baseline survey since the targeting interventions had not been successfully implemented in two of the three northern highland regions (see *Changes to the Sample,*in Section 3.1.7. These revised calculations revealed that if the sample size was doubled in Arusha (from 460 households to 920 households), there would be a power to detect a 30 percent increase in yields, assuming a conservative intraclass correlation of 0.1 and 46 clusters. Given that the yield changes were larger than 200 percent in the baseline listing survey, Arusha's sample size was indeed expanded.

2. Other outcomes

Table 1 complements the results based on the listing survey in Table 3.3, by using data from the household survey. Because the household survey contains plot and crop information on input usage, we are able to run regressions using only maize plots in 2010/11 (columns 2 – 10) or rice plots (columns 11-13). Interestingly, we find that while the areas planted of maize by non-beneficiaries are 2.82 acres, participation in NAIVS leads to a lower area planted by about 1 acre. This reduction in area planted is statistically significant at the 5 percent level. This effect is mostly concentrated in the northern regions where the reduction in area planted under maize is about 1.5 acres. The program leads to no change in the area for paddy cultivation. The program also leads to a reduction in the probability of total crop failure, defined as the event of planting some area but being unable to harvest any area. The 2010/11 season experienced some drought, so perhaps the improved seeds included varieties that matured earlier and thus could work with less rainfall, while a later maturing traditional variety could not. NAIVS also leads to an increase in the probability that a plot receives improved seeds and fertilizer.

About half of the plots of non-beneficiaries use improved seeds, while the beneficiaries are 20 percent more likely to use improved seeds. The likelihoods of fertilizer usage in the plots are 25 percent and 56 percent for non-beneficiaries and beneficiaries, respectively. Of course, some of the beneficiary plots did not received improved seeds and fertilizer, which was due to the fact that some beneficiaries had about 2 acres and the program only covered inputs for one acre. Among those beneficiaries that only had one plot, these increases are even larger, 90 percent for seeds and 70 percent for fertilizer. The increase of fertilizer usage is also statistically significant for beneficiaries, about 47 kg more compared with non-beneficiaries. The impacts for paddy are smaller and less significant, as also reported in Table A.1. These increases in improved inputs in maize translate into significant increases in yields, from 5.81 in a log scale to 6.16.[11]

Panel B reports gains in food security and yields at the household level between beneficiaries and non-beneficiaries. Household expenditure on food is higher among beneficiaries than non-beneficiaries but the difference is not significant. Food security is measured with a set of indicators such as "Number of meals per day in the last 30 days", etc. We report the first component of a principal component analysis using all these indicators and find that food security is significantly higher among beneficiaries than non-beneficiaries for both seasons. Finally, yields measured at the household level, aggregating the production from all maize plots also report a 50 percent increase in yield for beneficiaries. The fact that this number is even higher in North suggests that beneficiaries may also be growing maize in smaller and less productive plots, lowering the plot-level coefficient for beneficiaries, relative to non-beneficiaries.

[11] Yields are computed as log(1+yield) and thus the regression includes observations with crop failures.

Impact of Voucher Scheme

Crop:			Maize								Paddy		
Region:			All		North			South			All		
	Method	Obs	Mean NB	B	Obs	Mean NB	β	Obs	Mean NB	β	Obs	Mean NB	β
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Panel A: Plot-Level Outcomes													
Area Planted (Acres)	OLS	2221	2.82	-1.051**	1236	3.1	-1.484*	985	2.45	-0.500	300	3.0	-0.021
				(0.511)			(0.831)			(0.461)			(1.223)
Crop Failure (1=Yes)	OLS	2221	0.06	-0.019*	1236	0.11	-0.030	985	0.01	-0.003	300	0.01	-0.002
				(0.011)			(0.018)			(0.006)			(0.013)
Farmer uses improved seeds (1=Yes)	OLS	2221	0.52	0.200***	1236	0.65	0.113***	985	0.35	0.315***	300	0.30	0.115*
				(0.023)			(0.029)			(0.032)			(0.059)
Farmer uses fertilizer (1=Yes)	OLS	2221	0.25	0.312***	1236	0.30	0.133***	985	0.18	0.535***	300	0.25	0.129**
				(0.021)			(0.030)			(0.027)			(0.057)
Kg of fertilizer	Tobit	2221	13.10	47.141***	1236	16.80	26.077***	985	8.42	66.869***	300	16.40	22.583*
				(4.381)			(6.391)			(6.245)			-13.628
Log Yield: Kg/Area Planted	OLS	2100	5.81	0.351***	1124	5.78	0.323***	976	5.9	0.381***	296	6.30	0.208*
				(0.052)			(0.080)			(0.063)			(0.119)
Panel B: Household-Level Outcomes													
HH expenditure on food in past 30 days	OLS	2037	62168	5052.532	1080	76309	7057.705	957	46255	2694.304			
				(4214.40)			(7167.60)			(3575.15)			
Food Security (PCA of 7 items)	OLS	2040	0.562	-0.325***	1080	0.402	-0.236**	960	0.741	-0.423***			
				(0.10)			(0.11)			(0.16)			
Log Yield: Kg/Area Planted	Tobit	1822	5.84	0.511***	991	5.81	0.595***	832	5.87	0.416***	150	6.35	0.269
				(0.08)			(0.13)			(0.08)			(0.21)

Note: * p<0.10 ** p<0.05 *** p<0.01. An observation in Panel A (Panel B) is a plot (household). In Panel A, standard errors reported in brakets below the coefficients in columns 4, 7, 10 and 13 are clustered at the household level. The items used to construct the Food security index are as follows: "HH worried about the amount of food at least one time in the last 30 days", "HH forced to eat at unpreferable food at least one time in the last 30 days", "Meals were smaller during lean period", "Meals per day in last 30 days" "Meals per day in a month during lean period", "Days HH member went to bed hungry in last 30 days", "Days HH member went to bed hungry in a month during lean period".

Appendix 6: Consumer and Producer Prices per Kg

	Maize			Rice	Paddy
	Consumer	Producer		Consumer	Producer
Region	Market Price	Farm-gate Price	Market Price	Market Price	Market Price
Arusha	625	400	400	2000	800
Kilimanjaro	600	500	600	1650	600
Morogoro	500	300	600	1500	600
Ruvuma	250	400	360	1800	600
Iringa	300	350	350	2000	
Mbeya	250	290	280	2000	650
Rukwa	300	300	300	2000	840
Kigoma	400	525	467		

Note: Median prices reported in columns. Consumer price data come from the village questionnaire. Producer price data come from household survey.

Appendix 7: Voucher distribution to the regions: Administrative costs in TZS

Sn	Region	2009/10	2010/11	2011/12
1	Iringa	146,082,539	222,823,148.93	91,104,270.00
2	Kilimanjaro	60,558,407	53,478,474.00	28,939,457.00
3	Lindi	1,866,154	12,987,121.00	15,788,728.00
4	Shinyanga	22,273,496	38,838,324.00	18,281,973.00
5	Geita	10,144,612	33,087,734.00	24,750,512.00
6	Dodoma	4,349,287	20,347,090.00	6,923,596.00
7	Mwanza	12,065,146	6,000,000.00	6,000,000.00
8	Ruvuma	101,890,505	138,577,324.00	91,239,159.00
9	Manyara	25,359,531	46,738,954.00	3,431,573.00
10	Coast	4,866,154	16,000,000.00	
11	Tabora	25,139,832	30,116,886.00	29,768,223.00
12	Mara	24,686,447	25,653,871.00	20,281,973.00
13	Singida	7,857,777	16,347,090.00	13,264,541.00
14	Mbeya	144,215,747	155,072,808.00	153,539,325.00
15	Tanga	9,073,162	29,890,477.00	24,176,777.00
16	Morogoro	78,489,947	99,865,490.40	94,988,036.00
17	Rukwa	67,990,531	100,021,634.62	30,919,484.00
18	Mtwara	1,581,367	30,199,223.00	4,387,079.00
19	Arusha	55,241,513	15,630,159.00	19,404,225.00
20	Kigoma	43,794,350	47,126,194.00	61,261,233.00
21	Kagera	22,273,496	-	30,563,946
22	Tanga	-	-	5,324,529
23	**Total**	**869,800,000**	1,138,802,003	**774,338,639**

Appendix 8: Terms of reference of the district agriculture and livestock development officer (DALDO)

The District Agricultural and Livestock Development Officers are responsible for all agricultural and livestock related activities; and are key players in making sure that set agricultural development activities are achieved. The TOR for the DALDO in relation to the AFSP (and therefore NAIVS) is as follows:

(a) Knows the number of farm families in his district and those eligible for inputs subsidy.
(b) Compiles agricultural inputs potential demands (such as chemicals, fertilizer and seeds) for the region.
(c) Ensures that vouchers allocated to his/her district reaches the farmers.
(d) Ensures that recruitment of agro-dealers is properly done.
(e) Ensures that adequate agro-dealers are available and are well distributed.
(f) Ensures that adequate inputs are available in his/her district and that the agro-dealers have adequate inputs in the village shops.
(g) Monitors that the inputs being sold by agro-dealers are of good quality by effectively utilizing the services of the fertilizer and seed inspectors.
(h) Monitors the day to day activities in relation to implementation of the AFSP.
(i) Makes sure that all district committee members effectively participate in the implementation of the AFSP.
(j) Receives inputs vouchers and distributes them to the villages.
(k) Monitors the implementation of the AFSP by the villages and sends monthly reports on the general performance of the AFSP to the region.
(l) Evaluates the impact of the NAIVS in increasing production and productivity at farmer level.
(m) Keeps track of the inputs prices and gives monthly feedbacks to the region.
(n) Provides funds to VAEO to carry out FFS

Appendix 9: Terms of reference of the Village Agricultural Extension Officer (VAEO)

The VAEO is responsible for all agricultural activities in the village, and thus is entrusted with the following in relation to the AFSP and therefore NAIVS:

(a) Have a very close working relationship with the VVC
(b) Ensures that the selection criterion set for eligible farmers have been followed.
(c) Keeps a register of the selected farmers and sends the list to the ward, division and district.
(d) Ensures that agro-dealers are available and have opened shops in his/her village(s).
(e) Keeps a close check on the inputs stock position and sends an alarm to the DALDOs office as appropriate.
(f) Provides technical backstopping to farmers using inputs.
(g) Makes sure that farmers use inputs as per recommendations
(h) Provides weekly progress reports to the DALDOs office on implementation of AFSP.
(i) Conducts FFS to facilitate farmers training.

Appendix 10: Distribution of Vouchers by Region: 2010/11

Region	No of HHs	Total No of Voucher	Grand Total Value	Unit Value	Average Value per HH
Iringa	**336,635**	**1,009,905**	**21,680,957,500**	**21,468**	**64,405**
Mbeya	**317,012**	**951,036**	**20,408,924,000**	**21,460**	**64,379**
Ruvuma	**203,412**	**610,236**	**13,804,816,000**	**22,622**	**67,866**
Rukwa	**157,647**	**471,941**	**10,697,996,000**	**22,668**	**67,860**
Morogoro	**140,706**	**421,412**	**8,582,476,000**	**20,366**	**60,996**
Kigoma	**92,941**	**278,822**	**6,219,968,000**	**22,308**	**66,924**
Dodoma	24,776	74,328	1,489,456,000	20,039	60,117
Singida	25,731	77,193	1,603,860,000	20,777	62,332
Tabora	56,942	170,825	3,308,614,000	19,368	58,105
Shinyanga	53,192	159,576	3,085,360,000	19,333	58,000
Mwanza	53,596	160,788	3,374,528,000	20,987	62,962
Kagera	53,192	159,576	3,085,136,000	19,333	58,000
Mara	63,596	190,791	4,236,594,000	22,205	66,617
Pwani	10,981	32,943	614,464,500	18,652	55,957
Mtwara	24,000	72,000	1,349,962,000	18,749	56,248
Lindi	21,197	63,591	1,293,818,000	20,346	61,038
Arusha	**101,863**	**305,589**	**6,570,163,500**	**21,500**	**64,500**
Manyara	84,000	252,000	5,418,000,000	21,500	64,500
Kilimanjaro	**142,289**	**426,867**	**9,148,456,500**	**21,432**	**64,295**
Tanga	47,292	141,876	2,696,918,000	19,009	57,027
TOTAL	**2,011,000**	**6,031,295**	**128,670,244,000**	**21,334**	**63,983**

Source: Computed using data from MAFC – Agricultural Input Section

Note: Regions in bold denotes those covered by this Study's survey data collection. Two additional dry regions (Dodoma and Tabora in *italics*) were included in the second round follow up survey.