SUPPLY CHAIN ANALYSIS FOR AGRICULTURAL INPUTS IN TANZANIA:
A CASE OF SUBSIDIZED FERTILIZER IN THE SOUTHERN HIGHLANDS

BY

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ABSTRACT

The major objective of this research was to analyze supply chain of agricultural inputs in Tanzania using the subsidized fertilizer in the Southern highlands as a case study. It specifically sought to describe the subsidy fertilizer supply chain in the Southern highland zone with a view of identifying key stakeholders in the system and their linkages. The study further, aimed at examining the fertilizer consumption levels and the impact of fertilizer subsidy programme on maize production in the study area. Finally, the study presented policy options that would help improve the fertilizer subsidy programme. The study at large based on secondary data and information, obtained from various sources including; Sokoine National Agricultural Library, documents and consultations with officials from input unit in the Ministry of Agriculture, Food Security and Co-operatives, input transporting companies particularly Tanzania Fertilizer Company, input related publications from various sources including internet. Secondary data on fertilizer consumption and maize production were analyzed using annual growth models. This was aimed to examine the impact of the subsidy fertilizer on consumption and production levels. Results from the analysis indicated that there has been a significant increase in the fertilizer consumption and maize production level since the inception of the subsidy programme. From these results it can be concluded that, fertilizer use is a vital input for sustainable agricultural production and so its use has to be highly encouraged in order to maintain higher level

of output. In light of the observation, it was recommended that, further fertilizer distribution be effected through Grass Root Economic Groups such as Saving and Credit Societies. Fertilizer distribution through such group could enhance better service delivery to target farmers.

DECLARATION

I, George David Nguruse, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation has not been submitted for a Degree award to any other University and that it is my own original work.

_____   _____
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The above declaration is confirmed

_____   _____
Dr. D. Gabagambi   Date
(Supervisor)

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DEDICATION

I dedicate this dissertation to my beloved mother Vestina Cosmas Nguruse who laid a foundation of my education.

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LIST OF ABBREVIATIONS

ARF	Arab Reform Forum
ASDS	Agricultural Sector Development Strategy
CAN	Calcium Ammonium Nitrate
CRDB	Co-operative Rural Development Bank
DAP	Di-ammonium Phosphate
GEGs	Grassroots Economic Groups
GDP	Gross Domestic Product
HRDS	Human Resources Development Survey
IFA	International Fertilizer Industry Association
KCB	Kilimanjaro Co-operative Bank
LGAs	Local Government Authorities
Mt	Metric Tonnes
MKUKUTA	Mpango wa Kukuza Uchumi na Kupunguza Umaskini
NPK	Nitrogen Phosphate Potassium
NSGRP	National Strategy for Growth and Poverty Reduction
PRSP	Poverty Reduction Strategy Paper
SA	Sulphate of Ammonia
SSP	Single Super Phosphate
SACCOs	Saving and Credit Co-operative Society
STACO	Shivlal Tank & Co Ltd
SNAL	Sokoine National Agricultural Library
TFC	Tanzania Fertilizer Company
TSP	Triple Super Phosphate

UAE	United Arab Emirates
USA	United States of America
URT	United Republic of Tanzania

CHAPTER 1

INTRODUCTION

1.1Background

Agriculture is the leading sector of the economy of Tanzania and accounts for about 45 percent of the GDP and 60 percent of the export earnings (URT, 2005). Over 80 percent of the poor are living in rural areas depending on agriculture (Mlambiti, 1994). Some other occupations are linked to agriculture such as transportation, processing and trading of agricultural products and materials. The agricultural sector has maintained a steady growth rate of around 3 percent per annum, which is greater than the population growth rate. It is important to note that this rate is unsatisfactory because it has failed to improve the livelihood of the poor people most of whom depend on agriculture as their major occupation (URT, 2001).

As an integral component of the on going macro-economic adjustment and structural reforms the government established an Agricultural Sector Development Strategy (ASDS) effectively in 1998 (URT, 2001). The strategy provides a framework for action by public and private sector and aims at creating enabling and conducive environment for improving profitability of the sector. The strategy is in line with national strategy for growth and reduction of poverty, which envisions halving poverty by 2010. It is also committed to Millennium development goal as internationally agreed, among other targets to reduce poverty and

hunger by 2015 (URT, 2005). The main focus will be on modernizing agriculture for increased profitability and productivity. In fact, any attempt to improve agricultural sector, will ultimately increase farm productivity and income at family and national level.

The constraints to rural growth are largely related to those in agricultural sector, broadly defined to include low productivity of land, access to financial services and production inputs (URT, 2005). Over the years various attempts have been made by government to revive the sector including input subsidization for agricultural production. The government used to provide significant subsidies on inputs to farmers. In 1976 the subsidy rate on fertilizer was 50 percent. By 1990/91, the rate rose to 78 percent. As part of the reforms, input subsidies were phased out in 1994/95 cropping season (Mdoe et al, 1997) and marketing functions were privatized. The prices on fertilizers increased astronomically after the removal of subsidies on agricultural inputs and consumption was reduced significantly. The poor agricultural productivity, particularly in food crops, can partly be attributed to this. In the wake of increasing food shortages the government resumed the subsidy program effectively in 2003/04 financial year (TFS, 2003). Fertilizer subsidies program initially targeted Southern highland regions, before being spread countrywide.

1.2 Problem statement and justification

The Tanzania Development Vision envisages that by the year 2025 Tanzania should have created a strong, diversified, resilient and competitive economy (URT, 2003). The establishment and development of the agricultural subsidy programmes is among initiatives towards this end. Under the programme the deliveries consists of mainly Urea and Calcium Ammonium Nitrate (CAN), which are needed for maize growth after germination and emergence.

Despite the subsidization of input supply services, there are evidence of inconsistency increase in input price especially for fertilizer, the major agricultural input. As a result of high demand private operators have continued to increase input prices making it unlikely for the programme to increased output. According to Tanzania food security report (2003) the retail subsidized price of Urea and CAN in 2003 ranged between Tshs 14 000 and 15 000 per 50 kg bag. To date retail fertilizer subsidized price of Urea is Tshs 17 000 in urban areas while in rural areas the price ranges between 21 000 and Tshs 25 000 per 50 kg bag, an increase of about 67 percent. Taking into consideration farmers' social economic situation especially in rural areas, these rates are so high and it is unlikely to be affordable by most of them. The increase in fertilizer prices hinders wide utilization and its availability to smallholder farmers (Mdoe *et al,* 1998). Tanzania's fertilizer consumption rate is only 17.9 kg per hectare on average, which is 15 times lower than

China's average fertilizer consumption of 263 kg per hectare (Qiaolun and Rozelle, 1993 and IFA, 2002).

This study seeks to analyze supply chain of agricultural inputs in Tanzania using the subsidized fertilizer in the Southern highlands as a case study. Focus in most studies has been on output side of production while ignoring the input side of it. Findings from this study are expected to provide assistance to planners, policy makers, extension agents and input service providers on some important aspect pertaining to fertilizer distribution, transportation and marketing.

1.3 General objective

The major objective is to analyze supply chain of agricultural inputs in Tanzania using subsidy fertilizer in the Southern highlands as a case study..

1.3.1 Specific objectives

(i)   To describe the fertilizer supply chain in the Southern highland zone with a view of identifying key stakeholders in the system and their linkages.

(ii) To examine the fertilizer consumption levels before and after the inception of subsidy programme.

(iii) To examine the impact of fertilizer subsidy programme on maize production in the study area.

(iv) To identify programme's weaknesses, opportunities and threats in view of providing recommendations for improving the fertilizer supply chain in the study area.

1.3.2 Research hypotheses

The research is guided by the following key hypotheses: -

(i) There is a significant difference in fertilizer consumption before and after the inception of subsidy programme.

(ii) There is significant difference in maize production before and after the inception of subsidy programme.

CHAPTER 2

LITERATURE REVIEW

2.1 Definition of terms

2.1.1 Supply chain

Supply chain, also known as the value chain is defined by Deardoff, (2001) as: the sequence of steps, often done in different firms and/or locations in a view of producing final goods from primary factors. He further describes the supply chain to encompass processes of raw materials, continuing with production of a series of intermediate inputs and ending with final assembly and distribution.

Supply chain can also be defined as the distribution channel of a product, from its sourcing, to its delivery to the end consumer. It includes the growing of crops and acquisition of raw materials, manufacturing products, distributing finished goods to retailers and sale to the final consumer. The typical supply chain comprises of a chain of companies, each contributing to the final product such as supplying component parts, or doing something further to the product in view of adding value.

According to (http://www.Learnthat.com) supply chain consists of a network of retailers, distributors, transporters, storage facilities and suppliers that participate in sale, delivery and production of a particular

product. On its way from sourcing point, the product acquires a value through transportation, packaging, processing and storage activities.

2.1.2 Subsidization

Subsidy can be defined as financial assistance granted by the government to a person or group in support of an enterprise regarded in the public interest. It is basically the government attempt to facilitate increased public access to some social service. A subsidy can also be described as any measure or attempt that keep consumer prices below that would have been guaranteed in competitive markets or keeps prices for producers above the market level. Generally, subsidy is meant to reduce cost for consumers and producers by giving them some kind of direct or indirect support.

2.1.3 Economic reform

Kostadinova, (2004) define economic reform as process involving a fundamental shift from the socialist centrally planned economy; which based on dominance of state ownership towards a free market in which private sector has an active role in the development processes. In their part, ARF, (2004) describes economic reforms as encompassing the legislations, policies and general measures that would free national economy and turn it efficiently in accordance with market mechanisms. Basically, economic reform is characterized by three basic components; macro economic stability, dismantling of government controls and creation of new institutions and legal frameworks.

2.1.4 Market liberalization

Market Liberalization comprise of policies that make economy of the country open to trade and investment with the rest of the world (IMF, 2001). Through market liberalization a country is better placed to achieve economic successes in terms of substantial increase in living standards of its people. In practice, market liberalization policies have been carried out concomitantly with market reform programmes (Markard et al, 2001).

2.2 Theoretical framework

The study seeks to examine input supply chain in the southern highlands. The idea to undertake this study originates from the results accrued from implementation of economic reforms particularly in the agricultural sector. The agricultural sector reforms undertaken since early 1980s, forms the central component of economy wide structural adjustment programs in Tanzania. The prevailing wisdom was that the reforms would allow free entry into markets, increase marketing channels and ultimately increase the number of market players (Figure 1) The market reforms was inspired by the need to turn markets into more competitive arena and thereby increase incentives for participants and total output through cost reduction and general encourage adoption of new farm technologies.

Despite the fact that there has been increased number of marketing channels, free entry and resultant increase in the number of

participants, various literature suggests that the reforms have not delivered what it was expected (Mwakalobo, 1998, Ryeyemamu 2003, Ponte, 2000). Further, empirical records on agricultural marketing and pricing have revealed an irregular escalation of input prices making it unlikely if the reforms would benefit the target groups especially farming communities. Despite the multiplicity of the number and scale of market actors, less attention has been paid to the target beneficiaries. Jayne and Jones, (1996), assert that, there has been increased price volatility by frequently altering their prices as market conditions change and have paid less attention to the social objectives historically pursued in the region through food marketing policy.

Under perfect market model, the existence of increased marketing channels, number of actors and free entry to market actors signifies market competitiveness. From the forgoing discussion, it is clear that the expected quality of competitiveness does not exist. Under such circumstances of inefficiencies, the prevailing market prices do not reflect citizens ability and willingness to pay for such goods and services which ultimately erode their capacity to alleviate poverty. In that case, pricing inefficiency which is basically the central discussion of this study could be said to hamper community efforts to reduce poverty levels. The existence of such cases which are not in compliance with expectations, it was thought worthwhile to examine the existing input supply chain in detail.

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                         │  Market reforms │
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      │              │ │  channels    │ │              │
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              │   Competitive agricultural    │
              │            market             │
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      │   Expectations   │   │  Unknown factors │
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      │ Pricing efficiency│  │Pricing inefficiency│
      └──────────────────┘   └──────────────────┘
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              │      Poverty reduction        │
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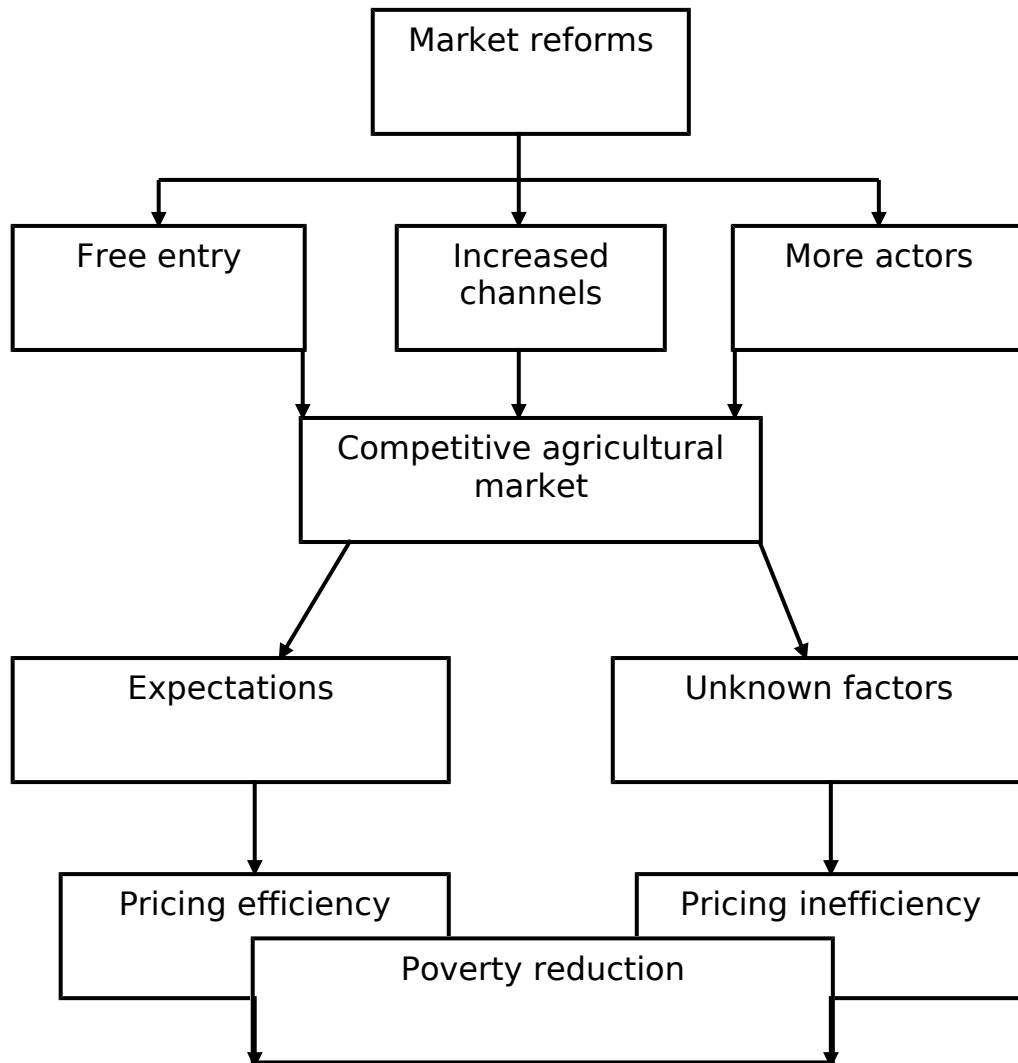
Figure 1. Conceptual framework for agricultural input marketing

2.3   Forms and mechanism of subsidy schemes operation

Subsidies come in many forms, ranging from financial transfer to opportunity cost and can be both direct and indirect (Norman, 1998). A number of countries have acted to reduce the price of fertilizer to the

farmer by either paying a direct subsidy or by giving indirect subsidies. Such intervention come in various forms including establishment of schemes that provide fertilizer credits below market rates and help reduce transaction cost through provision of transport subsidies. It also involves reduced consumer prices, infrastructure and provision of services such as extension and training.

Applications of these measures are closely related to the nature of the target group or sector in the economy. For example a situation may exist where output is growing slowly especially when tradition farming practices are employed. A subsidy program may be instituted to increase output level to meet the aggregate demand. In the case where output levels may be falling possibly due to increased input price, subsidy programme may be employed to prevent further decline in national output. According to Norman, 1998, subsidies are also issued to ease transport bottlenecks, increase farmers access to markets or promote technical progress and thus increasing efficiency.

2.4 Rationale for fertilizer subsidy provision

Fertilizer subsidy serves a variety of ways, including encouraging small and marginalized farmers to use fertilizer and thereby increase total production (Hawassi, 1997). Moreover, subsidy provision can be used to stimulate the aggregate demand, increase consumption rate and

facilitate establishment of manufacturing industries and other agro-based companies.

Elimination of fertilizer subsidy and liberalization of input marketing that took place in 1980s is most frequently mentioned criticisms of the reforms. Both Ponte and IFPRI, (2000) contend that fertilizer prices have generally risen as a result of the subsidy removal and depreciation of real exchange rates.

Further evidence of relationship between fertilizer use and productivity is provided by Couston and Narayan, (1987) who studied the difference in growth in fertilizer use in a number of countries. They found that fertilizer consumption rates were higher in countries with fertilizer subsidy programmes. After waving out fertilizer subsidy, a drastic increase in farm gate price reaching 224 percent occurred between the year 1990/91 and 1994/95 (Ponte, 2000).

2.5 Global discussions on subsidization processes

Agricultural sector is an area in which developing countries, particularly the sub Saharan Africa has a comparative advantage. Various efforts has been geared towards increasing access to marketing opportunities. Such measures include market integration measures and some deliberate efforts designed to increase quotas. While it is clear that, integration into the world economy is a promising means to promote economic growth, development and poverty existing barriers including

subsidies and high tariffs act as setback for developing countries to take advantage of opportunity offered by trade liberalization for development. Many developing countries have higher tariffs on average they have three to four times higher import tariffs, compared to industrialized countries (IMF, 2001). Existing barriers within and outside Africa and Middle East has significantly eroded its capacity to fight against poverty, and without efforts to lower them they risk further marginalization.

At international level, a debate surrounds on the rationale for governments continual subsidy provision. While it beyond doubt, third world countries can not guarantee subsidizing farmers in their countries due to economic setbacks and instead demand for its removal, EU and western countries particularly the US has continued granting subsidy to its citizen. In effect, the subsidies depress world market prices and renders products from the developing world less competitive.

2.6 Review of empirical research

Previous studies in economic reforms particularly on agricultural sector has shed some significant light in the possible underlying caused for declining resource productivity especially after the reforms (Turuka, 1995; Mwakalobo, 1998; Sechambo and Kulindwa, 1995; ESRF, 2003; Ponte, 2002). However, these studies did not address comprehensively the extent to which input supply system promote or derail the

production process. This study contends that supply chain systems are an equally important variable that need to be looked into.

Maliyamkono and Bagachwa, (1990) point out various government attempts to reduce budget deficit and increase revenue generation while cutting down recurrent and development expenditure simultaneously. This was implemented through Structural Adjustment Programmes and later Economic Recovery Programme. Experience obtained from the implementation of SAPs and ERP indicates that these measures were not satisfactory to cure persistent increase in factor prices as envisioned; instead there was an increase in input and factor prices (Kashuliza, 1993 and ESRF, 2003).

Whereas, in assessing the impact of the reforms on smallholder farming system in Rungwe District, Mwakalobo, (1997) revealed that some farmers had to switch from growing some of crops that used lesser amount of farm inputs and abandoned some crops especially tea. Results from the same study noted that farmers decreased area under production because of increased production cost.

Meanwhile, when analyzing agricultural output growth on post independence period, Ngirwa (1995) highlighted a negative shift on resource productivity. He points out that since independence there has been a gradual declining trend on productivity highly, exacerbated by mismanagement within the co-operatives system. This view is further

supported by Banturaki (2000) and Maliyamkono and Bagachwa (1990) who went further into categorizing two major types of mismanagement: misappropriation of resources and wrong choice of development policies and strategies. With the first type involving illegal transfers of resources for example theft, fraud and other malice practices.

ESRF (2003) in the other study titled the reforms in the agricultural sector noted that although reforms aimed at improving farmers livelihood through increasing income levels, in fact farmers have remained victims of the process. Instead, the reforms have resulted to decline in access to major agricultural inputs, declining output prices and declining in access to credit facilities particularly in remote areas of the country. Gender disparity in access to farm input has also been a problem in farmers bid to access to inputs equally; men had more access and control over the agricultural inputs probably due to more access and control to family income than women in most African societies.

When examining the constraints affecting the development of the smallholder cashew industry in southern Tanzania (Poulton, 1996) argues that liberalization of output marketing systems has provided incentives to farmers to expand production, but limited ability of farmers to finance purchases of sulphur is a constraint to further

production increases and to more equitable economic development in the area.

Ellis (1988) argues that it is the decline in real producer price that reduced farmer's incentives to maintain their farms. Other literally works point out that the implementation of villagization programme (*Ujamaa*) in mid-1970s was part to blame for decline in output. It caused the removal of many farmers from their farms in government bid to concentrate them in villages for ease access of social services provision. It however, increased distance from villages to farms and thus made it impractical to maintain the fields.

Market liberalization in the cashew was partial with continued government intervention. Until 1990, Sulphur was supplied freely by the Ministry of Agriculture to small number of farmers for demonstration purposes. The switch to market liberalization in 1991/92 season, and the accompanied removal of government control and subsidies provision necessitated private sector to take over the responsibility. So during the year 1992 and 1993, all Sulphur importation and marketing was handled by private traders. The private sector performance however was less satisfactory, in that the amount delivered was inadequate to meet farmers' rising requirement as more land were retuned to production. Effectively since 1994, the private sector

supplies have been supplemented with that supplied through Input Trust Funds administered by regional governments.

Ponte (2002) associates farmers switch to growing of crops that generate regular year-round income to elimination of various subsidies and rising demand caused by inflationary pressures. Although, most of literature associate reforms with the declining output levels it has to be born mind that no single factor could determine the decision in the production and resource allocation process (Jones and Mutuura, 1989). In fact, a declining production trends could emanate from a combination of factors.

2.8   The role of fertilizer

Fertilizer is something added to the farm to increase productivity or maintain the amount of productivity at constant level. Its effective application may lead to increase in either milk yield, meat or livestock related products, in case fertilizer was used for growing plants for animal feeding. According to (Ngeze, 1979) fertilizer can be categorized into two major groups, organic fertilizer which is obtained from birds, animals and plants and inorganic fertilizer which is also called mineral/chemical fertilizer.

Each of fertilizers has three basic components which are Nitrogen, Potassium and Phosphorus. Fertilizers regardless of its types are used in farms for commercial crop production, staple food production or for

stimulating grass germination for animal feeding. Fertilizer are very useful and facilitates retaining soils moisture content levels especially for loam soils, increases soil aeration and thus enabling roots penetration. It has also been widely used to prevent soil erosion. When soils are thoroughly mixed with manure fertilizer, they form a compact package hard to disintegrate and thus preventing soil erosion.

2.10 Agricultural activities in the Southern Highland Region
2.10.1 Ruvuma region

This is among the region in the Southern highland with majority of its residents depending on small scale farming. In that case, the status of economic activities in Ruvuma region is greatly determined by development of agricultural sector. Generally, it has vast potentials in agriculture, livestock, Tourism, Cooperative, business and industries. Maize is the major food crop cultivated, although owing to the nature of the existing markets maize has turned to be cash crop.

Other crops cultivated include paddy, cassava and beans. The major cash crop cultivated include; coffee, cashew and tobacco. Others are sunflower, groundnuts, pepper, coconut and soybeans. The region has a relatively high comparative advantage in production of these crops, but recently there has been declining level of production mainly attributed to unpredictable pattern of rain and inputs related problems. Cash crop production has also had unimpressive performance (Figure 2). Statistics

on tobacco production has shown declining trend particularly from
2001/02.
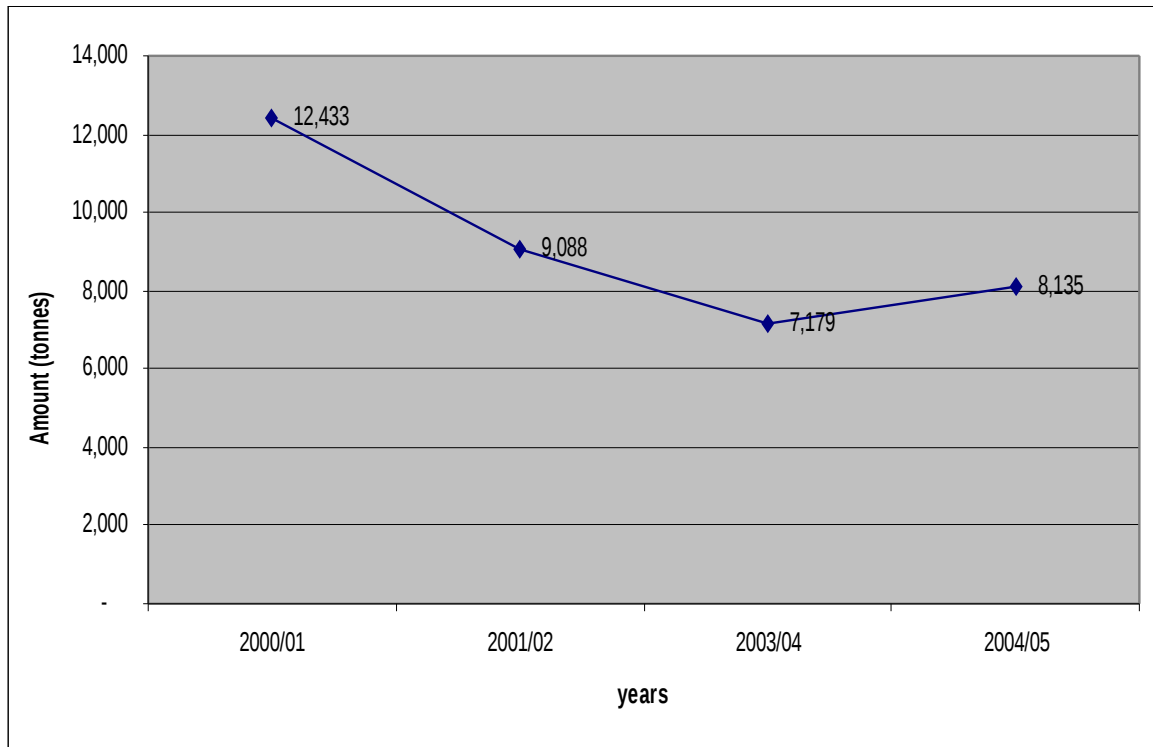
Figure 2.   Tobacco production in Ruvuma (2000/01 - 2004/05)

Source: URT, (1997)

In 2001/02 agricultural season total produced 12 433 tonnes of tobacco
cultivation of 35 759 hectares. Tobacco production level in the year
2001/02 was 9 088 tonnes, which is equivalent to 27 percent level
decline. Production level rose from 7 179 tonnes in 2003/04 to 8 135 in
2004/05, however taking into consideration the area under production
these rates are still minimal. Among the initiative that has been taken
by local government includes setting up Mbinga Community Bank,
which offers loans in collaboration with CRDB.

2.10.2   Mbeya region

Mbeya region is among the southern highland region with abundant resources particular fertile farmland. This is among the food surplus region and is regarded as among the big four as far maize production is concerned. This region shares many of characteristics prevailing in the remaining part of southern highlands regions. Large section of residents derives their income from agricultural related endeavors.

Maize is vitally importance to the region and its production largely affects national maize surplus. Apart from maize, other food crop grown in the region include paddy, bananas, Irish potatoes, beans, sorghum, millet, wheat, ground nuts, cassava, vegetables and sweet potatoes. Generally, there have been notable variations in the total amount of production for major food crops especially between 1990/91 to 2000/01 (Figure 3).
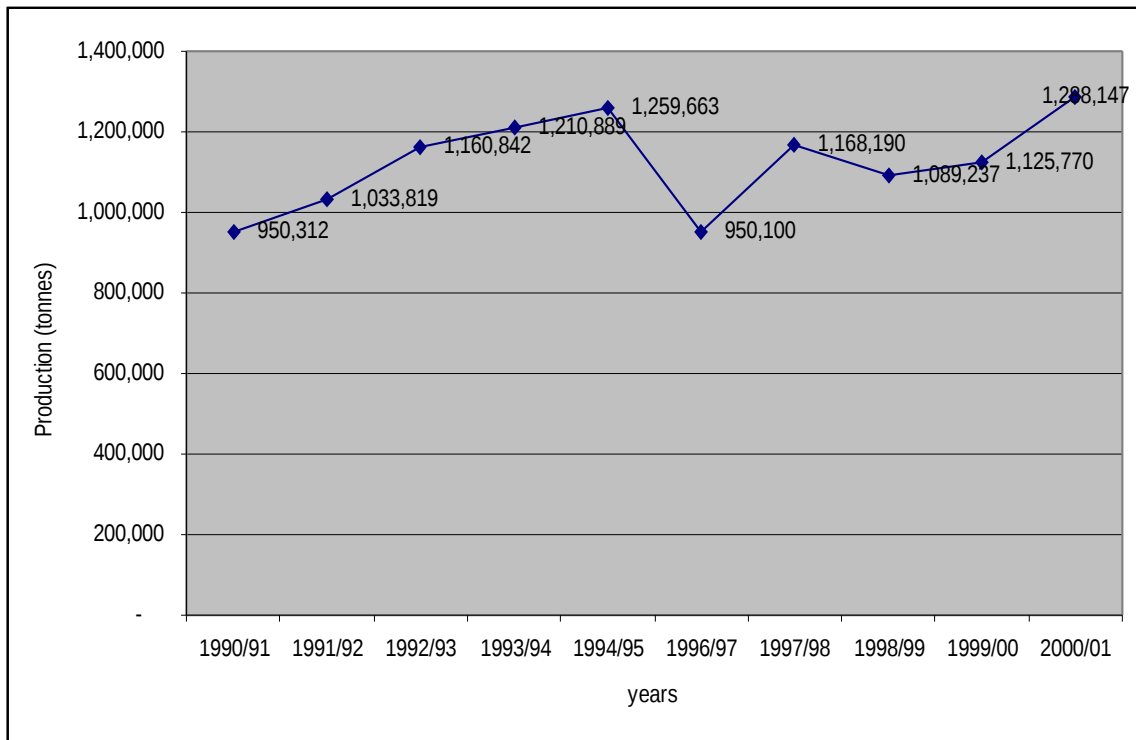
**Figure 3. Production trends of major food crops in Mbeya
region 1990/91-1994/95 (Tonnes)**

Source: URT, (1997)

2.10.3 Rukwa region

Rukwa region is endowed with vast agricultural potential land. Maize is
the leading food and marketed crop. During the agricultural season
1993/94 maize production alone accounted for about 45 percent of all
crops in volume; out of which about 62 percent came from
Sumbawanga district. Apart from maize production Rukwa region also
depends on cultivation of paddy, cassava, beans, and sorghum.
However, apart from maize production other crops such as paddy,
cassava, beans and sorghum accounts for small proportion of the total
produce. This is substantiated by the fact that during the agricultural

season 1989/90 to 1993/94 maize production alone accounted for about 88 percent of the marketed output (Figure 4).
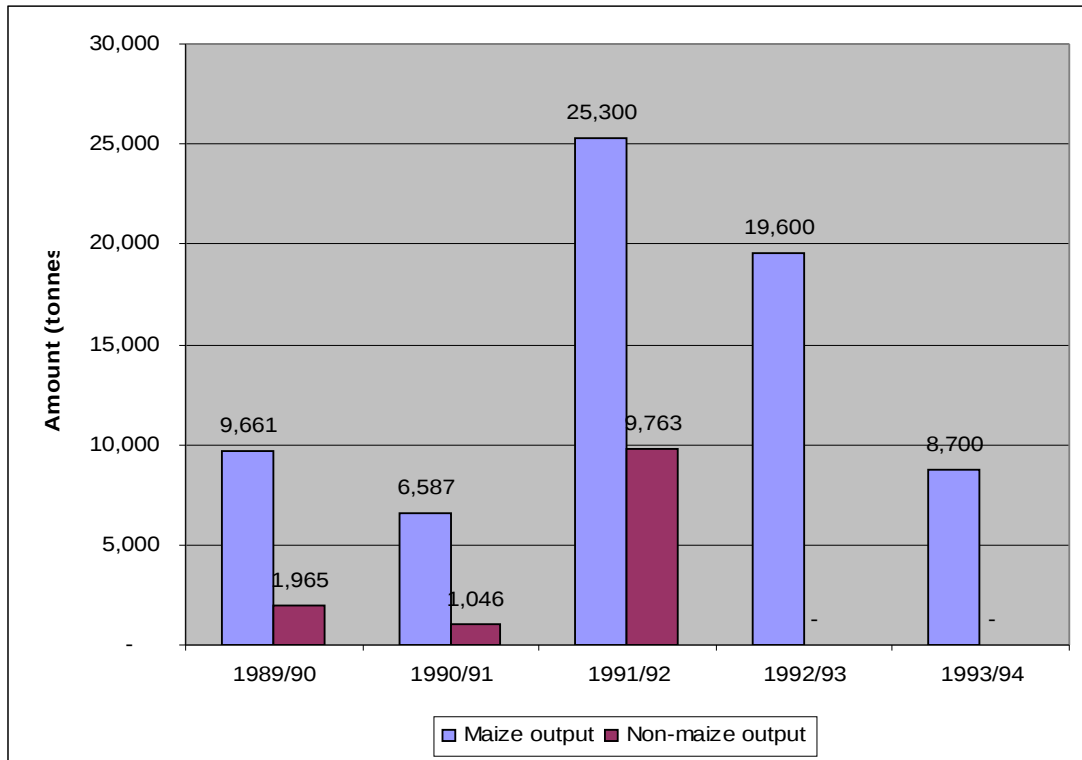
Figure 4. Volume of marketed farm product in Rukwa region 1989/90 – 1993/94

Source: URT, (1997)

Looking at the above presented statistics, maize has increasingly become the dominant crop in the market representing the largest share of the marketed crops. This fact might be attributed by the emphasis at local and National level towards increasing maize production level in order to curb the imminent food shortages within and/or outside the region. Apart from maize production, finger millet is the other important cereal crop with the longest tradition in the Rukwa region. According to (URT, 2004), until recently the market value of finger millet was relatively higher compared to other cereals including maize. It serves

both purposes as cash and food crop, which is centrally to Mbeya region where apart from maize, paddy cultivation is the most dominant in the region also serving as cash as well as food crop.

2.10.4 Iringa region

Land is the major economic resource available in the region, covering 56 940 square kilometers, out of which 41 945 are suitable for agricultural production (URT, 2000). However, only 4 720 square kilometer of the suitable land equivalent to 11 percent land is under cultivation. Agriculture is the main economic activities employing more than 90 percent of the regional population. Other sectors with a lot of potentials include livestock, fishing, forestry, beekeeping, mining and industries.

Maize is the major staple food and the most marketed crop in the region, other crops include beans, sorghum, paddy and wheat. Maize grow almost throughout the region, paddy is grown in Ruaha plains, Sadani in Mufindi and Upangwa. The general level of productivity level is relatively low, for instance in 1996 maize harvest only 2 tonnes of maize per hectare were harvested against the normal capacity required 6.5 tonnes of maize per hectare. Also the maize actual yield per hectare level between 1991/92 to 1994/95 was never surpassed the set targets as seen in Figure 5.
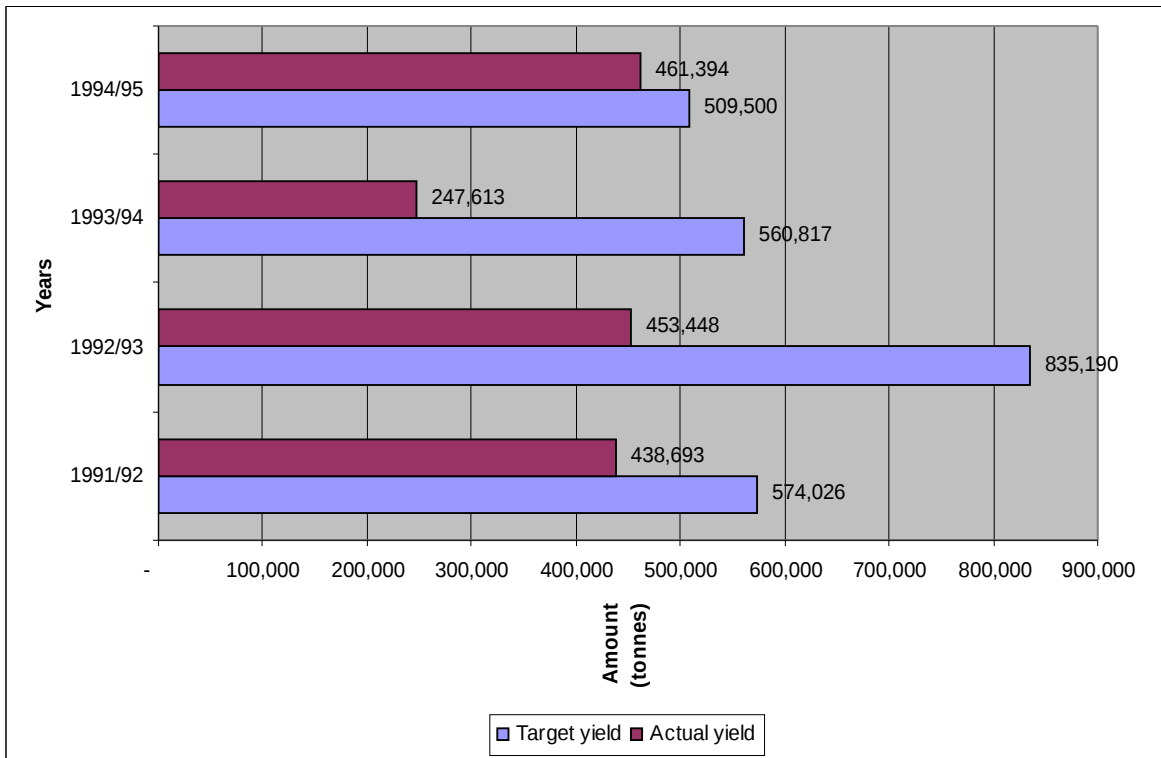
Figure 5.   Maize production in Iringa region (1991/92 – 1994/95)

Source: URT, (2000)

The low level of production is mainly attributed to the frequent use of inferior agricultural implements, non availability of farm inputs especially fertilizer and pesticides (URT, 2000). However, percentage wise comparison of maize deficit levels in Iringa region between the agricultural seasons 1991/92 to 1994/95, indicate that the deficit has been declining over time as seen in figure 6. From these figures it can be concluded that, there is gradual improvement in maize production level in the region and that effective and efficient use of resources will be crucial to increase production levels on sustainable basis.
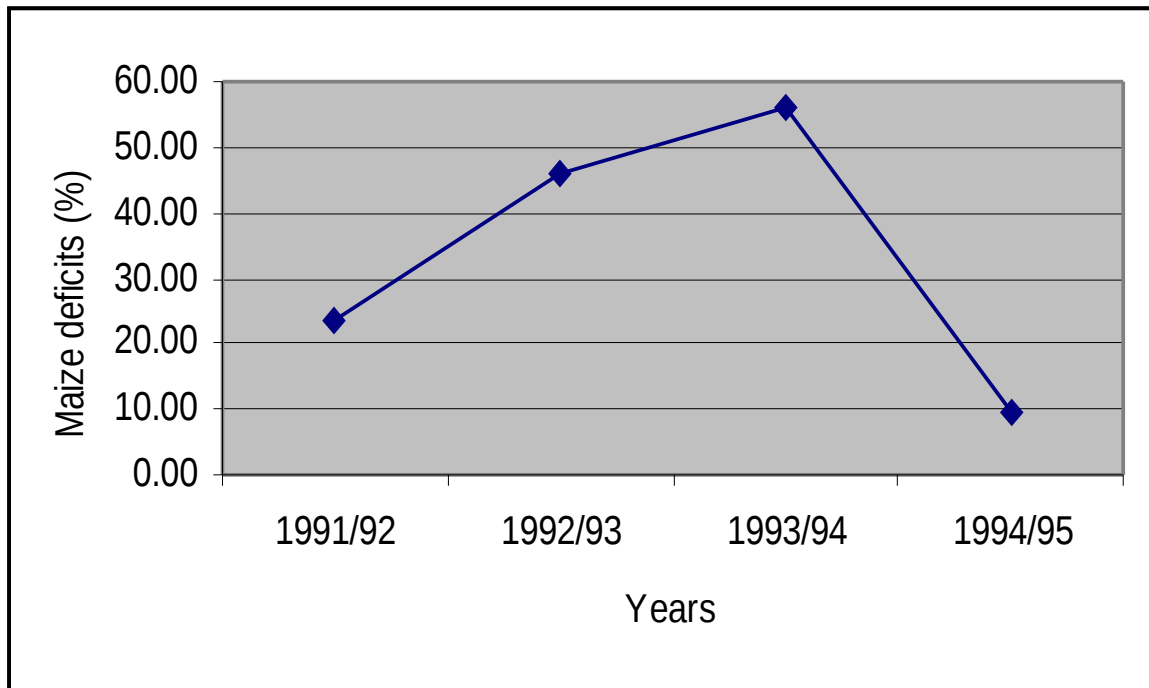
Figure 6.   Maize deficit levels in Iringa region (1991/92 – 1994/95)

Source: URT, (2000)

2.11 Input accessibility in Tanzania

Various literatures suggest a relatively high level of fertilizer consumption in Southern highlands region. Studies by Ponte, (1990) and Mdoe, (2000) point out, that farmers in these areas are increasingly using improved farm inputs (seeds, fertilizer and pesticides) for the production of high value crops such as tomatoes and cabbages. Kilimanjaro, Rukwa and Tabora are some other regions with higher consumption levels. Figures on fertilizer consumption levels between the years 1987 to 1992 seasons, indicate the highest consumption being made in Southern highlands. Of the consumption that goes outside the Southern highlands higher percent of it is taken up by Tabora, Kilimanjaro and Arusha region.

Generally, Southern highlands have the highest input demand and consumption levels. However, past experience indicates a existence of wider discrepancy between the amount demanded and supplied throughout the region (URT, 2004). An extract from Rukwa region indicate that over an entire period of three years none of the amount three major fertilizer (UREA, CAN and SA) supplied has ever exceeded 30 percent of the actual demand (Table 1). Also the annual general fertilizer availability is below 50 percent and is in further declining trend 35% (1990/91), 43% (1991/92), 2% (1992/93) and 22% (1993/94). The use of improved seeds particularly maize seeds is also showing similar declining trend. Input price is explained as the major factor towards the trend (URT, 1995).

Table 1   Fertilizer demand and supply in Rukwa region 1990/91-1993/94

Type of fertilizer	1990/91		1991/92		1992/93		1993/94	
	DD	SS	DD	SS	DD	SS	DD	SS
TSP	1650	281	2500	665	2750	237	3200	-
CAN	1650	312	3800	745	4000	204	4500	1010
UREA	3000	357	3700	180	4000	330	5000	1597
SA	100	-	2500	2000	3000	907	3600	486
NPK	1980	1981	300	1900	3500	1728	4000	1393
Total	8380	2930	12800	5490	17250	3406	20300	4486

Source: URT, (1999)

Note: DD - Demand
       SS – Supply

Outside the Southern highlands region, Tabora region represents the region with high fertilizer consumption. For instance in the year 1988, about 31 percent of fertilizer was distributed to the rest of the country (places with exclusion of Southern highlands) of which 12.8 percent was distributed to Tabora region alone (Figure 7). This is supported by the study undertaken by ESRF, (2003) which observed that about 50 percent of fertilizer distributed in the year 1996/97 went to Tabora region alone. The inter-regional pattern use for other farm inputs is similar to that of fertilizer where apart from Southern highlands, most of it is used in Kilimanjaro, Arusha, and Tabora region. Largest share of fertilizer in Southern highlands use this fertilizer for growing maize, tobacco and coffee, while Tabora region use more of it for tobacco production.
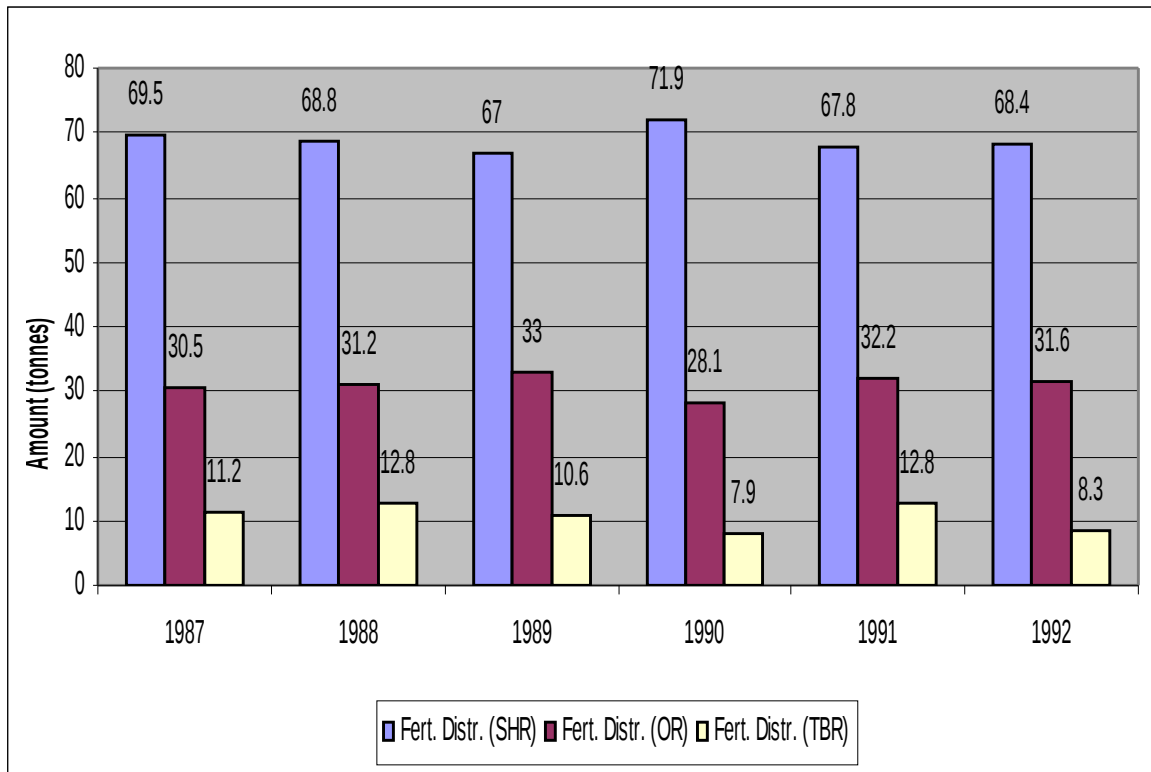
Note: SHR- fertilizer distributed to southern highlands.

OR - fertilizer distribution to the rest of the country.

TBR - fertilizer distributed to Tabora region (as proportion of OR).

Figure 7. Comparison of fertilizer distribution between the southern highlands and the remaining regions of Tanzania

Source: TFC, 1992

2.12 The experience from past input usage

Over the years Southern highlands has been praised for the intensive farming, involving high level of fertilizer use. However, the intensive use of fertilizer has significantly reduced soil fertility and bringing about serious environmental damages in some areas. Ruvuma region is one such place which has seen dwindling production levels. Despite the immense potential in terms of conducive climatic condition, topography

and human capital both production level and productivity per hectare has been of fluctuating nature. Although maize production still accounts for large portion of the total output there has been decline in productivity per hectare from 2.2 registered in 1995/96 to 1.8 percent in 1996/97 agricultural season, which is equivalent to 18 percent sag. Figures in three former districts (Mbinga, Songea and Tunduru) indicate a decline in production trend especially in Songea and Mbinga, and a relatively low production level at Tunduru district (Figure 8). To avoid further adverse effects, experts recommends that farmers use fertilizers which reduce soil acidity and at the same time restoring nutrients. Such fertilizer includes UREA, NPK and CAN.
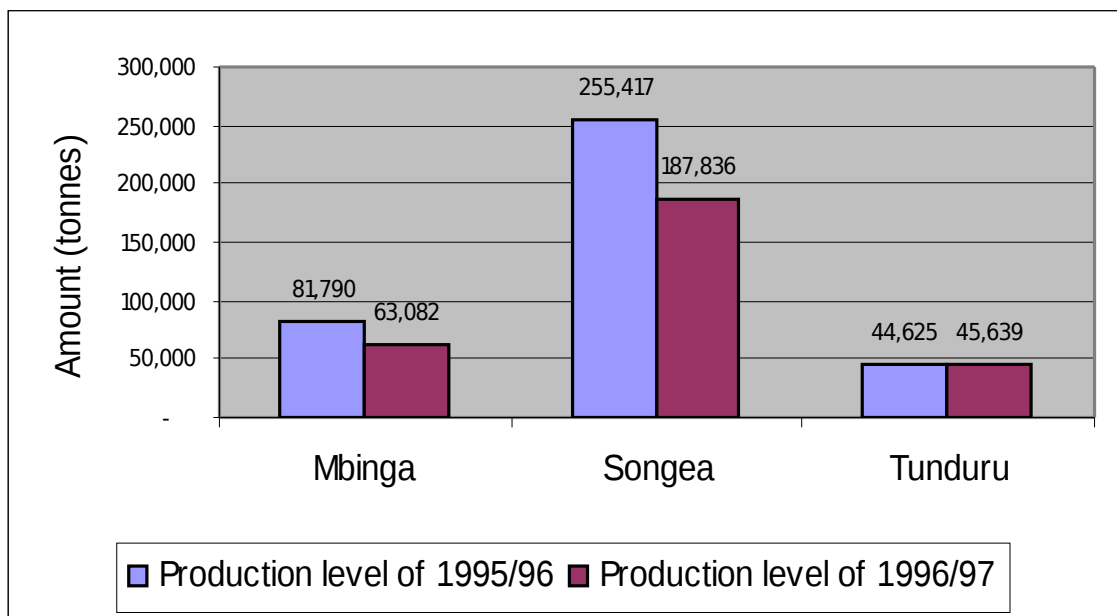
Figure 8.   Ruvuma crop production 1995/96 - 1996/97

Source: URT, (1997)

2.15 Domestic markets for agricultural crops

From 1980s there has been shift of policy from government controlled to free market system. The government gradually halted its direct engagement in economic activities including production, transportation and marketing; instead the role has been taken over by the private sector. Under such conditions, major economic activities including decisions on resource allocation has been handled over to the private sector while the government remains with key role of providing enabling environment in various ways including establishment of new and/or reviewing the existing National and sectoral policies, strategies and plans to reflect upcoming changes in the economy. The Government also remains with the activities of ensuring quality control especially on establishment of standards and undertaking monitoring activities particularly on the sector performance.

Major decisions regarding to existing market prices, where to sell, to whom the products are to sold rest on the concern business entity and are largely determined by the existing market prices, the existent of available information regarding the existing market conditions and such condition as distance covered from farm to the markets.

Dar es salaam city forms one single massive and most dependable marketing center attracting a large section of agro-business firms and individual traders, secong to it is Dodoma market (ESRF, 2003). The two

markets absorb a large section of transported crops. Estimates of the amount sold indicate that maize is the leading commercial crop for most farmers. Between the period 1989/90 - 1993/94 maize crop formed about 88 percent of the total amount sold in Rukwa region. Highest amount was registered in the year 1991/92 in which at total of about 253 008 tonnes was sold and purchased. On average 16 538 tonnes of maize have been sold and bought annually between the 1989/90 - 1993/94 (Table 2).

Table 2   Purchases of major crops in Rukwa region (1989/90 - 1993/94)

Crop	1989/90	1990/91	1991/92	1992/93	1993/94
Maize	9 661	6 587	25 367	19 600	8 701
Rice	522	420	n.a	n.a	n.a
Cassava	551	n.a	n.a	n.a	n.a
Beans	892	n.a	n.a	n.a	n.a
Total	11 626	7007	25 367	19 600	8 701

Source: URT, (1999)

Note: n.a   -   not available

2.16 Fertilizer consumption pattern in developing countries

In general, developing countries has registered a substantial increase in consumption level over the last few decades. The total consumption levels have been increasing annually though at a smaller pace to bring about sustained growth of agricultural sector. Green revolution has been the major driving force, through creation of massive demand for fertilizer for enhancing higher yield. It placed much emphasis on intensive cultivation by stimulating utilization of modern farming inputs

such as pesticides, herbicides and improved seeds. According to the International Fertilizer Industry Association (2006), between 1999 and 2001, developing countries has registered a notable annual increase in consumption level averaging some 87 percent metric tones with China, India and Brazil taking the lead.

Across African continent two scenarios exist; the fertilizer use per hectare is concentrated in the Near East/North Africa region. FAO, (2006) projects the trend to remain so for quite some time. It is further projected that by 2020 the average fertilizer use across the region and Asia will exceed that of the developed countries. On the other hand, consumption levels across the sub-Saharan Africa remains to be the lowest and insufficient for the sustainability of its agriculture. However, despite of the unsatisfactory consumption level, the region is projected to register increased consumption levels owing to its quest for increasing production.

2.17 The consumption pattern of other farm inputs

The consumption of other farm inputs particularly pesticides in mid 1980s was about one-fifth of global consumption. Pesticides consumption in terms of active ingredients decreased from 620 000 to about 530 000 tonnes between 1980 and 1985. Since then there has been general decline in consumption level in both developed and developing countries largely contributed by economic factors as

pesticides price, product price, price of alternative plant protection means, and the opportunity cost of labour.

They are also existence of significant discrepancy in the type of pesticides that are being used and the intensity of its use. In general, the demand for pesticides has been increasing with the available farming technology. Farming practices such as tillage and cultural control measures such as crop rotation have an affect on the levels and extent of pesticides use. Recently, about half of pesticides used in developing countries are insecticides, with herbicides accounting for minor part of the total consumption.

This pattern is opposite to that of developed countries owing to ecological and economical differences (FAO, 2006). In humid tropical countries, pest generation and pressure from fungal infections is much more strong and severe necessitating insecticides use for controlling migrating pests such as locusts. In this region, manual weeding is more economical and affordable due to low labour costs compared to herbicides use. On the other hand, pesticides consumption levels across the sub-Saharan Africa remains to be the lowest (Table 3).

Table 3   Pesticides use across developing countries in 2006

Region	Pesticides use (%)
East Asia	38
Latin America	30
Near East/North Africa	15
South Asia	13

sub-Saharan Africa	4

Source: FAO, 2006

2.18 Cross National experience in fertilizer production and consumption

2.18.1 Tanzania's chemical fertilizer use

The use of fertilizer in Tanzania is very low with nitrogen, phosphate and potassium applied at an average rate of 3.3, 1.9 and 1.1 kilograms per hectare of cultivable land, respectively (ICRA, 2006). Which implies that, nitrogen takes about half of the nutrients, phosphate almost one third and potassium about 15 %. According to the agricultural census of 1994/95, only 15 % of holdings were found to be using some mineral fertilizers, mainly nitrogen. Still of these the applied dosages was found to be smaller than the recommended ones.

Generally, the annual fertilizer consumption within the country depicts a gradual increasing trend (Figure 9). Despite of this fact the country is among the world's lowest user of fertilizer, a vital component for agricultural production. According to Allafrica.com (2006), the per capita fertilizer consumption in Tanzania is 21 kg per hectare, a figure far below even some African countries such as Zimbabwe, which has an average fertilizer consumption of 52 kg per hectare.

It is further pointed out that; in comparison with the outside world the consumption has been declining from an average of 209 000 Metric tonnes annually in early 1990s to 100 000 Metric tonnes in 2000s. Of recently the consumption has been rising steadily, partly due to the

implementation of various agrarian reforms including establishment of input subsidy programme. Of late the annual average consumption registered is 150 000 Metric tonnes.
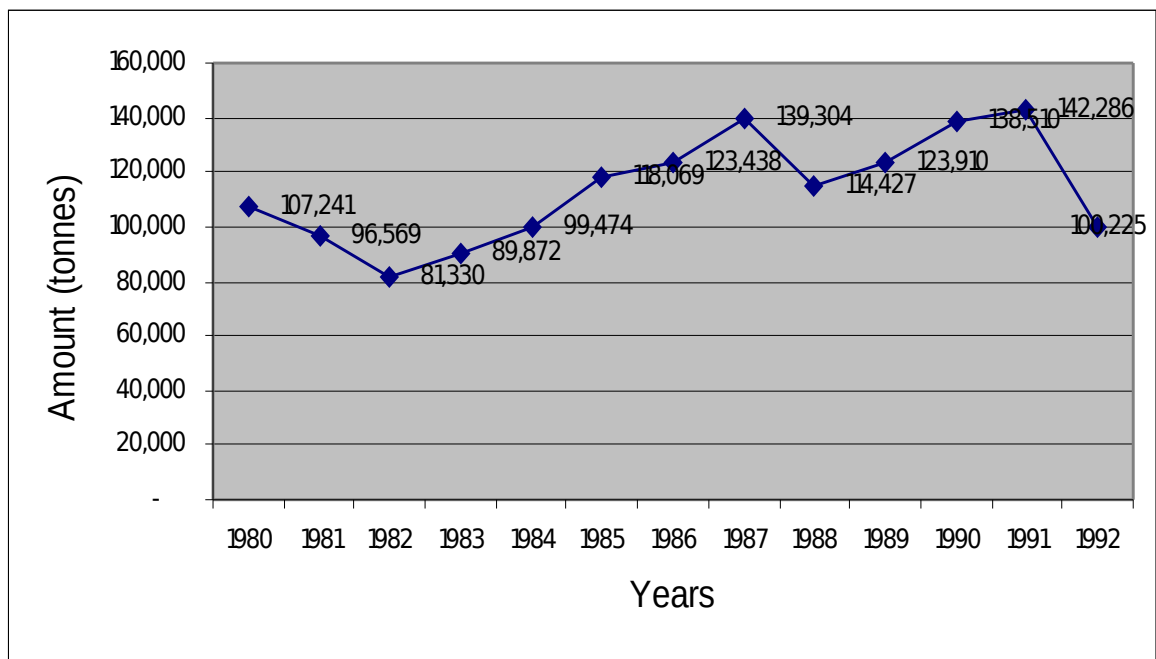
Note: The figure includes Zanzibar

Figure 9.   Total fertilizer distribution in Tanzania 1980 - 1992

Source: TFC, 1992

2.19 Food crop production in Tanzania

Food crop production in early 1970s thrived partly due to government support programme through subsidy provision. In particular, there is significant potential for increasing food production, partly due to population growth especially in urban areas. However, food crop production has not kept pace with demand, and has in fact declined. For example in 2002, Tanzania's domestic maize production was 3 495

000 tonnes, a figure far below the country's aggregate demand, prompting an import of about 128 374 000 tonnes to fulfill the required amount.

Maize is both a major food staple and the most important marketed crop (Maliyamkono and Bagachwa, 1990 and Msambichaka, 1983), but due to its biological nature it is susceptible to weather changes. In simple terms, weather changes have had impact on the amount of rainfall, which determines the level of maize output. Apart from maize production, paddy, wheat, millet, sorghum are among the crops grown in Tanzania (Table 4).

Table 4   Food crop production in Tanzania in metric tonnes (1994 - 2002)

Crops	1994	1995	1996	1997	1998	1999	2000	2001	2002
Maize	1	2	2	2	2	2	2	3	3
	458	875	822	386	073	848	870	348	495
Paddy	192	517	495	413	847	439	443	1	1
								010	054
Wheat	44	47	49	51	53	68	61	65	68
Millet	295	222	269	195	50	76	72	74	77
	258	443	360	449	249	363	365	364	380
Sorghum									
Cassava	1	1	1	1	2	2	2	2	2
	697	812	873	936	048	187	118	007	095

Source: MAFSC, 2002

In case of food shortage due to causes such as drought, floods etc importation becomes the option available. With emergence of

libelization policies, which among other elements advocates privatizing output and input distribution, private business companies undertake all these activities including bulk purchasing, transporting, and distribution and selling at retail and wholesale levels.

2.20 Tanzania fertilizer distribution system-historical perspective

2.20.1 Pre-independence period

Before independence colonial period the Government owned large-scale farms and fertilizer use was mainly to those farms (Sirili, 2001). They were no factories for producing fertilizer; in that case local needs for chemical fertilizer was met through importation. During this time a multi-channeled input supply and crop marketing system predominated (Ngirwa, 1995). In this system, the government exercised a limited control over factor and product markets. In essence it was a free market system allowing private sector involvement in factor and product distribution.

2.20.2 Post independence

In 1967, six years after attainment of independence the country pronounced the Arusha declaration, which called for government and other public institutions to implement policies which would make Tanzania self reliant (Maliyamkono and Bagachwa, 1990). It was envisaged that, its achievement would bring about structural changes

and rural development. During this period the government through its apparatus controlled agricultural marketing activities including input production and distribution. Before 1969 Tanzania's local chemical fertilizer demand was met through importation. Overseas fertilizer procurement was effected by Tanzania Fertilizer Company (TFC), which was established in 1968.

TFC dealt with fertilizer production, importation and distribution, it started producing chemical fertilizer effectively from 1972. The Company was chiefly involved in producing five common types of fertilizer, which were Sulphate of Ammonium, Triple Super Phosphate, Single Super Phosphate, Di-ammonium Phosphate and NPKs. Of all types, Sulphate of Ammonium, NPKs, and Triple Super Phosphate were produced in much large quantities followed by Di-Amonium Sulphate and Single Super Phosphate (Figure 10). Up to 1981 local fertilizer production constituted about half of total demand, the remainder being supplemented through Commodity Aid Grant (Sirili, 2001). TFC halted fertilizer production effectively in 1992 due to financial and technical bottlenecks.

Other public and quasi public institution were also involved in secondary input distribution, the major ones being Co-operative unions, Regional Trading Centres (RTC) and marketing Boards (ICRA, 2006). According to Ngirwa, (1995) a three–tier single system of marketing comprised of Primary Societies, Regional Co-operative Unions and a

specific crop marketing board was being used. It was during this period that the Government subsidized agricultural production activities, in a view of increasing access and affordability of farm input.
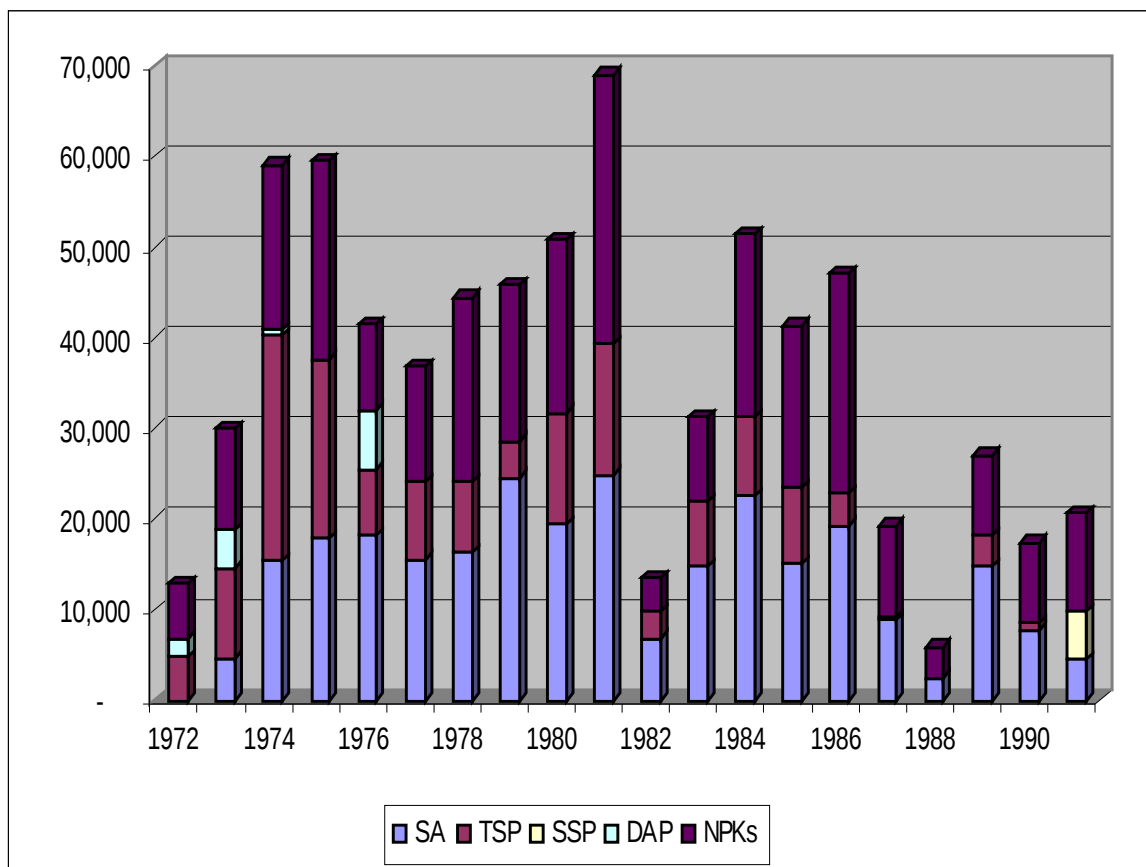
Figure 10. TFC Fertilizer Production (1972 - 1991)

Source: TFC, 1992

2.20.3 Post - liberalization period

From 1980s across to 1990s Tanzania engineered major economic reforms including Structural Adjustment Programme (1983 - 1985) and Economic Recovery Programme (ERP). According to Maliyamkono and Bagachwa, (1990) the major objectives of these measures were to

attain sustained growth in real income and output. As a result of the reforms, the state abandoned its direct role on economic activities and handled over the role to private sector. Independent private firms could now import and market agricultural inputs at all levels of the supply chain-import, wholesale and retail. Nevertheless, skepticism surrounds on whether the increased number of private traders has real kept pace with service delivery. The input market has at large remained fragmented and timely access to farm input remains a challenge to smallholder farmer.

2.21 Tanzania's input supply chain

The modern fertilizer input supply chain in Tanzania consists of two separate chains of private-sector lead input distribution chain; domestic and international components. Domestic input chain consists of importers, transporters, commercial banks, agricultural research centers, local government authorities and input stocking companies. These are involved in varying degree in distribution processes. Members in this group range from small to medium scale enterprises. Generally, the marketing domestic component is relatively much less cumbersome compared to international chain. This is simply because of existence of high homogeneity within a country in terms of culture, experience, procedures, and tastes.

International chain consists of input importing companies dealing with overseas procurement activities. However, some of such importing

companies are also involved in domestic input distribution. The common purchasing destinations are North and Western European countries, Middle and Far East. This component is relatively complex due to marked differences in terms of market information requirement, procedures, culture and tradition, values e.t.c. Further, the international chain is characterized by good integration, high level of investment and technology use. In contrast, the domestic chain is characterized by poor organization and limited information flow among market participants, which thus imposing high transaction cost and risky situation to its participants. Despite the differences, there is higher degree of overlapping between the two in terms of service providers and information sharing systems.

2.22 The trend of fertilizer importation in Tanzania

Currently, Tanzania relies on imported fertilizer for agriculture production due to the limited financial and technical capacity. Despite that fact, the general fertilizer importation trend has been declining (Figure 11) the aggregate fertilizer imports peaked in the year 1982/83 in which case more than 250 000 tonnes were imported. This was early years that saw Tanzania depending solely on imported fertilizer for production after the closure of Tanzania Fertilizer Company that dealt with domestic manufacturing of fertilizer.

Lowest amount of import was recorded in the year 1980/81; largely caused by high domestic production. Some external factors, including

changes in the general international prices levels and the decline in the value of domestic currency against major currencies particularly the US Dollar have also affected the aggregate importation.
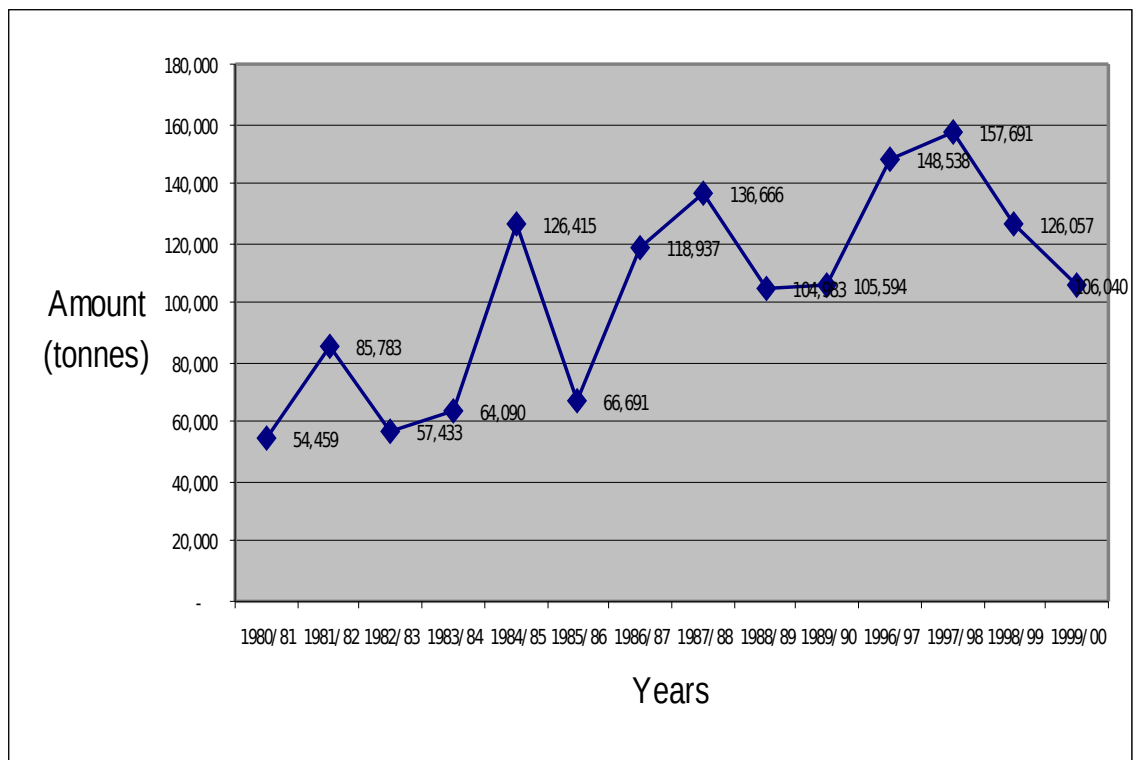
Figure 11. The trend of aggregate fertilizer imports in Tanzania 1980/81 – 1989/90

Source: MAFSC, (2006)

2.23 Fertilizer imports by products

The types of fertilizer commonly used in Tanzania include Sulphate of Ammonium, UREA, Calcium Ammonium Nitrate, TSP and NPKs. This dictates the type of fertilizer that is imported into the country. Sulphate of Ammonium (SA) leads in the importing chart for example in 1982/83,

SA constituted a great proportion of fertilizer import. (Figure 12). NPKs which are mostly used during planting are imported in smaller quantities due to their limited use in production activities.
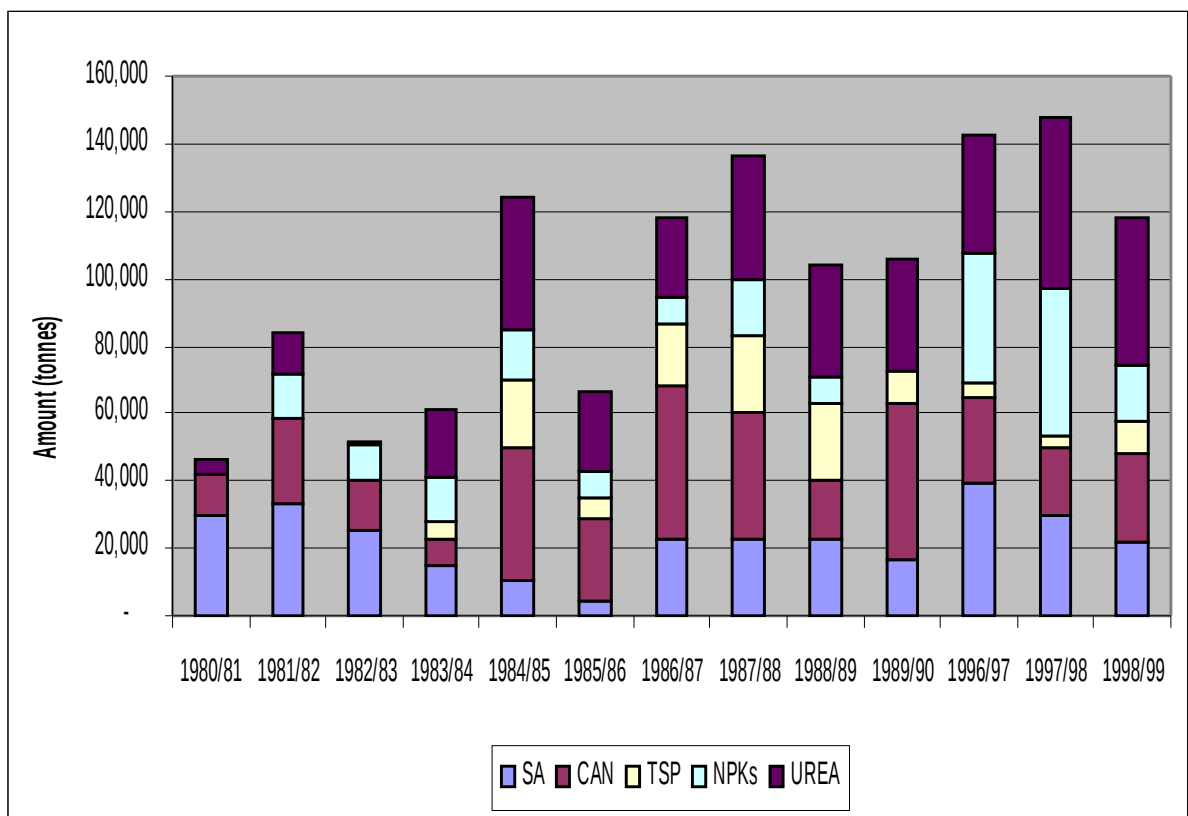
Figure 12. Fertilizer imports by products (Tonnes) 1980/81 -1989/90

Source: TFC, 1992

2.24 Agricultural Input Trust Fund (ITF) and Banks

Input Trust Funds was statutory established by Parliament Act No. 9 of 1994. Primarily the instrument was designed as a result of failure of Co-operative Unions and Crop Marketing Boards to deliver services as expected. The government spearheaded the move to fast track the

attainment of Millennium Development Goals, National objectives and targets as envisioned in National Development Vision and specified in the National Strategy for Growth and Poverty Reduction.

Input Trust Funds offers soft loans to facilitate acquisition and enable distribution of farm implements. Among others, target beneficiaries are provided with various farm inputs including chemical fertilizer, insecticides, pesticides, herbicides and animal feeds.

Under the Trust Fund, loan is provided to groups of organized farmers and livestock keepers, individual farmers and/or livestock keepers, Saving and Credit Co-operative Societies (SACCOs), independent agencies and other organizations such as district and council Input Trust Funds.

To enforce compliance and proper management of funds, two banks have been accredited the responsibility of monitoring and supervising disbursement processes. These are, Exim and Ushirika Co-operative Kilimanjaro (KCB). The banks issue loan after being satisfied with the recipient capacity to repay. The Exim bank issues such loan on short-term basis with an interest rate of 12 percent. Borrowers are required to possess certified immovable property in accordance with the banking procedures and guidelines. The recipient is further required to have an active bank account, and all input related transactions will be dealt through that specific account.

According to Economic Survey, (2005) in the year 2005, ITF issued credits for purchase, repair and maintenance of tractors. A total of about 44 credits worth Tshs. 1 278 192 000 was provided, out of which 18 were directed to agricultural inputs and livestock drugs, 10 credits worth Tshs. 313 800 000 for purchase of new tractors, and 16 credits worth Tshs. 42 000 000 for repair of tractors.

The main advantage of this system is that has substantially increased availability of input in the districts where it operates by bringing in substantial amount of inputs that might not otherwise have been available. The system, however, may be criticized on a number of grounds including; the limited coverage of the banks, presence of banking complex procedures, regulations and requirement including the need of having collateral of which most farmers do not have.

CHAPTER 3
METHODOLOGY

3.1 Overview

This chapter describes the methodology that has been used in conducting the study. It is divided into three sections; section 3.2 describes location of the study area while section 3.3 presents the types and sources of data. The final section presents various analytical methods that have been employed in the study.

3.2 Location

The study area is Southern highland zone comprising of four regions, which are Ruvuma, Iringa, Mbeya, and Rukwa. This area was chosen because the agricultural input subsidy programme was first initiated in the region effectively in 2003 as a pilot study.

3.3 Types and data sources

The study is purely based on secondary data. The data were obtained from Sokoine University National Agricultural Library (SNAL), publications from the Ministry of Agriculture, Food security and Co-operatives and various internet sources. The use of secondary data and information has been justified given the nature of the study.

3.6 Data analysis

3.6.1 Quantitative analysis

Secondary data obtained was used for computing the annualized growth rate of both fertilizer consumption and maize production. This was intended to measure the impact of the subsidized fertilizer obtained under the programme on consumption and production levels.

3.6.2 Theoretical model

Growth rates are calculated as annual averages and represented as percentages. Except where noted, growth rates of values are computed from constant price series as rates of change from one period to the next. Various methods are used to calculate annual growth rates as detailed below:-

3.6.2.1 Consider the values of the first and last observations

In this case, rates of change from one period to the next are calculated as proportional changes from the earlier period. The calculated growth rate is an average rate that is representative of the available observations over the entire period. However, results obtained are greatly influenced by the first and last observations. Using this method annual growth rate is computed as follows:-

$$r = \left[\left(\frac{X_t}{X_0} \right)^{\frac{1}{t}} - 1 \right] * \quad 100\% \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 1$$

Where X_t and X_0 are respectively the values in period t and 0, and X_t represents the level of the referral variable in year t and X_0 is the level in the base year. The major weakness of this method lays in its failure to take into account changes that might arise as a result of changes in intermediate values in the time series.

3.6.2.2 Consider the values of the first three and the last three observations

This method is an advancement of the earlier method, in that it considers the first three and the last three observations. The method is more beneficial compared to the first one, as it minimizes the shortcoming of the first method by taking into consideration more number of observations. When computing annual growth rate through this method, the annual growth rate (r) is computed as follows:-

$$r = \left[\left(\frac{X_t + X_{t-1} + X_{t-2}}{X_0 + X_1 + X_2} \right)^{\frac{1}{-2}} - 1 \right] * 100 \% \qquad \dots\dots\dots\dots\dots\dots 2$$

Where:-

X_0, X_1, and X_2 are the initial observations in the array of time series data;

X_t, X_{t-1} and X_{t-2} are the last three observations in the array of time series data; and r= annual growth rate.

In the case of large number of observations, the problem noted in the first method will be unavoidable.

3.6.2.3   Linear trend regression

This method is an improvement of the earlier two methods; in operation it considers all the observation in the time series. Computation of growth rate using linear trend regression is done by first running an OLS regression estimation of the following equation:-

$$X_t \quad = \quad \alpha \quad + \quad \beta T \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \quad 3$$

Where:-

X_t = represents the observation in period t; and

T = represents the trend.

Running an OLS regression does help to estimate the value of α and β, then the values of Xt can be estimated by varying the value of time (T) according to the relationship 3. After obtaining the new time series data of the estimated Xt values, then annual growth rate can be conveniently calculated using other methods such as equation 1.

3.6.2.4   Exponential regression method

This method is used when there is sufficient time series data that will permit reliable calculation. No growth rate is calculated if more than half the observations in a period are missing. Using this method

estimation is done by first running an OLS regression according to the following equation:-

$$\ln X_t = \alpha + \beta T \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 4$$

Which when transformed is equivalent to;

$$X_t = X_o * (1 + r)^t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 5$$

Where:-

X_t = represent the variable;

T = represent time;

$\alpha = \ln X_o$ and $\beta = \ln (1 + r)$ are parameters to be estimated; and

r = represent the average annual growth rate.

The OLS regression estimation will enable to obtain the values of a and b in equation 4. The value of b represents the coefficient of the independent variable and once obtained then the growth rate can be calculated according to the equation 6 as follows:-

$$r = (EXP (\beta) - 1) * 100 \dots\dots\dots\dots\dots\dots\dots\dots 6$$

The calculated growth rate is an average rate that is representative of the available observations over the entire period. However, the calculated growth rates does not necessarily match the actual growth rate between any two periods.

In this study three methods covered in sections 3.6.2.1, 3.6.2.3 and 3.6.2.4 have been employed for computation of fertilizer consumption and maize production levels.

The choice of this method was based on the following factors:

(i)   The limited number of the available observations;

(ii)   The algebraic form of the function;

(iii)   Convenience in estimation;

(iv)   The relevance of variables to be included;

(v)   The logic implication of the function; and

(vi)   The method of estimation to be employed.

CHAPTER 4

RESULTS AND DISCUSION

4.1 Description of the subsidy fertilizer supply chain, key stakeholders and their linkages in the system

4.1.1 Overview

The history of subsidy provision in Tanzania dates back to mid 1970s, when the government first instituted such programmes to facilitate the availability of inputs and ease its access by small scale. However, all forms of subsidy provision were officially eliminated completely in 1994/95 season.

It was revived in 2003/04, and initially implemented in the Southern highlands as a pilot study. Under the programme, Ministry of Agriculture and Food Security plays a central coordination role through provision of guidelines that would create fair ground for farmers and traders. Local governments prepare data and information on fertilizer requirements and ultimately submit to the Ministry where they are used to establish the actual annual demand.

In its initial year of operation 2003/04, two major types of fertilizer was issued under the Programme, these were Di-ammonium Phosphate and UREA. In the subsequent agricultural season, 2004/05 subsidy provision was shifted to Triple Super Phosphate and Calcium Ammonium Nitrate. In both cases, the government subsidized in varying amount part of

selling price fertilizer and transportation costs from Dar es salaam main collection center up to the regions distribution centers.

Due to rising need to curb shortages and positive response in terms of the rising farm output, the programme has widened the scope of kinds of fertilizer being supported. They rose from the past two (Di-ammonium Phosphate and UREA) supported in the agricultural season 2003/04 and Triple Supper Phosphate and Calcium Ammonium Nitrate in 2004/05 to five supported in 2005/06. In the agricultural season, 2005/06 the program subsidized acquisition of Di-ammonium Phosphate (DAP), UREA, Calcium of Ammonium Nitrate (CAN), Triple Super Phosphate (TSP) and NPKs (20:10:10, 25:5:5 and 10:18:24).

Much as the program aims at increasing input supply in target producing areas, the emphasis in the agricultural season 2005/06 shifted to the supply of high analysis fertilizer (DAP and UREA). The high analysis fertilizer is much more efficient in terms of increasing soil fertility compared to low analysis fertilizer. As of 2005/06 agricultural season, the Southern highland zone had a total of five major storage centers. Two centers are found in Iringa region (Iringa Municipal Council and Makambako) and one center in each of the remaining places i.e. Mbeya, Songea and Rukwa region.

Figure 13 indicates the fertilizer supply chain, in which case the flow of subsidy fertilizer is shown using normal lines while unsubsidized fertilizer is shown by dotted lines. Looking at the figure, three different chains can be identified in which case subsidy fertilizer consists of a single supply chain while unsubsidized fertilizer consists of two different supply chains. The supply of subsidy fertilizer which consists of importers selling fertilizer directly to certified stockists in the respective areas. Concerning unsubsidized fertilizer, it consists of two supply chains in which importers distribute and sell fertilizer at both wholesale and retail level to target destinations. The first supply chain of unsubsidized fertilizer consists of importers selling fertilizer directly to target farmers. Through this approach, importers sell fertilizer mainly on retail basis using their collection centers located in target regions while the second supply chain consists of importers selling fertilizer to local input traders who then sell to eventual farmers.
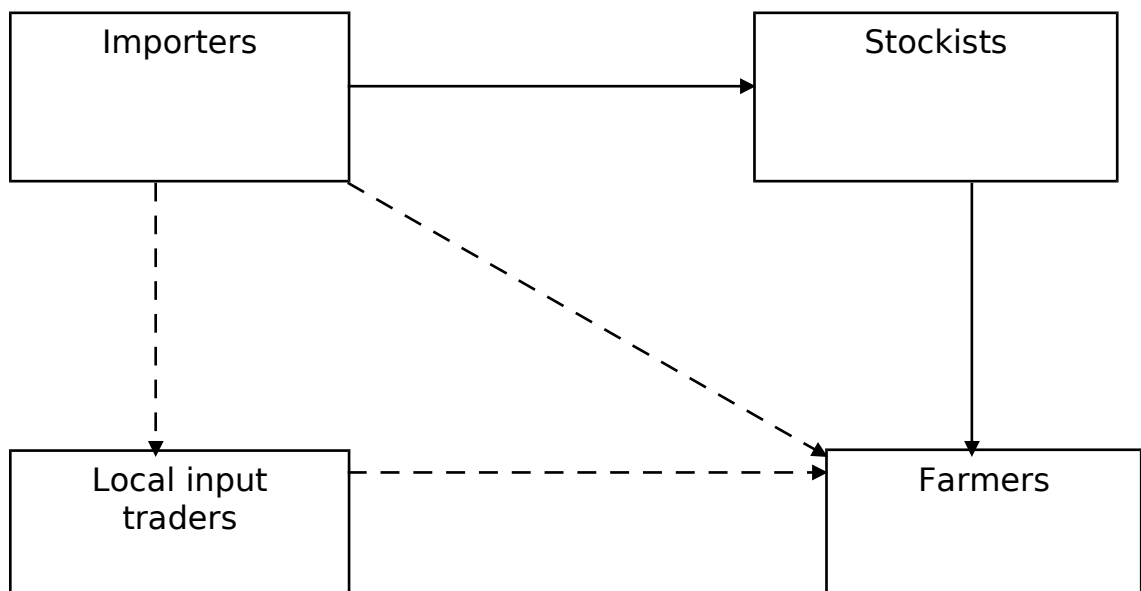
Figure 13.   The supply chain of subsidy and unsubsidized fertilizer

4.1.2 Subsidy programme operations in the Southern highlands

In this programme, the Government through the Ministry of Agriculture, Food Security and Co-operatives nominate reputable importing companies that would purchase fertilizer from overseas markets and sell to stockists in target areas. In order to qualify to work under the programme, importing companies must first meet minimum set criterion. These include possession of a certified valid business license, having storage houses in major distribution centers and the proven ability and experience to carry out the activity. Qualified applicants would enter into business of purchasing fertilizer abroad and facilitate its shipping up to domestic markets.

Regional and district authorities nominate reputable stockists who will be responsible for purchasing, transportation and selling of subsidized fertilizer to target consuming places. They are nominated by the regional and district authorities the same way the Ministry do for importers. The qualifies applicants are notified, and will be responsible for transporting fertilizer to target places and undertake selling in both wholesale and retail level. Farmers will then purchase subsidized fertilizer from stockist.

Importing companies such as TFC undertake transportation and purchase fertilizer from overseas markets particularly the Middle and

Far East, and European markets (See Appendix. 4). The most common imported fertilizer includes SA, UREA, CAN, Phosphates, Potash and NPKs. On arrival to the country, the importer select reputable transporting companies for example TAZARA who would avail fertilizer to their specified major storage warehouses. Once the fertilizer arrives to target destinations, importing companies deliver sell the consignment to the appointed stockist who will avail it to target farmers.

Concerning the fertilizer marketing arrangements, the major importers have their own storage capacity and distribution point in major regions. They also offer limited advice to farmers especially on application rates, otherwise they have no other strong links with their customers. Fertilizer is mainly sold on cash basis, although they may grant short-term credit when firm guarantee for payments are given (ICRA, 2006).

The Southern highlands are highly prioritized areas in terms of subsidy provision due to intensive use of chemical fertilizer in the region. During the agricultural season 2005/06, Mbeya region received the highest total amount followed by the Iringa, Ruvuma and Rukwa region (See appendix 6). Outside the Southern highlands, highest amount of fertilizer is distributed to Tabora, Arusha, Morogoro and Kigoma regions. UREA leads in the amount of distributed fertilizer, followed by DAP and

NPKs. The use of these is mostly recommended due to their nutritive value.

The issued amount varies between regions depending on the actual demand and the available amount in the stock. The actual consumption is determined on the basis of information obtained from respective LGAs. The wide range of fertilizer use across regions may be attributable to many different factors such as soil types and types of crops grown, weather patterns, level of transportation infrastructure and access to markets.

Variance in consumption, is also found within the Southern highlands and greatly determines the disbursed amount for instance during the agricultural season 2005/06, Mbeya region received the highest total amount of subsidized fertilizer followed by the Iringa, Ruvuma and Rukwa region. There has been much distribution of UREA followed by DAP, CAN, TSP, NPKs and MRP (Figure 14). Of the regions, Rukwa region has generally received less amount of each of the fertilizer distributed. This might be attributed to comparatively less total requirement of the region. In overall, TSP, CAN, NPKs have been availed in smaller quantities compared to UREA and DAP. This might be attributed to farmers specificity of demand in certain types of fertilizers, largely pushed by prices differentials.
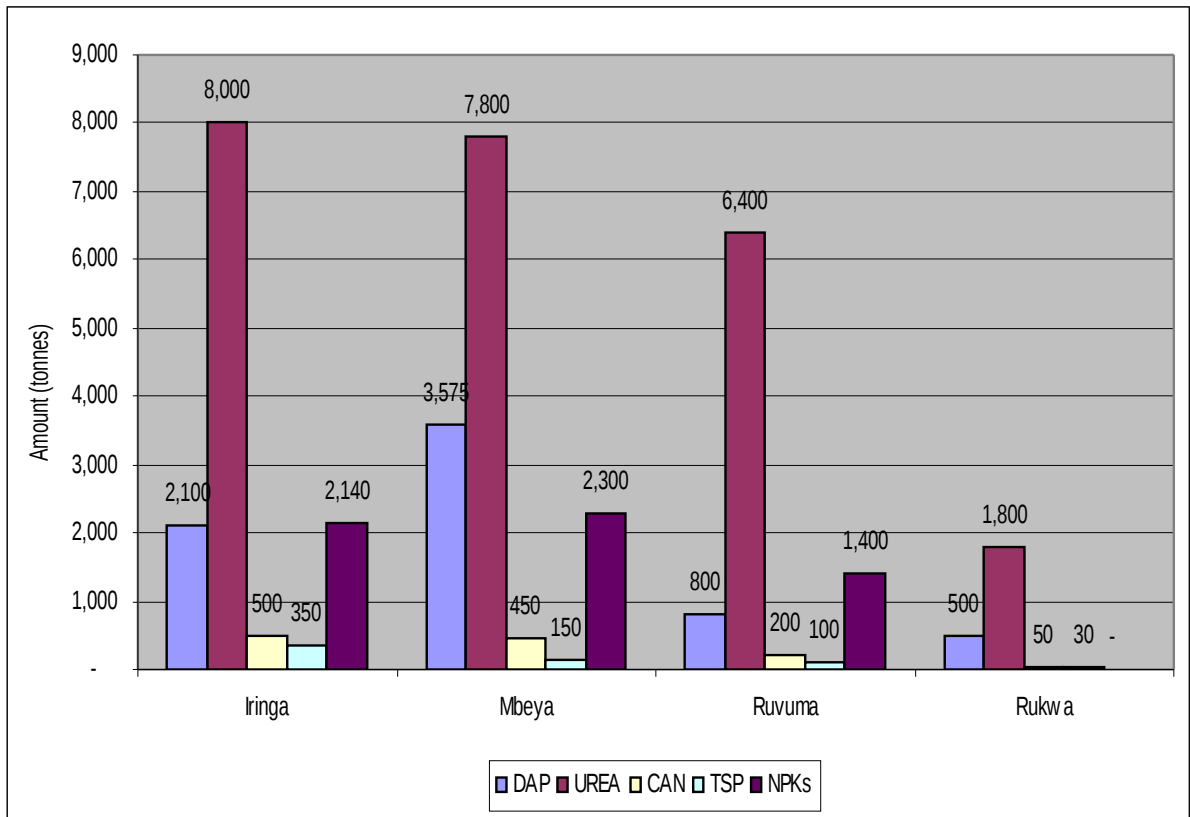
Figure 14. The amount of subsidized fertilizer in the Southern highlands (2005/06)

Source: MAFSC (2006)

The government quest to alleviate poverty is evident through its effort geared to strengthen agricultural sector. In this respect support granted to fertilizer acquisition has increased overtime. For instance, the year 2006/07 saw assistance extended to include other types of fertilizer that were not supported in the past MRP being the citing example. Also, there has been a substantial increase in subsidization for other types of fertilizer particularly DAP, UREA, and CAN (Figure. 15). Studies show that most of fertilizer in the Southern region is used for production of maize and tobacco.
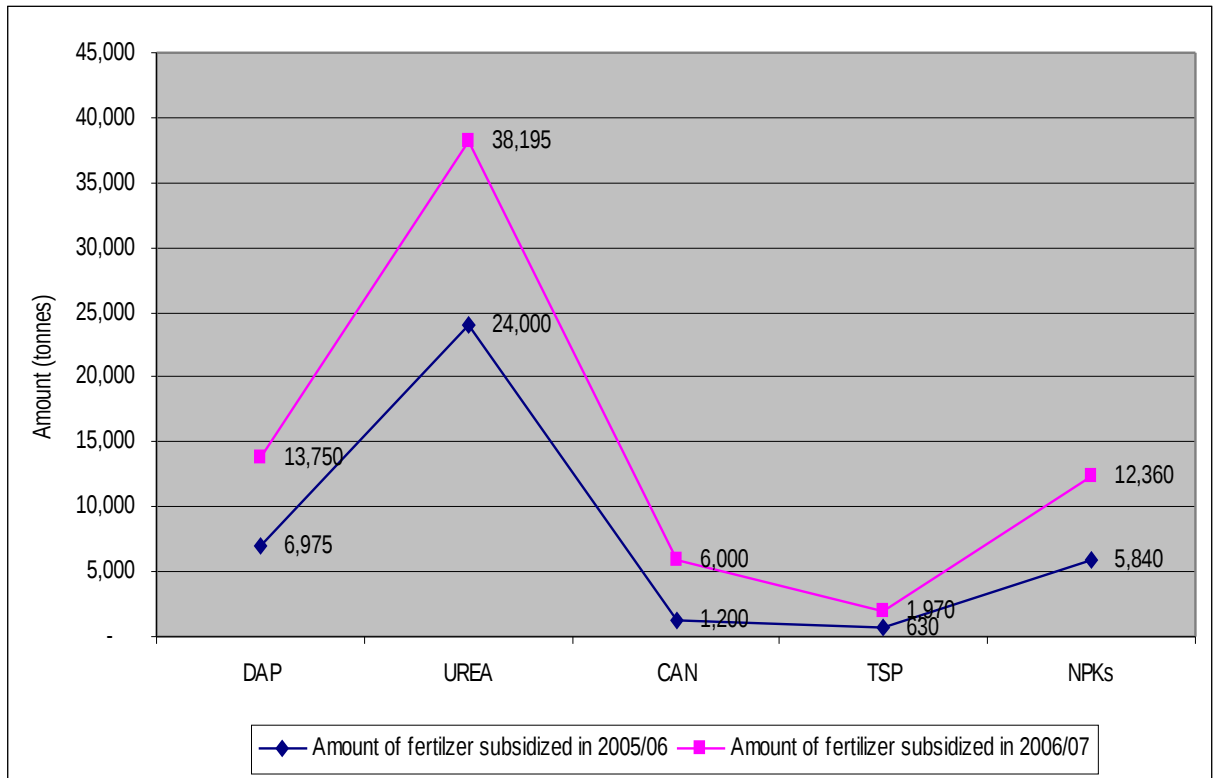
Figure 15. Subsidization trend within the Southern highlands between 2005/06 - 2006/07

Source: MAFSC (2006)

4.1.3   Comparison of market price trends between subsidy and non-subsidy fertilizer

Market price trends of fertilizer availed through subsidy programme and that obtained at competitive markets are shown in Table 5. The price has been increasing at varying rates depending on prevailing market conditions. Larger shifts in market price are found in competitive markets in which case, the increase has been high rates for high analysis fertilizers, mainly due to their nutritive value. For instance,

between 2005/06 - 2006/07 the average price of DAP increased by 17 percent while the increase for other types remained above 4 percent on average. During the same period, the price increase for subsidy fertilizer (with exception of TSP) remained below 3 percent on average.

The combination of such factor as increased price levels and the limited knowledge about fertilizers, cause farmers to make use of the lowly priced fertilizer; which technically in terms of nutrients are more expensive. According to (ICRA, 2006) some distributors and stockists misuse this lack of knowledge and sell low-analysis fertilizers at excessively high prices. Several measures have been adopted to make sure that the subsidy fertilizer is sold at specified prices. Such measures include undertaking monitoring exercises and instruction to supplying companies to label each subsidized bag with a mark "Ruzuku" meaning subsidized.

Table 5   Comparison of price trends between the subsidy and non-subsidy fertilizers (2005/06-2006/07)

Types of fertilizer	Unsubsidized (Tshs/50 kgs)			Subsidized (Tshs/50 kgs)		
	2005/06	2006/07	% price increase	2005/06	2006/07	% price increase
DAP	23 500	27 500	17	17 000	17 500	2.9
UREA	22 000	23 500	6.8	17 000	17 500	2.9
CAN	19 000	20 500	7.9	17 000	17 500	2.9
TSP	19 000	20 500	7.9	17 000	20 000	17.6
NPK 25:5:5	21 000	22 000	4.8	21 750	22 000	1.1
NPK 20:10:10	22 000	23 500	6.8	23 150	23 500	1.5
NPK 10:18:24	24 000	24 500	2.1	24 750	24 500	-1.0

Source: MAFSC, 2006

4.1.4 Stakeholders and their involvement in the fertilizer distribution processes

Different sectors of the economy have different sets of critical actors; input distribution system is not exceptional. They are different actors who are variously involved in the process of input distribution to target destinations. They include Ministry of Agriculture, Food Security and Co-operatives, Local Government Authorities and firms that import fertilizer in the country. The list also includes stockists, who transport fertilizer from regional centers to districts and small towns, commercial banks, research institutes, input transporting companies, storage warehouses and the target farmers.

4.1.4.1 Input manufactures

These comprise of factories involved in the manufacture of farm inputs particularly fertilizer. Due to limited capacity to manufacture fertilizer domestically, foreign market remains to be the only sourcing point available. Majority of fertilizer stocks are brought through shipment from the Middle East and Eastern Europe countries.

4.1.4.2 The role of the central and local government authorities

The Central government which is represented by the Ministry of Agriculture Food Security and Co-operatives provides subsidy through incurring fertilizer purchasing and transportation costs, collects data and information related to fertilizer requirements from all over the

country. It also appoints reputable importing companies that are responsible for purchasing, transporting fertilizer from overseas and distribute to region centers.

The Ministry is further involved setting up minimum criteria importing companies must meet to be legible to undertake transportation activities. Finally, the Ministry compiles inputs related data for harmonization and consolidation purposes. The local government authorities prepare relevant data and information related to kind and total amount of fertilizer requirement annually. They also appoint reputable stockist who will be responsible for delivering fertilizer to target places.

Through the subsidy programme, importers avail and sell fertilizer to the stockist in the target region. After verifying that the transactions between the importer and stockist have actually taken part, the government pays importers accordingly. Government assistance has set subsidization rates that differ across regions depending upon the type of fertilizer and the distance of the target destination from Dar es salaam main port. However, more emphases have been given to DAP, UREA, CAN and TSP fertilizers; due to effectiveness in terms of nutrients.

Transport cost varies depending on the distance from the target destination to Dar es salaam main port. As expected, places located far away would involve higher transportation cost and so requiring more support. For instance, the cost of transporting a single bag of fertilizer up to Rukwa is about thrice that of transporting the same bag to Iringa region. In that case, in order to enable access and remove disparity in market price Rukwa would require more financial support compared to Iringa region. As seen in figure 16, Rukwa region, being much far away from Dar es salaam constitutes the large percentage share of transportation budget which is equivalent to about 26 percent higher than Iringa region.
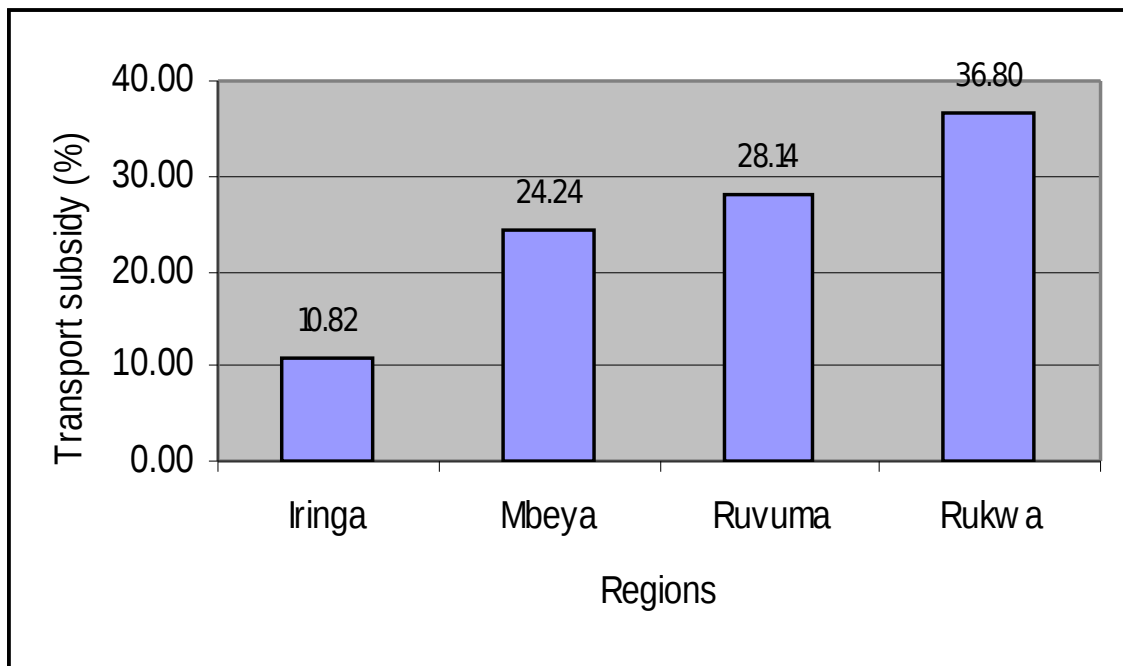
Figure 16. Transportation costs from Dar es Salaam main port as of December, 2006

Source: TFC, (2006)

4.1.4.3   The role of importing firms

Following the implementation of market liberalization policy, fertilizer procurement activities are executed by independent private firms. This is the second important player in the input procurement and distribution process. It comprises of limited number of private firms that execute fertilizer importation activities. Among the companies in this business include; Tanzania Fertilizer Company (TFC), Premium Agro - Chem, Collman (T) Ltd, Shivlal Tank & Co. Ltd (STACO).

Fertilizer importing companies are competitively selected by the government basing on the networking capability, experience in transportation of agro-based commodities and ownership of storage houses. Largest section of the imported fertilizer comes from European countries, Middle and Far East (See appendix 4). The importing companies transport fertilizer through Railway and road means up to the region centers. After reaching regional centers, fertilizer is sold to certified stockists who avail fertilizer to target regions.

In the year 1998/99, twelve companies participated in fertilizer importation. The fertilizer imported included SA, CAN, UREA, TSP, DAP, NPKs and MOP. As seen in Table 6, percentage wise, KR II 1997 imported 15.8 percent of the total amount of annual import, the largest

amount of fertilizer compared to that imported by other companies. It was followed by Premium (11.9 %), Mohamed Enterprises (9.5 %), TLTC (7.5 %), STACO (7 %), TFC (6.5 %) and DIMON (6.2 %).

The combined share of import for the remaining companies (SEIF IMPEX, COLLMAN (T) LTD, BALTON (T) LTD, TFA and RAMWIG) were less than 6 percent of the annual imports. It is also clear from these figures, in that particular year (1998/99) CAN constituted largest share of the total fertilizer import (32 %), followed by SA (20 %), DAP (17 %), UREA (10 %), TSP (4 %) and NPK (0.001 %).

Table 6.   Fertilizer importation by companies in Tonnes (1998/99)

Companies/Types	SA	CAN	UREA	TSP	DAP	NPK	MOP
TFC	5 200	3 000	0	0	0	0	1
Mohamed Enterprises	3 000	2 500	5 000	500	0	0	0
STACO	1 000	4 000	4 000	0	0	0	0
PREMIUM	3 000	2 000	6 500	0	3 000	0	0
SEIF IMPEX	0	0	1 500	0	0	0	0
COLLMAN (T) LTD	700	1 000	0	0	0	0	0
BALTON (T) LTD	500	400	2 300	294	13	0	0
TFA	1 000	0	1 000	0	300	200	0
RAMWIG	0	0	0	0	500	0	0
TLTC	0	0	2 000	0	0	7 500	0
DIMON	0	450	0	0	0	7 400	0
KR II 1997	1 804	4 510	6 314	7 316	0	0	0
TOTAL	16 204	17 860	28 614	9 110	3 813	15 100	1

Source: URT, (2005)

Statistics on fertilizer importation between 1996/97 to 2002/03, reveal a mixed trend, with the highest amount of import being registered in the 1997/98 in which a fertilizer totaling to 157 691 tonnes were imported. The importation trend further show that there has been declining trend in importation since that time up to the year 1999/00, when is started picking up (Figure 17). The year 2001/02 registered the highest amount of import ever recoded for the last three previous seasons. However, this trend was never maintained, as importation declined reaching to 111 025 tonnes in the year 2002/03.
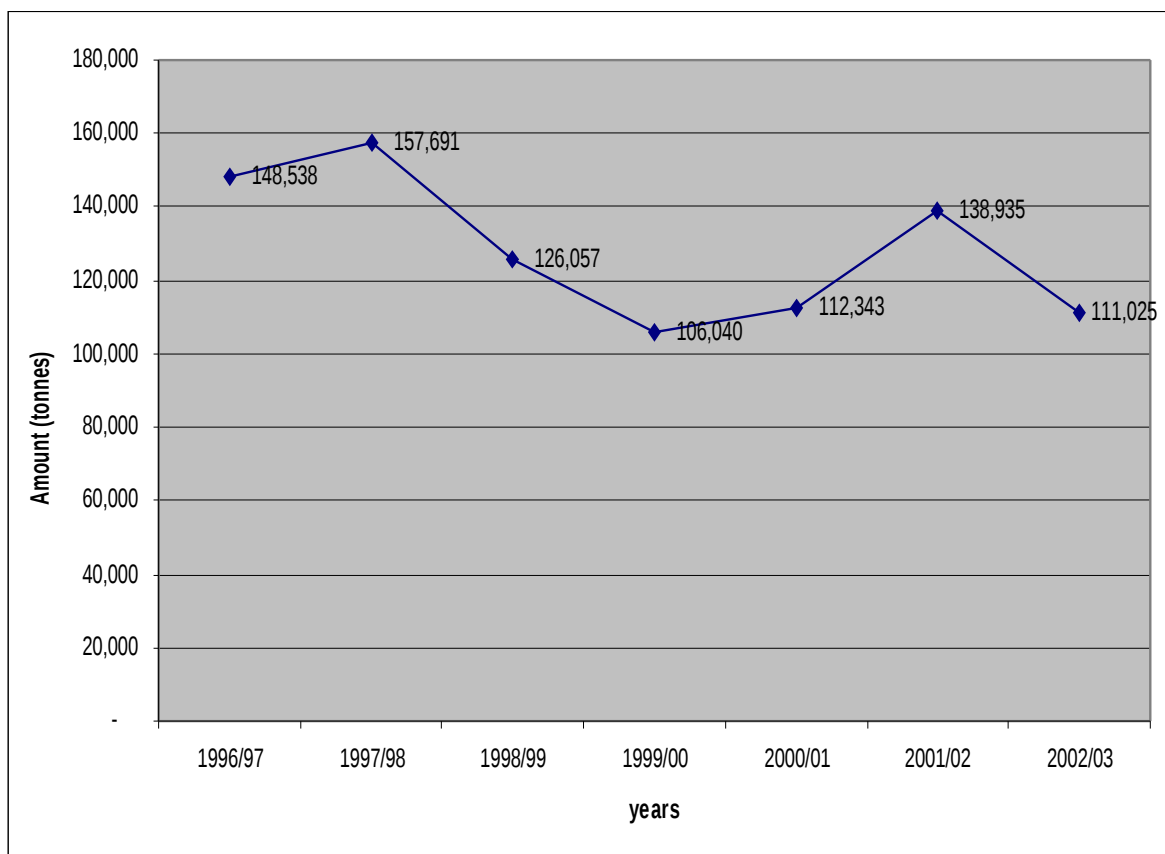
Figure 17. Fertilizer importation trends

Source: URT, (2005)

In the agricultural season 1998/99, twelve importing were involved in fertilizer importation business. A total of 126 057 tonnes of different types of fertilizer were imported. These includes; SA, CAN, UREA, TSP, DAP, NPKs and MOP. Percent wise analysis show that, UREA was at the top of ranking in terms of imported amounts (34.57), followed by CAN (20.36), SA (17.62), while the remaining types (TSP, DAP, MOP and NPKs) had a combined total share of 27.45 (Figure 18).
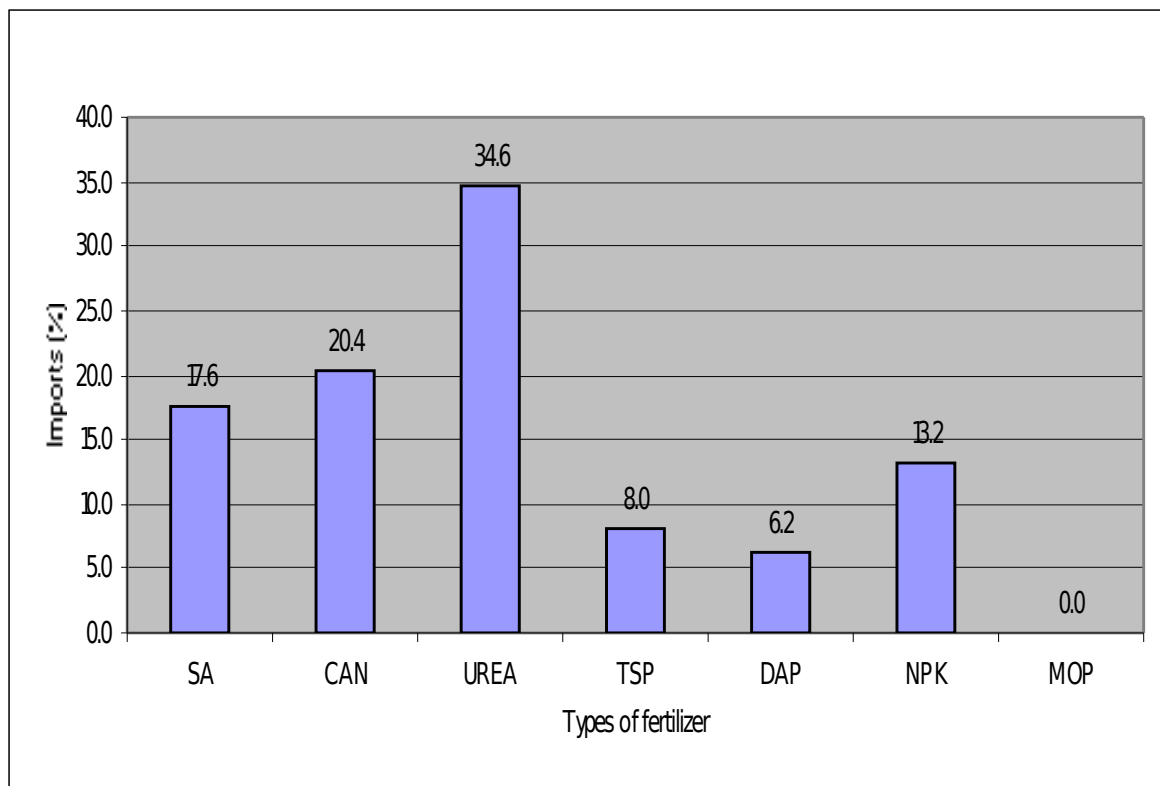
Figure 18. Fertilizer importation by types (1998/99)

Source: URT, (2005)

4.1.4.4 The role of the certified stockist

Formerly, the government through crop boards and cooperative unions was actively involved in input and output markets, including selling of agricultural input such as chemical fertilizers, agricultural chemicals (pesticides and herbicides) and improved seeds. Following implementation of liberalization policies, responsibility of input marketing is now with private leaving the government with the role of providing favourable environment in terms of policy direction. Certified stockists are among the domains of private sector; they have the role of purchasing inputs in bulky from importers and supplying them to districts and small towns. They are competitively selected by respective regional authorities basing on their set criterion. Qualified stockists are required to deliver and sell fertilizer to main target destinations of the country.

4.1.4.5 The role of the commercial banks

The role of Commercial banks is limited to provision of loans on short and long terms basis to key stakeholders. Otherwise banks are not integral part of fertrilizer subsidy programme but provide loans to such as actors as importers, stockists and transporting companies. In this way commercial banks enrich the capacity of other stakeholder to undertake their duties efficiently.

4.1.4.6   The role of input transporting companies

Public and private transporting companies are involved in transporting fertilizer from Dar es salaam main port to target regions. Interested transporters are carefully selected basing on the experience in transportation of agricultural related facilities, the ability to transport large quantities and honest among others. Tanzania and Zambia Railway Authority (TAZARA) is most commonly used transporter used to avail fertilizer in Southern highlands region. Private companies and individual transporting company meeting minimum set criteria for transporters are also legible to carry out the activity.

4.1.4.7   The role of agricultural research stations and
warehouses in the system

Agricultural research institutes include Universities and research centers. These among others carry out agricultural research studies and provide recommendations accordingly, devise new farm technologies. Basically they are centers for innovations and provide guidelines on proper farming practices, type of inputs befitting each agro ecological zone and the appropriate crops that has to be grown in that specific area.

Warehouses are found in the Dar es Salaam main port and region centers. On its arrival to the country fertilizer bags are first stored in the warehouses at the main port before being moved by transporting

companies to regional centers where they are also storage houses. While in region center, fertilizer is stored in the warehouses and then sold to appointed stockist who will be responsible to avail it to farmers. In the southern Highlands Tanzania fertilizer Company (TFC) has warehouses at seven (7) destinations, which are Makambako, Iringa, Njombe, Songea, Tunduru, Mbeya and Sumbawanga.

4.1.4.8 The role of farmers

This is the last group, which comprises of largest number members. Basically, this is the target group towards which all efforts are geared. Farmers purchase subsidized from the premises of the certified stockist. Usually, the market price of subsidized fertilizer will comprise of the price of subsidized fertilizer, transport cost plus a fair profit margin for a transporter.

4.1.5 The relationship linkages between stakeholders

The relationship between actors in fertilizer distribution process is best explained in form of actor diagram (Figure 19). The arrows indicate flow of goods and knowledge in form of information sharing, facilitation, financing, research and development. A hard line depicts a strong relationship, while normal line indicates existence of relatively much less relationship between the actors. The dashed lines indicate the relatively weak relationship between the connected actors.

The government is variously involved in creating favourable environment in terms of setting policies, strategies and plan for agricultural development, instituting legislation and laws to enable actors take full advantage of market opportunities. Local governments are involved in coordination of the activities at local level. A strong link between them in which case information from local governments is used to determine disbursed amounts. Commercial banks play a facilitation role through providing short and long term loans to actors (such as import, stockists and transporting companies) in the system. Close links exist between importers, stockists and farmers; in that the former transport fertilizer up to the regional centers where they sell it to certified stockists who deliver them to farmers.

To ensure input efficiency and effectiveness a feedback mechanism exist to supply information from target beneficiaries to government authorities. The input related data and information obtained from farmers are used to make proper adjustment in the disbursement levels and delivery procedures.

Central
government

Commercial
banks

Private
stockists

Farmers,
Households

Local Government
Authorities
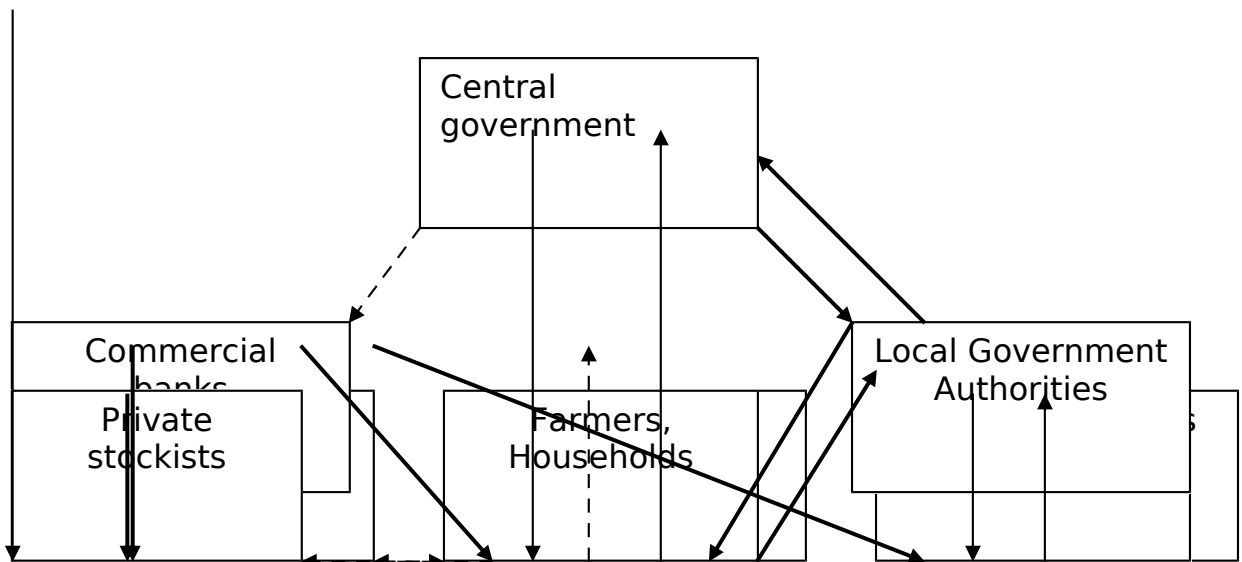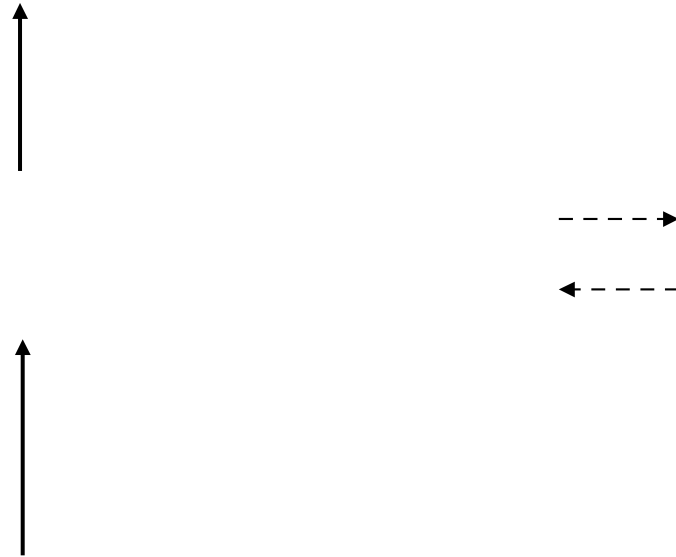
Figure 19. Relationship between different actors in the fertilizer supply chain.

4.2.1 The impact of the subsidy programme on fertilizer consumption levels

Table 7 shows fertilizer consumption levels in the third column and the estimated consumption levels in the fifth column. The estimated values has been obtained by using linear trend regression method. In this case, estimation was done by running an OLS regression of the equation 7 and then substituting the respective values of T which eventually yield the corresponding estimated values. This was done so as to estimate the values of α and β, then estimation was carried out to obtain the value of Xt according to the relationship denoted in the

following equation 7. The estimated consumption values were used to obtain annual growth rate using the relationship shown in the equation 9. Xt was estimated as follows:

$$X_t = \alpha + \beta T \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ 7$$

Where:-

X_t = The estimated fertilizer consumption value;

α = Intercept;

β = Coefficient; and

T = Time.

Table 7   Fertilizer consumption levels

Year	Time (T)	Fertilizer consumption	% change in consumption	Linear trend (X_t)
1995/96	1	157 588		142 379
1996/97	2	148 238	-6	142 101
1997/98	3	158 691	7	141 823
1998/99	4	126 050	-21	141 545
1999/00	5	137 697	9	141 267
2000/01	6	112 343	-23	140 989
2001/02	7	138 935	24	140 711
2002/03	8	111 025	-20	140 433
2003/04	9	125 653	13	140 156
2004/05	10	195 062	55	139 878

MAFSC, (2006)

After running an OLS estimation of fertilizer consumption level presented according to Table 8, we can identify the following relationship:

$$X_t = 142\ 656.8 - 277.9\ T \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots 8$$

$$(18\ 315) \qquad (2\ 951.8)$$

The values in parenthesis are standard errors. The values of estimated X_t which are obtained by substituting time value (T) in equation 8 are presented in the fifth column of Table 8. With the estimated values of X_t, the average annual growth rate can be calculated according to the equation:-

$$r = \left[\left(\frac{X_t}{X_0} \right)^{\frac{1}{t}} - 1 \right] \qquad * \qquad 100\ \%$$

$$\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 9$$

Where X_t and X_0 are the respective estimated values of fertilizer consumption in period t and 0.

(i) Computation of the annual growth rate between 2000/01 – 2002/03

$$r = \left[\left(\frac{X_t}{X_0} \right)^{\frac{1}{t}} - 1 \right] * \qquad 100\% \dots\dots\dots\dots\dots\dots\dots 10$$

Where X_t and X_0 are the respective values in period t and 0, and X_t represents the level of fertilizer consumption in year 2002/03 and X_0 is the level in the year 2000/01. Given Xt = 111 025 and Xo = 112 343

$$r = \left[\left(\frac{111\,025}{112\,343} \right)^{\frac{1}{2}} - 1 \right] * \ 100\ \% = -\ 0.59\ \% \ \dots\dots\dots\dots\dots\ 11$$

(ii)   Computation of the annual growth rate between 2003/04 –

2004/05

Using the formula:-

$$r = \left[\left(\frac{X_t}{X_0} \right)^{\frac{1}{2}} - 1 \ \right] \qquad * \qquad 100\ \% \ \dots\dots\dots\dots\dots\dots\dots\dots\ 12$$

Where X_t and X_0 are the respective values in period t and 0, and X_t represents the level of fertilizer consumption in year 2004/05 and X_0 is the level in the year 2003/04. Given Xt = 195 062 and Xo = 125 653

$$r = \left[\left(\frac{195\,062}{125\,653} \right) - 1 \right] \qquad * \qquad 100\ \% = 55.24\ \% \ \dots\dots\dots\dots\ 13$$

According to results from (i) and (ii), fertilizer consumption was declining at a rate of 0.59 percent per annual during 2000/01 – 2002/03. It was however appreciating at a rate of 55.24 percent per annual from the year 2003/04. Although this period is so short to measure and validate the impact of the subsidy programme, but increased fertilizer consumption that has been noted during this period

gives an early indication that the subsidy programme is making an impact by increasing the fertilizer consumption levels.

Further examination of Table 8; indicate irregular variances in total fertilizer consumption level particularly before 2003/04. For instance sharp surge in consumption level is evident during 1996/97, 1998/99, 2000/01 and 2002/03. General consumption pattern during this period was unimpressive and even when growth escalated it was insufficient and unsustainable. However, some positive shifts in consumption is prevalent in some years especially during 1997/98, 1999/2000 and 2001/02 season.

Conversely sustainable growth rates can be noted from the year 2003/04 onwards. Between 2003/04 – 2004/05, consumption level increased from 125 653 to 195 062 which is equivalent to 55 percent increase; the highest amount over the last decade (Table 8). When looking back at maize production trend, it can be noticed that the increased fertilizer consumption has gone concomitantly with overall increase in maize production capacity.

4.3 The impact of the subsidy programme on maize production levels

4.3.1 Maize production trend

Table 8 presents maize production levels for Southern highlands in the third column and the estimated maize production levels in the fourth column. The estimated values have been arrived at by using exponential regression method. In that case, estimation was done by running an OLS regression of the equation 14 to obtain the values of α and β, and then substituting the respective T values to give the corresponding estimated values presented in the fourth column. The obtained β value was substituted in the equation 15 to obtain the annual maize production growth rate.

Table 8   Total maize production for Southern highlands (2000/01-   2005/06)

Year	Time	Maize production	% change in maize production	Ln trend
2000	1	937	45.89	6.84
2001	2	1367	5.27	7.22
2002	3	1439	-24.39	7.27
2003	4	1088	54.04	6.99
2004	5	1676	-18.97	7.42
2005	6	1358	45.89	7.21

Source: MAFSC, (2006)

According to Table 9, we can identify the following relationship:

$$Ln (X_t) = α + βT \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

14

Then the growth rate is calculated using the equation

r   =   (EXP (β)   -   1)   *   100 % 15

From data in table 10;

Ln (Xt)   =   6.94 +   0.062T   16
                (0.180)   (0.046)

Where in parenthesis are the standard errors.

r   =   (EXP (0.062)   -   1)   *   100%= 6.4 %

According to the equation 16, maize production during 2000 – 2005 was increasing at a rate of 6.4 percent per annual. This result sheds some light that there is great prospect of increasing maize productivity through increasing resource use particularly fertilizer and other improved farming practices.

Close examination of Table 9, depicts an irregular pattern of maize production. For example, during the period 2002 and 2004 maize production declined drastically. It however, improved substantially during 2003 and 2005 to 1 088 000 and 1 358 000 tonnes respectively. Even in some years where production was relatively impressive it was mainly contributed to the expansion of area under production rather than actual increase in resource productivity.

4.4 Challenges of the subsidy programme

The program has also encountered some challenges which need to be addressed; among others includes the problem of fertilizer hoarding. In which case, some unscrupulous traders unlawfully retain fertilizer bags and sell it afterwards at relative high prices than indicative for subsidized ones. This has been a major setback, because it has kept input prices higher despite assistance that is being offered through subsidy.

The programme also encounters a problem of unrealistic estimation of quantities demanded by some regions. In practice, LGAs, are responsible for compilation of regional requirements and then send information to higher levels. But, they are complains that often times the figures are too high to be realistic. In that case, delaying other procedures for prompt disbursement through check backs.

Transporters complain about unrealistic estimation of transport costs; leading to low amount being disbursed. Due to rise in fuel price and weakening of local currency there has been an increase in the transports cost but the amount of subsidy for fertilizer transportation has remained below the real price. Poor infrastructure in terms of especially in terms of roads increases operation and maintenance costs, and thus erode transporters capacity to provide services efficiently.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The major objective of the study was to analyze supply chain of agricultural inputs in Tanzania using subsidy fertilizer in the Southern highlands as a case study In view of this broader objective, it was hypothesized that there is a significant difference in fertilizer consumption before and after the inception of subsidy programme and that there is existence of significant difference in maize production before and after the inception of subsidy programme.

Moreover, close examination of the obtained results reveals substantial increase in fertilizer consumption especially after the inception of the subsidy programme. Empirical analyses have indicated a decline in fertilizer consumption during the entire pre – subsidy period. However, during post subsidy period the both fertilizer consumption and production level increased significantly. These results conform to earlier results obtained by (Mwakalobo, 1998) who observed deviations from optimal fertilizer use before and after the complete removal. In light of the observations it can be concluded that high prospect of increasing production and income level exist particularly if much emphasis is placed in effective input use.

It is however crucially important to remember that the use of fertilizer should not be in isolation. This is because due to the nature of agricultural production being subject to natural phenomena such as weather and its dependency on other sectors of the economy such as infrastructure and marketing mechanisms. These factors are equally important to influence the farmers capacity to adopt and make use of improved farming technologies that would eventually enhance high level of productivity. Some of the other factors as described by (Mbiha, 1998) include the differences in resource and biophysical conditions, farming systems, technology kevel and tenure arrangements.

5.2 Recommendation

In general, there is quite an enormous potential to be tapped from the current fertilizer distribution process especially if some notable emerging discrepancies will be properly addressed. It is indubitable that distribution process under the programme has facilitated cost reduction and eased inputs access by majority. Rising concerns especially on the programme adequacy to serve people with varying socio economic status, inevitably calls for better review of the programme. With the existing distribution in place, there is possibility of sidelining some communities especially those living in remote areas of the country from enjoying the benefit offered by the programme.

(i)   There has been limited involvement of social economic groups particularly at community level. In light of this observation, it is recommended that review measure be undertaking so that such groups are involved in one way or the other in the distribution process. Involvement of such groups could help increase the economies of scale by reducing associated marketing costs through bulky input procurement and disbursement. Normally, transport cost constitutes the largest share of final marketing price, such cost are significantly reduces through measures such as bulk procurement. In effect it reduces the unit cost, saves family extra income that might be diverted some other uses for economic development. Among such groups includes saving and credit Associations (SACCOs), SACCAs, and other similar associations. A development intervention that involves people right from the grass root level, has the advantage of having lasting impact and facilitates economic analysis of such an intervention.

(ii)   Promoting simple soil conserving technologies; including the use of "*marejea*" plant for soil enrichment. "*Marejea"* plant is among the cheapest form of technology available to increase resource productivity. It basically, improve soil aeration capacity and restores fertility through natural nitrogen fixation process.

Despite the fact that it is cheap form of technology available, it also requires minimal supervision level.

(iii)   Punishment has to be imposed to firms and other business entities that are reluctant to abide to set rules and regulations and deliberately operate in ways that jeopardize community development. Enforcing such measures could help enhance compliance level and facilitate the smooth input distribution process across the country.

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APPENDICES

Appendix 1.   Programme strengths, weaknesses, opportunities and threats

	strengths	weaknesses	opportunities	threats
1	Stimulates increased farm productivity.	Higher estimation of the actual fertilizer requirement by the local authorities.	The increased farm output may act as a catalyst to intensive cultivation.	Changes in country's macroeconomic policy.
2	Proper management enhances input accessibility through reduction in general price level.	Stimulate fertilizer hoarding (i.e. traders selling subsidized consignments at competitive price rates).	The decrease in input price, *ceteris paribus* translates into increased farm gate price.	Lack of proper pricing controlling measures.
3	Enables further expansion of area under cultivation.	Could lower farm productivity especially when inappropriate rates are being applied.	The increased land under cultivation means more fertilizer will be required.	Changes in country's macroeconomic policy.
4	Raises farm income levels.	Deterioration of income levels emanating from inefficiencies in other sectors such as education, infrastructure.	The increased farm income levels may act as a catalyst to intensive cultivation.	Compliance of actors particularly transporters to specified terms and conditions.
		Depletes the ability of importing companies to carry out its activities efficiently, because fertilizer transportation costs has remained below the real price.		

	strengths	**weaknesses**	**opportunities**	**threats**
5	Enable marginal lands to be put into agricultural production.	Might tempt people in areas with comparative disadvantage to engage in farming despite leading to losses.	Availability of abundant cultivation fields/land.	Changes in country's macroeconomic policy.
6	Facilitate economies of scale due to bulky fertilizer shipment.	The decision to avail the consignments in target areas rests upon the transporter, thus imposing some risky situation.	Diversification and intensive agricultural production.	Changes in country's macroeconomic policy.
7	Stimulate increased fertilizer use. For instance the annual consumption in 1994/95 was 91 303 tonnes, before rising to 111 053 tonnes in 2004/05 season.	Marketing activities such as transportation are normally associated with higher transaction costs, due to rise in fuel price and weakening domestic currency.	Diversification and intensive agricultural production.	Changes in country's macroeconomic policy.
8	Relatively minimal handling/storage costs.	Underestimation of the transport costs, leading to low disbursement.	Intensify agricultural production.	Changes in country's macroeconomic policy.
				Compliance of actors to the specified terms and conditions.

Appendix 2.   Total fertilizer consumption in metric tonnes (1980/81-2005/06)

	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Dev. countries fertilizer consumption	65.40	67.46	67.62	64.80	70.24	76.63	80.19	82.95	85.39	88.07	84.29	88.07	94.62	97.80	106.13	107.40
Percentage change (%)	-	3.15	0.24	-4.17	8.40	9.09	4.65	3.44	2.94	3.14	-4.29	4.49	7.44	3.36	8.52	1.19
Africa fertilizer consumption	2.56	2.48	2.51	2.77	2.51	2.24	2.53	2.51	2.56	2.64	2.54	2.72	2.94	2.77	2.89	2.59
Percentage change (%)	-	- 3.13	1.21	10.36	-9.39	-10.76	12.95	-0.79	1.99	3.13	-3.79	7.09	8.09	-5.78	4.33	-10.38

NB: Base Year 1990/91
Source: IFA (2006)

Appendix 3.   Details of the subsidized fertilizer for Southern highland region (2005/06)

Main Centers	Type of fertilizer	Price of subsidized fertilizer (per 50 kg)	Transport Cost (per 50 kg from Dsm)	Subsidy rate (per 50 kg)	Subsidy rate (%)
Iringa	DAP	17 000.00	1 500.00	8 000.00	47.06
	UREA	17 000.00	1 500.00	6 500.00	38.24
	CAN	17 000.00	1 500.00	3 500.00	20.89
	TSP	17 000.00	1 500.00	3 500.00	20.89
	NPK 25:5:5	21 750.00	1 500.00	750.00	3.44
	NPK 20:10:10	23 150.00	1 500.00	750.00	3.24
	NPK 10:18:24	24 750.00	1 500.00	750.00	3.03
Makambako	DAP	17 000.00	1 800.00	8 300.00	48.82
	UREA	17 000.00	1 800.00	6 800.00	40.00
	CAN	17 000.00	1 800.00	3 800.00	22.35
	TSP	17 000.00	1 800.00	3 800.00	22.35
	NPK 25:5:5	21 900.00	1 800.00	900.00	4.11
	NPK 20:10:10	23 300.00	1 800.00	900.00	3.86
	NPK 10:18:24	24 900.00	1 800.00	900.00	3.61
Mbeya	DAP	17 000.00	2 400.00	8 900.00	52.35
	UREA	17 000.00	2 400.00	7 400.00	43.52
	CAN	17 000.00	2 400.00	4 400.00	25.88
	TSP	17 000.00	2 400.00	4 400.00	25.88
	NPK 25:5:5	22 200.00	2 400.00	1 200.00	5.40
	NPK 20:10:10	23 600.00	2 400.00	1 200.00	5.08
	NPK 10:18:24	25 200.00	2 400.00	1 200.00	4.76
Songea	DAP	17 000.00	2 650.00	9 150.00	53.82
	UREA	17 000.00	2 650.00	7 650.00	45.00
	CAN	17 000.00	2 650.00	4 650.00	27.35
	TSP	17 000.00	2 650.00	4 650.00	27.35
	NPK 25:5:5	22 325.00	2 650.00	1 325.00	5.94
	NPK 20:10:10	23 725.00	2 650.00	1 325.00	5.58
	NPK 10:18:24	25 325.00	2 650.00	1 325.00	5.23
Rukwa	DAP	17 000.00	4 250.00	10 750.00	63.24
	UREA	17 000.00	4 250.00	9 250.00	54.41
	CAN	17 000.00	4 250.00	6 250.00	36.76
	TSP	17 000.00	4 250.00	6 250.00	36.76
	NPK 25:5:5	23 125.00	4 250.00	2 125.00	9.18
	NPK 20:10:10	24 525.00	4 250.00	2 125.00	8.66
	NPK 10:18:24	26 125.00	4 250.00	2 125 .00	8.13

Appendix 4.   Countries sources of subsidized fertilizer

Types of fertilizer	Country of origin
SA	Belgium Germany Italy Spain Romania South Africa
UREA	Saudi Arabia Qatar UAE Kuwait Egypt Indonesia Peoples Republic of China Ukraine Russia Romania
CAN	Finland Romania Russia Ukraine Greece West German South Africa
Phosphates (TSP, SSP, DAP, MAP and MRP)	USA Jordan FSU South Africa North Africa Tanzania
Potash	North Eastern Europe North Western Europe middle East FSU
NPKs (Complex/Compound types)	North Eastern Europe North western Europe FSU states USA East European States

Appendix 5.   Maize average wholesale prices in major regional wholesale   markets (Tshs/100kg)

Region	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03
Arusha	7120	9567	9672	14728	11897	12282	10588	11372
Dsm	12423	11747	14253	17630	13123	14603	12209	11050
Dodoma	7681	8850	10357	14869	10642	9931	10115	11370
Iringa	7333	8737	10078	13931	10974	9944	12682	11934
Songea	6311	7434	9094	12543	8499	7737	11576	10351
Mbeya	7154	7028	8459	12229	8156	6163	13212	11828
Morogoro	12051	11578	11935	17443	10739	10450	11919	12207
Moshi	8606	10783	6962	14610	12542	11536	8722	11594
Mwanza	9445	11674	17530	15004	12470	11038	9659	12657
Shinyanga	7505	10328	15309	14614	11411	9137	9396	10964
Singida	6741	6278	10266	15554	9405	9923	9766	9721
Rukwa	6697	6040	8203	10660	6234	5489	11216	11515
Tanga	9915	11374	8889	0	11649	9911	6490	11629
Tabora	7498	8904	15490	15990	10746	8098	7191	11974
Mtwara	10838	11027	9958	18610	12357	13180	15511	12487
Lindi	10534	12231	9700	15600	11381	12955	10481	10350
Mara	9299	13150	16549	15025	14027	12946	4863	14866
Bukoba	8658	15200	18018	14941	14117	11921	5490	14651
Kigoma	9832	9060	13687	13614	11270	9537	4573	12337
Total	165641	190990	224409	267595	211639	196781	185659	224857

URT, (2005)

Appendix 6. **Distribution of subsidized fertilizer by regions (2005/06)**

Regions/Type	Subsidized amount (tonnes)	% subsidized amount
Iringa	13 090	20.50
Mbeya	14 275	22.36
Ruvuma	8 900	13.94
Rukwa	2 380	3.73
Kagera	300	0.47
Mwanza	400	0.63
Mara	460	0.72
Shinyanga	400	0.63
Tabora	8 190	12.83
Kigoma	1 140	1.79
Dodoma	150	0.23
Singida	330	0.52
Arusha	3 450	5.40
Manyara	1 930	3.02
Kilimanjaro	3 665	5.74
Dar es salaam	530	0.83
Coast region	480	0.75
Morogoro	2 810	4.40
Tanga	680	1.07
Lindi	70	0.11
Mtwara	210	0.33
TOTAL	63 840	100