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Sunflower Production and its Contribution to Poverty Reduction in Singida District, Tanzania

by

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ABSTRACT

This study aimed at assessing the contribution of sunflower production to poverty reduction in Singida district. Specifically it was intended to examine production trends of sunflower in the study area, determine factors affecting sunflower production, determine income earned at household level through sunflower production, compare income earned from sunflower production with other economic activities and analyze dynamics of inter-linkages of productive sectors in commodity value chain of sunflower. The study was carried out in four wards and eight villages. A cross-sectional research design was applied in this study in the process of collecting data from various actors along sunflower value chain. Both SPSS and SAS were employed during data analysis.

The study revealed that the levels of yield of sunflower seeds in Singida district were increasing with years except for the year 2006/07. At the same time the acreage were also increasing but not as step as the levels of yields. The findings indicate that 76. 1% of respondents ranked sunflower as a major cash crop in the area. The results indicate that 51.4% of respondents indicated that sunflower is important in generation of household income and thus be able to meet various expenses related to schools, health, food shelter etc. The study findings revealed that the production of sunflower in surveyed villages among other factors it is strongly affected by unreliable or regularly fluctuating prices of sunflower products (60.9 %) and unreliable market (55.8 %). The results show that 22.7% of respondents indicated that their household earns about Tshs 100,001 - 200,000 per year while 21.2% earns from 200,001 – 300,000. It was noted further that about 6.1% of respondents reported their household to earn about 400,001 – 500,000 per year while another 6.1% of respondents reported to have an income of more than 1, 000,000 per year. In terms of income generation, the findings indicates that among the agricultural activities performed in Singida district, sunflower production ranks second to livestock keeping where the mean income is 414.015.20 compared to Tshs 572,288.9 of livestock keeping.

The findings shows that the quantities processed were increasing with years. Stiff competition from traders (75 %) importing similar products especially edible oil, price fluctuation of raw sunflower (75%), unreliable market (75%), and unreliable supply of raw sunflower (80 %) identified as the main factors which affect the performance of processors in the study area. Regarding business activities performed by sample

traders in Singida districts it was observed that retailers appeared to be the dominant group (48%) while wholesalers were 16 % and 36 % sold as both retailers and wholesalers. Fresh raw sunflower was the main form of sunflower products sold by 66.7% of sampled farmers in the study area. Analysis of variance for actual quantities of raw sunflower marketed by sample farmers and their prices indicate that there were significant differences for amounts sold in various years ($P < 0.001$) and between the wards ($P < 0.05$). Quantities sold by farmers were increased from mean 21.6 bags in year 2005/06 to mean 37.2 bags in year 2009/10. The prices of raw sunflower were significantly ($P < 0.001$) influenced by the year of production. Study findings revealed that the prices per a bag of 70 kg were increasing with years. In year 2009/2010 the mean price was highest (24 821.1 Tsh.) while it was lowest (14 966.5 Tsh.) in year 2005/2006. However the prices received by farmers did not differ significantly between the wards. Quantities of sunflower oil and sunflower cakes processed and their prices were significantly ($P < 0.05$) influenced by year. The mean prices of sunflower oil and sunflower seed cakes sold by processors were 1480.4/= and 2700.7/=, respectively. In terms of traders, it was observed that for both products, prices were increasing with business years. The most critical problem according to majority of traders was low market prices for their product which accounts for 72 %. This was closely followed by unreliability of market (60 %).

The study revealed that sunflower production in Singida districts is dominated by smallholder farmers. Because of limited storage capacity and market information, majority of them normally sell their products right after the harvest instead of selling it at competitive prices at later stages. The processing of sunflower in study area includes bulking, seed crushing and refining. However majority of them are involved with seed crushing and bulking only. The pressing machines in the sunflower chain act as market place for all forms of sunflower products. Privately owned processing machines are buying places for sunflower seeds from farmers, and also selling points for sunflower oil. In addition farmers and traders who pressed their seed into sunflower oil also sell their oil in these premises especially when there was a ready buyer. Seed cakes which are retained by the processor are sold to, traders dealing with livestock feedstuff, livestock farms and individual households which keep livestock.

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CHAPTER ONE: INTRODUCTION

1.1 Background Information

In Tanzania, agriculture continues to be the main backbone of the economy of most of the rural population. According to URT (2008) over 80%Tanzanians live in rural areas where agriculture and the use of natural resources are crucial to their livelihoods. Generally agriculture contributes about 26 % of the country's GDP and 14.3 % of the foreign exchange earning comes from agriculture (URT 2008). The sector employs more than 80% of country's labour force mostly from the rural areas. This means that agriculture if well managed is a major reliable source of poverty reduction and improving livelihoods of many Tanzanians.

However, small scale farmers in Tanzania are facing various problems as their fellow small scale farmers in Africa and worldwide in general. Most small scale farmers in the world, including Tanzania, experience low standard of living. This is largely due to their inability to attain recommended levels of income from their productive activities due to low productivity and subsequent low income (Wambura and Kapinga, 2007). The small scale farmers are faced by problems like low priority accorded to agriculture in public resources allocation and disbursement, poor rural infrastructure, farmers' limited capital and access to credit, inadequate support services, weak and inappropriate legal framework and tenure and tax policy. Also the current national crop marketing system does not guarantee returns to offset production costs and hence discourages small scale farmers who constitute the bulk of producers in this sector. Even the few large commercial farmers in the country are discouraged by the government policies on agriculture. This multitude of problems hampers growth of the agricultural sector (MAFS, 2001).

In Singida Region rural livelihood is detracted by high level of poverty. This situation calls for deliberate efforts to address the problem so as to improve the livelihood in the region. To address the problem, the Regional Government has taken various steps including promotion of cash crops. Among the cash crops which have been given high priority as potential crop for reducing poverty and improving livelihoods of Tanzanians in this region is sunflower (*Helianthus annuus L.*). This crop is one of the most important oilseed crops in Tanzania. The crop is adaptable over a wide range of environments and therefore it is widely cultivated in Tanzania. The crop is popular in the Eastern, Central, Northern and Southern Highlands of Tanzania. Sunflower is gaining popularity and current data shows that local production of both factory and home extracted oils contributes to about 40% of the national cooking oil requirement with the remaining 60% being imported (ARI 2008).

Due to its low level of cholesterol, sunflower oil is highly preferred as cooking oil for many households in the country since it is much safer for human consumption. Studies have indicated average income per acre to be Tshs 859,520/= with a profit margin of Tshs 479,520/= per acre (Mpagalile, 2008). Furthermore processing machines for oil pressing creates jobs and thus contributes to reducing unemployment among youths. Although increase of income per acre has been reported, income earned at household level with consideration of value chain of sunflower production is not well established. Understanding of value chain could assist in developing strategies which could lead to households earn more income and hence realisation of poverty reduction goals.

Hence this study aimed at investigating the relationship of socio-economic characteristics of sunflower farmers and their roles in sunflower production, reasons and the importance of sunflower production in the study area, income earned from sunflower production and other economic factors affecting production of sunflower in the study areas.

1.2 Statement and Significance of the study

Sunflower production has emerged as a major source of income in Singida Region. The regional government launched a campaign to promote production of the crop so as to alleviate the poverty situation in the area. Therefore, processing machines for oil pressing have created jobs hence reduced unemployment rate to youths. Despite this development, no information is available on how sunflower production has contributed to poverty alleviation at the household level. In addition, limited studies on value chain of sunflower production have been conducted. Inadequate knowledge on the value chain of this crop limits decision making with regard to raising incomes at the household level. However, the existence of a number of major sunflower processing plants in the Central Zone provides sunflower producers with local market outlets for the crop, and helps ensure the long-run viability of the sunflower enterprise in the region. The reliable sunflower value chain and other related agricultural products are not yet well-developed which is important tool for promoting sustainable production at smallholder farmers' level. Through commodity value chain, different actors within value chain have greater chances to ensure sustainability of their businesses. However, the challenge lies in the ability to transform efficiently and effectively the resources into goods and services that can be availed to the market at competitive prices. This knowledge gap is largely perpetuated by the lack of knowledge relating to the costs and risks embedded at different points in the value chain of the agricultural commodities. Therefore, there is a need of studying and analysing the sunflower value chain so as to understand what part of the added value remains with the producer, at household level and/or the local economy? Better understanding on this issue could lead to strategise

actions that could enhance sunflower production and its contribution to poverty reduction at household level effectively and efficiently. It is only through enhancing income at household level, efforts to address poverty could be attained. It is now evident that, gathered information on sunflower value chain could lead to having answers on questions like: which part of the added value is gained in what part of the economy? How does sunflower production contribute to alleviation of poverty at household level? And what other economic activities besides sunflower are important for poverty alleviation at household level?

1.3 Research Objectives

- Overall objective of this study was to assess the contribution of sunflower production to poverty reduction in Singida Region.

- Specifically, the study aimed to:

- Examine production trends of sunflower in the study area;

- Determine factors affecting sunflower production;

- Analyze dynamics of inter-linkages of productive sectors in commodity value chain of sunflower;

- Determine income earned at household level through sunflower production;

- Compare income earned from sunflower production with other economic activities.

1.4 Research Questions

- This study was guided by the following research questions:

- What is the production trend of sunflower production in Singida district?

- What are the major factors affecting sunflower production?

- What is the dynamics of inter-linkages of productive sectors in value chain of sunflower production

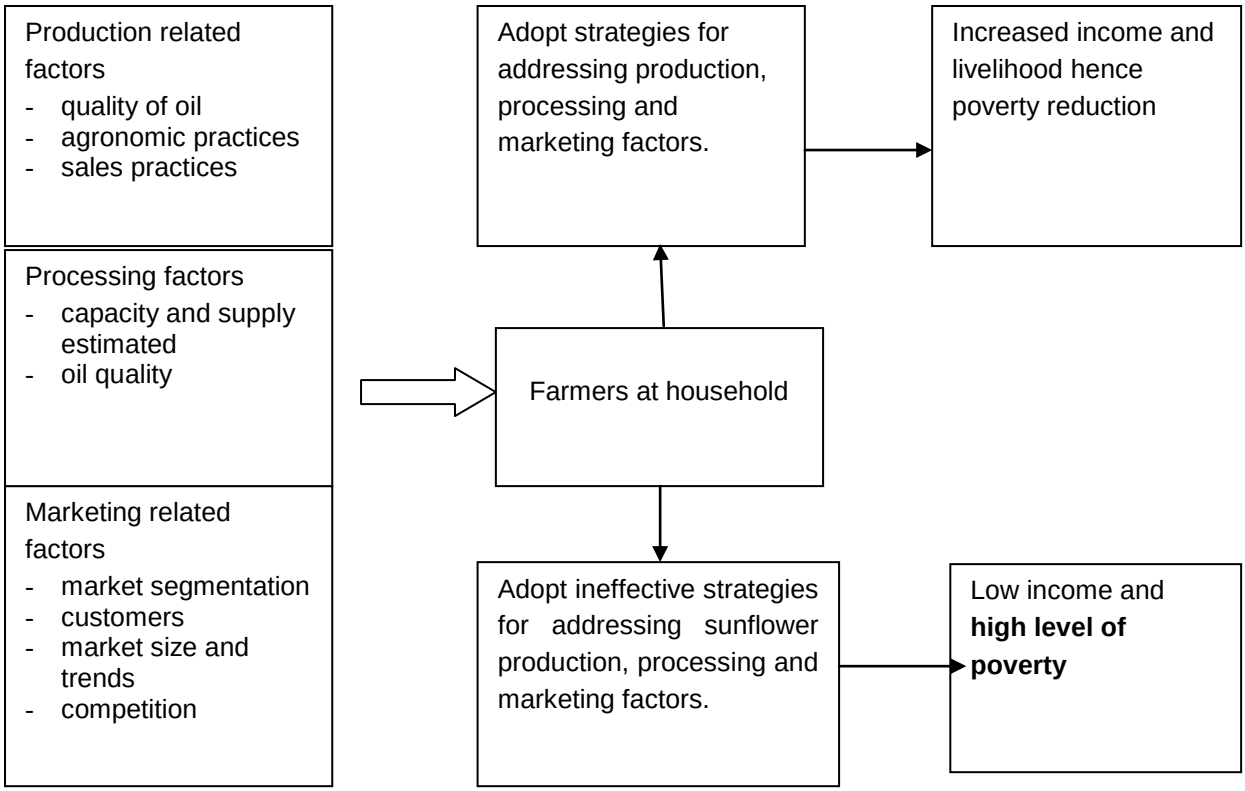
- What is the income earned at household level through sunflower production?

- What is the proportion of income earned through sunflower production when compared to other important economic activities?

1.5 Conceptual Framework

Sunflower production is one of the economic activities that if properly managed can contribute so much to poverty reduction and hence improve community livelihoods. Many studies has indicated that households income earned from sunflower production could be increased if the production, processing and marketing related factors are managed appropriately (Hawassi et al. 2011) Factors included under production related factor are quality of oil, agronomic practices and sales practices. Under processing factors are capacity and supply mismatched and oil quality while marketing related factors are marketing segmentation, customers, market size and trends as well as competition. Based on the aforesaid, households that would adopt effective strategies for addressing the aforesaid factors they are likely to increase income from the crop and thus improve livelihood. This implies that addressing the factors has added value to the value chain of sunflower. On the other hand, households that would not adopt effective strategies their income will continue to be low and hence increase on poverty level.

Figure 1: Sunflower production and poverty reduction in Singida District



CHAPTER TWO: THEORETICAL BACKGROUND AND LITERATURE REVIEW

2.1 The Concept of Poverty

Poverty is a form of deprivation. It exists when there is lack of the means to satisfy critical needs. Poverty may be absolute or relative. The definition of absolute poverty focuses on the inability of an individual or household to consume a certain minimum of basic needs, while that of the relative poverty compares the welfare of those with the lowest amount of resources with others in the society (Ogwumike, 1996). Basic needs are universal; they cut across cultural, social, racial, and other differences or barriers. They are thus common to humanity (Ogwumike, 1987). Ali (1992) believes that a family is poor, if it spends a very high percentage of its income on basic needs such as food, clothing, housing, health care and transport with very little left for a rainy day.

Absolute poverty has also been characterized by low calorie intake, poor housing conditions, inadequate health facilities, poor quality of educational facilities, low life expectancy, high infant motility, low income, unemployment and underemployment. Absolute poverty refers to people who live below the poverty line; people who are, in this category, unable to meet basic needs (Olowononi, 1982). Ogwumike (1991) defined relative poverty in terms of the bottom 10% or 15% of the income distribution. Relative poverty refers to a situation in which some households are not absolutely poor but are less rich than others in term of income, poverty and other resources. The Organization of Economic Co-operation and Development (OECD) defined as poor those households who earn less than two-third of the average disposable income in the country. However, the World Bank (1977) defines relative poverty as existing where household have a per capita income of less than one-third of the average per capita income of the country concerned.

Differentiation should, however, be made between temporary and chronic poverty. The transient poverty, otherwise known as poverty of the hopeful, is temporary. It may arise from theft, drought, war, flood or fire. The victims are poor in the short-run. The unemployed as a result of economic recession fall into this group. Chronic poverty on the other hand is long term and persistent. Its causes are largely structural. Chronic poverty may be transmitted from one generation to another and it is very persistent (Ogwumike, 1995).

2.2 Poverty Reduction and Pro-Poor Growth

Poverty reduction is about improving human well-being (the life people live, what they can do or cannot do); in particular that of the poor people (Kakwani and Pernia, 2000). Broadly speaking, pro-poor growth can be defined as one that enables the poor to actively participate in and significantly benefit from the economy, economic growth inclusive. It is such that no person in society is deprived of the minimum basic capabilities. For instance, everyone should be adequately nourished, no child should be allowed to die prematurely, and the populace should live satisfying lives with long life spans.

The poor have much lower well-being than the non-poor because they lack the resources to satisfy the minimum basic necessities of life (Kakwani and Pernia, 2000). The market forces induced growth process generally benefits the non-poor proportionally more than the poor. This is because the non-poor have inherent advantages like human and material capital in a market economy. Moreover, in many countries, government knowingly or unknowingly adopts policies that are biased in favour of the rich. Consequently, the gap in well-being between the poor and non-poor tends to persist, if not widen. Thus to foster the overall well-being of the populace, government needs to pursue policies that will reduce this gap.

Promoting pro-poor growth requires a strategy that is deliberately biased in favour of the poor so that the poor benefit proportionally more than the rich. Such an outcome would rapidly reduce the incidence of poverty so that those at the bottom end of the distribution curve of consumption would have the resources to meet their minimum basic needs. A pro- poor growth strategy entails the removal of institutional and policy-induced biases against the poor as well as the adoption of direct pro-poor policies. For instance, discrimination on grounds of gender, ethnicity, and religion hurts the poor more than the rich; the same can be said of artificial barriers to entry into certain trades and professions, or into the formal labour market in general.

Macro policies that tend to constrain pro-poor growth include policies as overvalued exchange rates, big-city-oriented industrial location policies, and public infrastructure spending biases toward urban areas and against the welfare of the poor such as monopoly powers enjoyed by some firms that result in high prices, subsidized public utilities (for example, low water fees), state universities (low student fees) that benefit primarily the non-poor, and housing policy (rent control) that limits housing supply.

Direct pro-poor policies are also required. These include adequate public spending for basic education, health and family planning services, improved access to credit, and the promotion of small and medium enterprises. A well-administered progressive tax system is also pro-poor. Typically, this means a heavier reliance on personal income taxation, which is progressive rather than on indirect taxation, which is regressive. Unfortunately, in many developing countries revenue generation depends much on indirect than on direct taxes.

2.3 Poverty Alleviation

Attempts to eradicate or mitigate poverty are not new; legislation and community efforts to assist the poor are reported at least as far back as biblical times. Poverty exists and has existed in every country, and the struggle against poverty has been just as widespread (Lander, 1993). Poverty reduction lies at the heart of development discourse and practice (Jackson 1997). Approaches to poverty alleviation require the implementation, of mutually consistent and reinforcing multifaceted packages of policies plans and programmes.

2.3.1 Micro and Macro Based Policy Intervention

Policy intervention aimed at poverty alleviation could be both micro and macro based. Micro involves using the household as the basic unit of analysis while macro is based on economy wide policies.

Poverty alleviation strategies could involve increasing the quality and productivity of assets by the poor, such policies include, land reform policies that redistribute land to the poor, investment in nutrition and health which improve the productivity of labour, and provision of educational services (including adult literacy) that improve both the quantity and quality of human capital. Others include policies aimed at factor and commodity markets, which aim at enhancing the real earning/income of the poor. Growth strategies that are labour intensive can be used to raise real wages for the poor. This however depends on how the labour market works. If barriers to employment of the poor are high, it is not likely that an increase demand for labour will raise the real income of the poor.

Price increasing strategies which work through commodity market aims to raise the prices of goods produced by the poor. This implies that increase in trade of agricultural products sold by the poor should be of benefit to them. These benefits should be such that leads to marketable surplus. This increase should also increase the demand for landless labour.

Finally, policies can be aimed at increasing the volume of sales of services from assets owned by the poor. As such, the focus is largely on development policies, which do the following, increase the absolute and relative demand for unskilled labourer; institutional changes access by the poor to high productivity jobs. Most importantly, strategies, which focus on agriculture light manufacturing and services, tend to increase the demand for unskilled labour.

2.3.2 Government Actions on Poverty Reduction

Since independence in 1961, the government of Tanzania has had poverty eradication as one among many of its main goals. One of the intervention measures suggested is the introduction and implementation of social and economic policies which address the issue of poverty both at national and individual level. This may necessitate increased state intervention in education and other social welfare service, and the creation of enabling environment for private investment in productive sectors (Tanzania national web site, 2011). In addressing the key challenge of strategizing to reduce pervasive poverty Tanzania prepared and adopted Development Vision 2025 in 1999 and the National Poverty Eradication Strategy (NPES) in 1997, which spell out a vision for the society with abject poverty and improved social condition. The NPES that was adopted in 1997 aimed at providing guidance to all stakeholders in identifying, formulating, implementing and evaluating their poverty.

The overall goal of NPES was to provide a framework, to guide poverty eradication initiative in order to reduce absolute poverty by the year 2025. For achieving the goals of NPES the government identified five key sectors: education, health and nutrition, water, agriculture and rural roads. The NPES has identified three areas of strategic interventions namely: those creating an enabling environment for poverty eradication, those building the capacity for poverty eradication and those eradicating poverty. The strategy has also spelt out roles at various levels for poverty eradication initiatives. Vision 2025 is in line with international development goal remains a point of reference for current poverty reduction initiatives.

The National Strategy for Growth and Reduction of Poverty (NSGRP) is a second national organizing framework for putting the focus on poverty reduction high on the country's development agenda. The NSGRP is informed by the aspirations of Tanzania's Development Vision (Vision 2025) for high and shared growth, high quality livelihood, peace, stability and unity, good governance, high quality education and international competitiveness. It is committed to the Millennium Development Goals (MDGs), as internationally agreed targets for reducing poverty, hunger, diseases, illiteracy, environmental degradation and discrimination against women by 2015. It strives to widen the space for country

ownership and effective participation of civil society, private sector development and fruitful local and external partnerships in development and commitment to regional and other international initiatives for social and economic development.

The NSGRP builds on the Poverty Reduction Strategy Paper (PRS(P)) (2000/01 -02/03), the PRS Review, the Medium Term Plan for Growth and Poverty Reduction and the Tanzania Mini -Tiger Plan 2020 (TMTP2020) that emphasize the growth momentum to fast -track the targets of Vision 2025.

The strategy requires increased commitment and resources from domestic stakeholders and development partners in the medium term. To increase the effectiveness of aid, Tanzania will pursue the principles laid down by the Tanzania Assistance Strategy (TAS) and Joint Assistance Strategy (JAS) for harmonisation alignment of aid modalities.

Further improvement in policy environment and market friendly institutional frameworks are keys to scaling up growth and reducing poverty to a significant extent. However, the key to significant poverty reduction in Tanzania is accelerated economic growth. Estimates of responsiveness of poverty reduction to growth indicates that such accelerated growth could lead to reduction in the share of population living below the poverty line from around 50 percent currently to 30 percent by year 2015 (URT, 2003).

2.4 Agricultural Situation in Tanzania

Tanzania resembles many countries in sub-Saharan Africa in that it suffers from economic problems due to rampant rural poverty and poor performance of the agricultural sector. Tanzania has a huge potential for agriculture with an estimated 43 million hectares suitable for farming. However, only an average of 6.3 million hectares is cultivated annually, mostly by small scale farmers. Large-scale commercial farms account for less than four percent of all farms in Tanzania (Menda, 2005). Deemed the backbone of the Tanzania economy since independence from Britain in 1961, that agricultural sector is poorly performing and its current contribution to GDP is about 26 percent, though it employs over 80 percent of national labour force. According to government statistics, the agriculture sector growth had high correlation (i.e. 0.995) with the growth of the national GDP during the period 1998 to 2007 (URT, 2008). During 1999, the GDP grew by 4.8%, while the agriculture sector GDP grew by 4.1%. However, due to expansions and significant investments in other sectors, the GDP grew by 7.1% in 2007 and agriculture sector grew by 4.0%. The results show that the agriculture sector grew at an average rate of 4.4% over the last decade, the growth that was not at an increasing rate. It is only

in one year (i.e. Financial Year 2003/04) where the agriculture sector exceeds the national target of 5% growth rate when it reached 5.9% (URT, 2008).

In Tanzania, small scale farmers comprising about 95% of the farm population depend largely on expertise from extension services provided by the Ministry of Agriculture, Food Security and Cooperatives and the Local governments. However, within the ministry, a systematic farm management programme has never existed. Extension advice has been commodity based, often targeting at technological transfer (husbandry and therapeutic) rather than participatory and education approaches, where farm problems are addressed simultaneously in a holistic manner (Joseph, 2009). Tanzania is endowed with high potential base for agricultural development. Yet it is among the poorest (one of the last 20 in the rank) developing countries (Sentozi and Katega 2007). Agriculture (including crop production, livestock and natural resources) is one of the leading sectors of the economy. Apart from providing food, it remains to be the country's main source of income for the rural population, which forms 80% of the total population and employs 70% of the active labour force. In the year 2005 agriculture contributed about 50% to GDP; crop production alone contributed 55% of the agricultural GDP followed by livestock, which accounted for 30% (Ugulumu, 2008) and natural resources accounted for 15%. Smallholder farmers dominate agriculture with farm sizes ranging from 1 to 3 hectares. Wide variety of crops can be grown in Tanzania due to its wide climatic variation and agro-ecological conditions. Maize and rice are principal food crops as well as commercial crops, while cassava and banana are important subsistence crops. Traditional export crops include coffee, cashew nuts, cotton, tea and sisal. Other widely grown crops include beans, sorghum, millet, sweet potatoes, and a wide variety of fruits, vegetables, oilseeds and flowers (Mpagalile, 2008).

The Tanzania economy is still depending on agriculture as its main stay. During the period between 1995 and 2000, the contribution of the agriculture to the total GDP has been around 50%. In 1998 agriculture contributed 70.8% to the total employment and 55% of the country's foreign currency. Agriculture is still the main source of its performance significantly, and hence determines the overall improvement of the living standard (Mariam, 2003).

Agriculture sector faces a multitude of problems which hamper growth of agricultural sector. These problems includes low priority accorded to agriculture in public resources allocation and disbursement, poor rural infrastructure, farmers' limited capital and access to credit, inadequate support services, weak and inappropriate legal framework and tenure and tax policy. Also the current national crop marketing system does not guarantee returns to offset production costs and hence discourages small scale farmers who constitute the bulk of producers in this sector. Even the few

large commercial farmers in the country are discouraged by the government policies on agriculture (MAFS, 2001).

2.5 Sunflower Production and its Income Contribution in Tanzania

The sunflower gets its name from the Greek words *helios* meaning sun and *anthos* meaning flower (Rindels, 2008). There are some 67 species within the Helianthus genus. Most oilseed and ornamental sunflowers are *Helianthus annuus*. Sunflower has being one of the most important oilseed crops in Tanzania. The crop is adaptable over a wide range of environments and therefore it is widely cultivated in Tanzania. The crop is popular in the Eastern, Central, Northern and Southern Highlands of Tanzania. Sunflower is gaining popularity and current data shows that local production of both factory and home extracted oils contributes to about 40% of the national cooking oil requirement with the remaining 60% being imported (ARI, 2008). The production of sunflower oil seeds varied between 75,000 to 100,000 tons from year 2001 to 2005. However, production increased in the season of 2007/2008 dramatically to more than 350,000 tons and to almost 90,000 tons of oil per year (MAFSC, 2008).

Sunflower growers could increase their income from oilseed cultivation by a net margin of about 75%. From each mill the community of users have earned an additional income of 10,000 to 15,000 USD per season. Farmers who do not use the milling services benefit indirectly through higher prices for their sunflower seed in their areas and lower prices for cooking oil in the village shops. Employment and income generation has been initiated through the presence of mills: tea shops and restaurants next to mills, mechanical workshops that provide repair and maintenance services and the demand for transport services (ox charts) for carrying sunflower to the mill. The income level of small farmers increased due to agriculture project which contributing to modernize agricultural processing methods (Mtui, 2008).

After threshing, sunflower seeds are pressed to extract sunflower oil which is further purified into edible oil used for cooking. The cake is used as livestock feed. According to Mpagalile (2008) and Ugulumu (2008) the production cost for one acre is TAS 380,000/- and one acre can produce up to 16 bags of 70-80 kg each. If those bags are processed into oil, then the revenue from sale of oil (TAS 800,000/-) and cake (TAS 59,520) making a total of TAS 859,520/-. This leaves a profit margin of TAS 479,520/- per acre.

The sunflower production support also women in improving the social welfare, reduce the migration of working age from rural to urban, reduce dependable of the rural people. Contribution of sunflower production is not only evident in Tanzania but

also worldwide. For instance contribution of sunflower production in USSR was 4.68 million in 1981 to 1982, Argentina was 1.98 million, Eastern Europe was 2.25 million, United States was 2.04 million, China was 1.33 million and Spain was 0.41 million (North Dakota State of University,1995). This depicts the importance of the crop in economic development for both farmers and at national level.

Rural Livelihood Development Company (RLDC) has embarked on a serious mission to transact the sunflower sector into high yield per acre cash crop in the central corridor of Tanzania. Success initiatives and experiences in the previous phase indicate that improving the sunflower sector would help immensely in reducing income poverty for many small scale farmers. The approach at RLDC now overhauling sunflower production from the bottom to the top, such as from production and distribution of quality seeds to producers at affordable prices, provision of extension services, collection and storage services, processing and marketing of oil and other sunflower products (Joseph, 2009).

2.6 Constraints Facing the Sunflower Sub-Sector in Tanzania

Based on the importance of sunflower, the MAFC carries sunflower research from ARI Ilonga in Kilosa District. In 1999, the oilseeds research sub programme at Ilonga, imported 20 accessions to start testing them in multi-location trials (ARI Ilonga, 2008; Mpagalile *et al*., 2008). It has been observed that from these accessions, two of them PI 364860 and PI 289624 recorded high yields and oil contents. Plans are underway to take them for on-farm, farmer's verification and assessment before they are officially released. However, the issue of seeds is still a problem because of lack of readily available high yielding varieties. Most farmers use their own seeds from previous seasons mainly because of high price and low availability of seeds from stockists.

Post-harvest management is an important aspect of sunflower production. Normally sunflower is harvested manually. In the Eastern Zone harvesting takes place in July – September while in Central Zone it is between May – June. After threshing sunflower seeds are pressed to extract sunflower oil which is further purified into edible oil used for cooking. The cake is used as livestock feed. The sunflower sub-sector is faced with a number of constraints which include: lack of improved and sufficient seeds; this force farmer to use own seeds; unreliable market and low prices for sunflower seeds; diseases such as downy mildew; insect pests and other pests before and after germination; inadequate improved tillage implements such as ox-plough or tractors; unreliable rainfall; inadequate knowledge on improved sunflower production techniques due to poor extension services; and stiff competition from edible oil imports. Generally sunflower sub-sector in Tanzania is constrained by the following narrated problems.

2.6.1 Production related problems

According to the study conducted by the Rural Livelihoods Development Company (RLDC) in 2008 in the six regions of the Central Corridor, the problems related to sunflower production are related to three major issues which are quality of seeds, agronomic practices and sales practices (RLDC, 2008).

2.6.1.1 Quality Seeds

Most of the small farmers do not use quality seeds, instead they use recycled seeds and traditional seeds from other farmers. The use of the wrong seeds is often a mixture of ignorance, lack of capital, and non-availability of quality seeds. Sometimes the farmers buy seeds that have not been certified for their area and they then face a low and disappointing germination rate, although the use of the same seed in the certified areas can produce a high germination rate (RLDC, 2008).

On the other hand, quality seeds were not available in sufficient quantities so that interested farmers had to source seeds from different suppliers. Another problem is even when quality seeds were obtained they were often planted in smaller quantities as per requirement so that yield per acre was still low although the germination rate was high (RLDC, 2008).

2.6.1.2 Agronomic Practices

Many small farmers do not apply proper agronomic practices in land preparation, planting, weeding and using of fertilizer. Where land is not a limiting factor, crop rotation and intercropping is not properly practiced, although it would allow soil replenishment. The government extension service does not provide enough support in introducing better agronomic practices. The yield is therefore much lower than expected. Inadequate agronomic practice is the result of ignorance, low motivation, and in some cases the lack of ploughing services or fertilizer (RLDC, 2008).

2.6.1.3 Sales Practice

The common practice makes small farmers vulnerable to manipulations by middlemen, mainly traders and, processors. Moreover, the practice of off-farm sales gives away the opportunity of bulking and possible the direct contact with traders or processors. The lack of weighing scales makes it necessary to sell the crop by volume rather than weight which in most cases are to the disadvantage of the small farmer. Based on these sales practices, the smallholder farmer receives low prices (RLDC, 2008).

2.6.2 Processing related problems

The oil processing companies can be broadly grouped into small scale seed crushing companies and oil refinery companies. The constraints of these companies are as follows:

2.6.2.1 Capacity and Supply Mismatch

Like most agricultural produce, sunflower seeds are mainly available at the end of the harvest. Since most small farmers do not have storage facilities, they want to sell their produce as soon as possible, and it is left to the processor to balance the purchase of sunflower grains, process them to oil, and meet the regular demand of the consumer markets. While the crushing equipment is a relatively small investment, the processor has to spend much money for buying and storing the sunflower grains to enable him to meet demand continuously. If, for example, a processor has installed a crushing capacity of about 50 bags per day, he would need to purchase about 10,000 bags if he wanted his machine to be active during 200 days. The purchase requires a capital of about Tshs 300 million which is far in excess of the machinery investment costs (RLDC, 2008, Hawassi *et al.,* 2011)).

At the same time, processors are sometimes not able to buy sufficient quantities of sunflower seeds at going prices. This is mainly the consequence of not having a reliable and trustful business relationship between the small farmers and the processors. In past projects, even in the case of contract farming, relationships were unstable and a lot of side-selling rendered the contracts almost useless (RLDC, 2008).

2.6.2.2 Oil Quality

According to the Tanzania Food and Drugs Authority (TFDA), sunflower oil for human consumption should be refined. If raw sunflower oil is consumed shortly after expression or extraction, it probably does not do any harm. If raw sunflower oil has however been stored for a long time or exposed to high temperature fluctuations, it is not advisable to consume it any more. As most raw sunflower oils are not labelled or the date of processing has not been indicated on the label, it is difficult for the consumer to know whether the oil is still safe for consumption (RLDC, 2008).

2.6.3 Marketing related problems

2.6.3.1 Market Segmentation

Most sunflower seed crushing companies sell the oil almost like a commodity in unidentifiable containers without proper labeling. As there is also hardly any market segmentation, promotion or advertising effort, one cannot help noticing that most oil mills need to develop a marketing concept for increasing their sales (Hawassi et al., 2011).

2.6.3.2 Customers

Tan sunflower local customers include individuals, Bakeries, schools, colleges, hotels, foreign countries etc. The oil products will also be sold abundantly in supermarkets and big malls in cities. There is a growing market for sunflower cake from nearby countries including Kenya, Comoro, Zambia and Malawi. Sunflower oil is now on the move to be exported to Turkey, Israel and North American countries.

2.6.3.3 Market size and trends

The market for sunflower oils and related products is now increasing. Many people are shifting from imported edible oils to the locally natural and organic products. It is estimated that almost 4 million people will be potential buyers of TAN Sunflower oils and this market size is expected to grow 10% annually for the first year and about 20% annually for the second and 35% for the third year.

2.6.3.4 Competition

Tan Sunflower competitors include Arab countries sunflower oil providers and local sunflower oil producers. There are two kinds of competitors. The first group of competitors is Substitute competitors. These are manufactures and sellers of substitute seed cooking oils such as groundnuts, simsim, olive, cotton et cetera. These competitors have less impact to Tan sunflower business as the products are not directly related, they are consumed with special purposes and they are in most cases more expensive compared to sunflower business. The second group is direct competitors. These are manufacturers and sellers of sunflower oils within Tanzania and abroad.

Despite a large number of big oil manufacturers, importers and exporters in the market place, still the opportunity to peak is available. Most of the brand which is available does not conceal a sense of creativity and product development probably because the market is not very much sensitive. It is expected that soon the market

will be more sensitive to quality, appearance, convenience and product availability. Bidnetwork (2011) noted that in order to realize and benefit from market sensitivity it is important to hijack part of the market share bit by bit until the biggest share in the market place is secured. It's just the matter of time and commitment, to secure a bigger portion of the market share (Bidnetwork, 2011).

2.7 Meaning and Rationale of Value Chain in Economy

2.7.1 Value chain defined

Value chain refers to description of the full range of activities from conception of the idea about a good or service through to its distribution, consumption and beyond (UNCTAD, 2010). These activities can be carried out within a single firm or among different firms in the same geographical area or different areas. The concept of Value Chain is associated with Porter (1985) who described a chain of activities for a firm operating in a given industry where each business unit form or builds a line for value. According to Porter (1985), there is a sequence of activities found to be common in wide range of activities. Value chain generally implies a full range of activities which include designing or conception of an idea about the goods or service, through to production, distribution, and consumption and final disposal of a commodity or service (UNCTAD, 2010). The concept of value chain proposes that basically "the chain of activities give the products more added values that are over and above the sum of added values of all activities. According to Porter (1985), a summation of value chains of upstream supplier and downstream channel and customers form value system. In this case, the system includes linkages of value chain within or between firms and they are basis for forms development of its competitive advantage.

2.7.2 Essentials of the value chain

According to Porter (1985), primary value chain includes:

- ✓ Backward linkage: Receiving inputs and distributing them as they are required.
- ✓ Processing: Transforming inputs into outputs goods/services.
- ✓ Forward linkage: Storing and distribution of finished goods
- ✓ Forward linkage: Identification of customer and generation of sales.
- ✓ Forward linkage: Support of customer after goods and services are sold to them.

These activities have complimentary activities such as technological development, human resource planning and management and infrastructure development. Firms profitability depends on how efficiently and effectively if performs collectively and

sequentially all these activities. A firm may generate superior value if it competitively manages to lower cost and upgrade quality or achieve some differentiation. The value chain model detects and defines a firm's competitive advantage in the aspect of cost and differentiation. Sources of competitive advantage include:

2.7.2.1 Cost advantage

If a firm manages to reduce one value chain activities the outcome may be cost advantage, but if may develop even more cost advantages if control all the drivers cost are Porters analysis there are ten cost drivers, institutions and policy frame (regulation, taxation etc) geographical location, economies of scale, learning process, capacity utilization linkage among activities, degree of vertical integration, timing of , violating entry, firm's policy of cost or differentiation and interrelationships among business units. But also through structural charges such as development of a new production line or new distribution channels etc., (e.g. acquiring own equipment).

2.7.2.2 Differentiation or uniqueness creation

Product uniqueness at any part of the value chain may be a basis for completive advantage product differentiation may be achieved in the final stage product or in the process. Porter identified sources of product differentiation as scale of operation, where unique product or service arises from the economies of scale, the firm enjoys. Others are policy and decisions, timing, leaving, location, interrelationship, integration and institutional factors. Differentiation is often costly and therefore always tradeoffs between cost and benefits of achieving differentiation need to be considered.

2.7.2.3 Value chain and technology

Value chain of a firm can also be restructured or re-shaped new technology is adopted and used in activities. New technology may set in competitive advantage, thus bringing new backward or forward integrations when for example a firm gains capability to undertake activities that were initially undertaken by its customers. It has forward linkage in the same way if with the new adopted technology can extend its control over the inputs. It has backward linkage if technology can have its impact at a point of the value be it in primary activities or support activities.

CHAPTER THREE: METHODOLOGY

3.1 Description of the Study Area

The study was conducted in Singida District which is one of the three districts of Singida Region. This district was selected due to the fact that production of sunflower has been promoted and smallholder farmers have been intensively involved. Because of this the crop has become one of the major cash crops for many smallholder farmers. The study was carried out in four wards and eight villages namely; Mtinko ward (Mtinko and Malolo villages), Ihanja ward (Ihanja and Unyangwe villages), Ikhanoda ward (Ngamu and Mjughuda villages) and Ikungi ward (Muungano and Ikungi villages). All wards and villages were randomly selected (see section 3.5).

3.2 Research Design

A cross-sectional research design was applied in this study. This design allows the collection of data on more than one case and at a single point in time in order to gather a body of quantitative or quantifiable data in connection with two or more variables, which are then examined to detect patterns of association. The population of the study consisted of sunflower farmers, traders involved in marketing of sunflower products, processors of sunflower products and consumers/ users of sunflower products. The inclusion of different groups was vital in order to analyze the linkages in sunflower value chain.

3.3 Data Sources and Types

Both primary and secondary data were collected. Primary data was obtained by interviewing sunflower farmers, traders, processors and consumers, discussion with key informants and through participatory observation. The major information collected included:

- Production trends of sunflower in the study area for the past five years,
- Factors influencing sunflower production in the study area
- The chain value in sunflower production (major actors and stakeholders, associated levels, strengths and weaknesses for each chain level),
- Estimation of income earned at household level in comparison with other levels in the sunflower chain value
- Other economic activities responsible for raising income at household level

- Comparison of household income earned from sunflower production and other important economic activities
- Suggestions on the modalities for improving income at household level .

3.4 Data Collection techniques

A combination of data collection techniques for both primary and secondary data was used for successful implementation of the study. Secondary data was collected through documentary review of relevant reports from the Singida regional offices, and Singida district offices, relevant published and unpublished reports from various sources such internets, government offices, and non-governmental organisation offices. Primary data was collected through interview of farmers, processors, traders and consumers using structured questionnaires. The questionnaires were administered by the researchers with the help of research assistants and village extension officers responsible for each village. Individual farmers were interviewed in their homes or village offices while processors and traders were interviewed in their places of work.

However, prior to the main survey, a pre-survey was conducted. This was essential as it enabled the pre-testing of questionnaires and thus ascertains the feasibility of conducting the major survey in the intended study area. Questionnaire pre-testing was conducted using a small sample of 15 farmers, two traders, two processors and two consumers and the result of this exercise was used to adjust the tools for data collection.

Participatory observation and consultation with key informants was also used with the aid of a checklist prepared to guide data collection process.

3.5 Sampling procedure

This study was conducted in four representative wards of Singida District namely Mtinko, Ihanja, Ikhanoda and Ikungi. These wards were selected randomly. From each ward two villages were selected randomly to get a total of eight villages. From the list of farmers in the villages, the study randomly selected a total of 18 farmers from each village. Sampled farmers were identified primarily from the sunflower production point of view and thus a total of 138 farmers were interviewed (Table 1). The sampling exercise considered the representation of both sexes.

A total of 25 sunflower traders and 20 sunflower processors were selected purposively for the interview. For the category of consumers of sunflower products, a snowball procedure was employed to get 51 people who were interviewed accordingly.

Table 1: Number of farmers interviewed per village and ward

Ward	Village	Number of respondents
Mtinko	Mtinko	18
	Malolo	15
Ikhanoda	Ngamu	17
	Mjughuda	18
Ihanja	Ihanja	18
	Unyangwe	18
Ikungi	Ikungi	18
	Muungano	16
Total		**138**

3.6 Data Analysis and Presentation

Collected data was compiled, coded and analysed using appropriate statistical packages. Descriptive statistics (such as frequencies, percentages and means) and ANOVA were analysed. The Statistical Package for Social Science (SPSS) and SAS computer programs were employed for data analysis. Figures, tables and charts were used in data presentation.

Value chain analysis was done by drawing of a map showing the flows of goods and services within a chain.

3.7 Reliability and Validity of Data

Reliability focuses on the extent to which the measurement of an object or an interview with the same respondent produces the same result (Lupala, 2002). Therefore, similarity of results from employing the same tools in interviewing different respondents was one of the methods for assuring reliability of the research. Yin (1994) suggested that the significance of the discrepancy between results may reduce or increase reliability of the employed tools, hence affect the research findings. On the other hand, validity deals with the questions “Does the research measure what it intends to measure”? It shows the relationship between what is measured and what the researcher intended to measure (Patton, 1987).

To ensure reliability of the collected data, pre-testing of the designed questionnaires was done. This allowed adjustment to ensure that only relevant information to the study was collected. During the interview session, it was necessary to explain clearly to respondents the purpose of the study so that they are aware of and hence provide relevant information. Adoption of various data collection methods like interviews,

discussion with key informants, documentary review and observation reduced the risk of getting unreliable information.

To minimize threats to validity, complementary data and information were applied. The collected data and information from various sources such as district council's office, reports from NGOs supporting sunflower farmers, were collaborated and triangulated.

CHAPTER FOUR; RESULTS AND DISCUSSION

4.1 Overview

This chapter presents and discusses the results of the analysis of sunflower production, processing, marketing and demand in Singida District. Particularly, the results presented rely profoundly on the information obtained from sample farmers, processors, traders and consuming households. The remainder of the chapter is divided into four main parts. The first part discusses the results of sunflower production. This is followed by an analysis of sunflower processing. The marketing system of sunflower products is presented in the third part, while the analysis of demand of sunflower products is described in the fourth part. Finally, the chapter wind-ups with an analysis of existing sunflower value chain.

4.2 Analysis of Sunflower Production

4.2.1 Socio-economic characteristics of farmers

4.2.1.1 Sex of farmers and status in the household

The findings revealed that in the study area, majority (79%) of farmers were males (Appendix Table 1). In all wards the number of males was higher than females. However, Ikhanoda (80%) and Ikungi (82.4%) wards had the highest number of male farmers than others. The highest number (36.1 %) of female farmers was observed in Ihanja ward. This implies that probably males are engaged more in sunflower production than females.

Also it was revealed that about 76% of farmers' households in the study area are being headed by males while the rest (23.9%) are female-headed households. This is probably due to the fact that majority of interviewed farmers were males as observed in the finding in above paragraph.

4.2.1.2 Age of farmers

This study found that 50.7 % (Appendix Table 1) of farmers are aged above 40 years followed closely by those in the age group 20-40 years (45.7%). Those aged below 20 years were 3.6 % only. This entails that majority of farmers are aged from 20 years and above. This group consists of large percentage of married people who are supposed to raise income through farming and other activities in order to take care of their families.

4.2.1.3 Level of education of farmers

It was observed that in the study area the proportion of farmers with primary school education was the highest (64.5 %) (Appendix Table 1) Very few (9.4%) of those interviewed had achieved secondary school education, 16.7 % had attended adult education classes, while the rest (9.4%) had had no formal education. The level of education is an important factor in coping with poverty and particularly coping with risks and uncertainties related to agricultural production. A certain standard of education aids can better equip a person to structure their enterprises to be sure that the family has enough to meet their requirements for cash, food and shelter. Mtinko and Ihanja wards had the highest proportions of farmers who had attained adult education (27.3 %) and secondary education (11.1 %), respectively. However in the current study levels of education did not significantly ($P > 0.05$) influenced sunflower yields in study area (Appendix Table 10).

4.2.1.4 Marital Status and Family Size

The findings revealed that over 84% of farmers in the study area are married (Appendix Table 1). About 12% are singles, 0.7 % of them are widows, 0.7 % divorced and 1.4 % has been separated. Ikhanoda ward had highest (91.4%) proportion of respondents that are married while Ihanja ward had highest (22.2%) proportion of farmers that are living single. The high percentage of married farmers observed in all wards could probably be among the factors that contributed to increase in yields since the households will have more members who can engage in crop husbandry.

Appendix Table 2 below gives results on the sizes of households that were involved in the current study. The table shows that about 57 % of household had more than six members. While those with between five to six members were only 30.4 %. The rest had between 3-4 members (7.4%) and lastly those having between one to two members (4.9%). This finding which indicates that about 87% of respondents have more than four members in their households thus giving indication that majority of farmers in the study area has reasonable workforce for the farming activities.

4.2.1.5 Main occupation of farmers

Majority (76.8%) of farmers in study area are engaging with crop production as their main occupation followed by those engaged on both livestock and crop production (13.0%) (Appendix Table 1). Only 6.4% were mainly depending mainly on salaried employment. Ikungi ward had the largest proportion of farmers engaged on crop production, while Ihanja (19.4%) and Ikhanoda (20%) had higher proportions of farmers depending on salaried employment.

Table 2: Size of households

household sizes	Ward				Total (%)
	Mtinko	Ikhanoda	Ihanja	Ikungi	
1-2	0.8 %	0.8%	0.8%	2.5%	4.9
3-4	0	0.8%	1.7%	4.9%	7.4
5-6	6.5%	2.5%	8.2%	13.2%	30.4
Above 6	17.2%	22.9%	12.2%	4.9%	57.3

4.2.3 Sunflower production trends in the study area

The study revealed that the levels of yield of sunflower seeds in Singida District were increasing with years, except for the year 2006/07. Also, although there was a decline in year 2009/10 the yield was much higher than the first three seasons under study (Fig 2). However, although the acreages were also increasing they did so not in step with the levels of yields. This can probably be due to better use of improved agronomic practices among sunflower farmers, including the use of improved seeds, pesticides and fertilisers.

Figure 2: Acreage and Sunflower yield in Singida District for the year 2005/06 – 2009/10

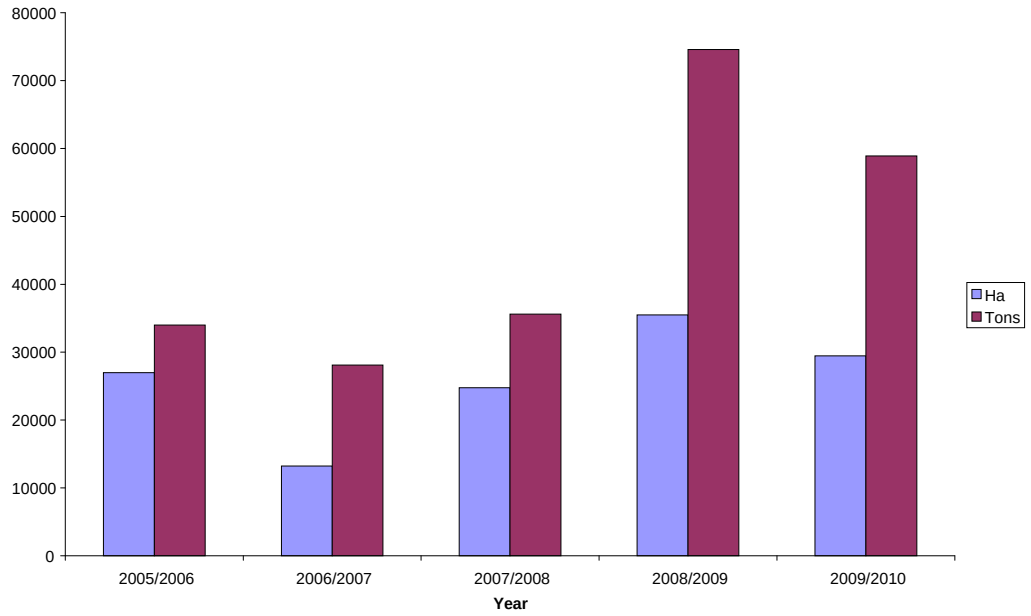
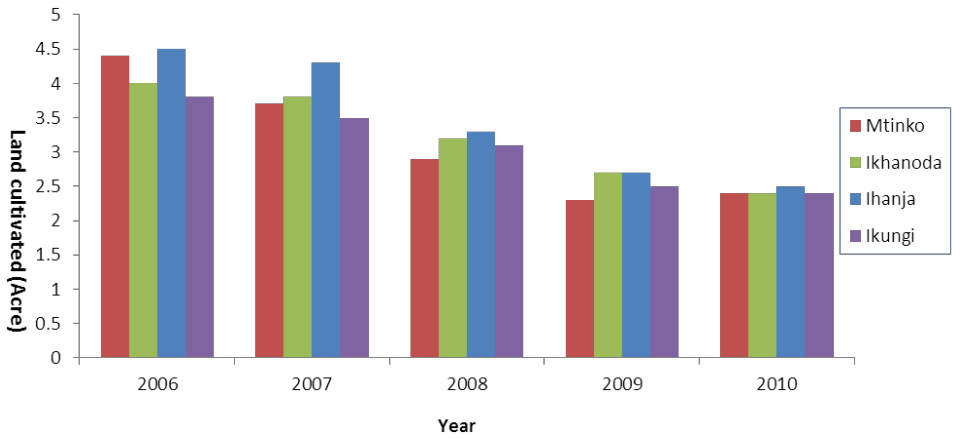
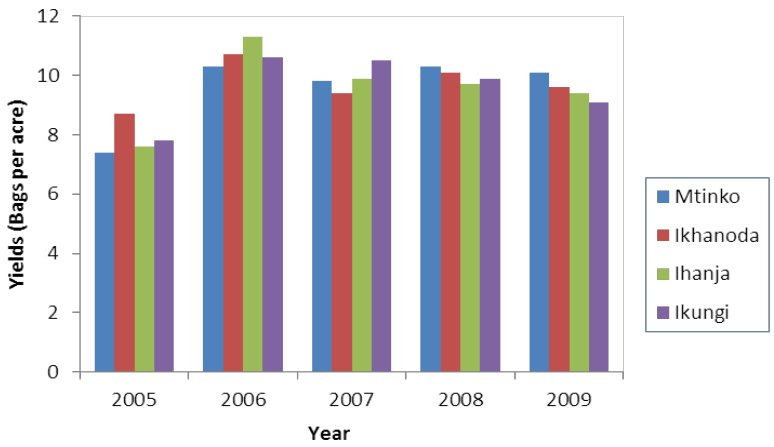


Figure 3: Trend of cultivated land for sunflower production in five years from 2006-2010 in the study area



In general, in all the wards studied, it was observed that the area under sunflower cultivation had been declining with years except in Mtinko where there was a small increment in year 2010 (Fig 3). Surprisingly, the levels of sunflower seeds' yields in all surveyed wards increased sharply in 2006 but from year 2007 there were gradual decrease in all wards but in year 2008 Mtinko and Ikhanoda recorded slightly more yield than that of 2007 then again declined in 2009 (Fig 4). Nevertheless, the yields recorded in year 2009 were higher comparing with those in year 2005. These variations in acreage under sunflower production and the increase in yield are probably attributed to experience gained with increase in number of years that farmers are involved in sunflower cultivation and also due to adoption of modern agronomic practices such as the use of improved seeds, timely planting, and weeding and fertilisers application.

Figure 4: Trend of sunflower production in study area in five years from 2005-2009



4.2.3 Reasons and importance of Sunflower production in the study

The findings of this study indicate that sunflower is one of the major cash crops in the study area (Table 3). The study findings indicate, for example, that 76. 1% of the respondents ranked sunflower as a major cash crop in the area. The justification of the importance of sunflower production in the study area were as follows: 51.4% of the respondents indicated sunflower as important in generation of household income used to meet various expenses related to schools, health, food, and shelter. The other reported importance of sunflower production in the area include provision of cooking oil (40.0 %), improvement of soil fertility (9.4 %), provision of animal feed (21.7 %) and as source of energy (3.6 %).

Table 3: Economic Importance of Sunflowers in Singida District

Reason	Ward				Total
	Mtinko (N=33)	Ikhanoda (N=35)	Ihanja (N=36)	Ikungi (N=34)	138 (100%)
Major cash crop	78.8 %	88.6%	58.3 %	79.4 %	76.1 %
Minor cash crop	21.2 %	11.4 %	41.7 %	20.6 %	23.9 %

Furthermore, the findings show that both men and women of all productive groups do participate in sunflower production as well as other crops (Table 4). However, it was very interesting to note that 54.2% of female respondents above 60 years indicated their active participation in farming activities compared to 45.8% of male respondents in the same age group. These findings imply that contrary to male farmers, female farmers engage in farm activities even at advanced age, supporting the fact that women are the main actors of farm activities in most of rural households in Tanzanian societies (FAO, 1994).

Table 4: Participation of members of household by age and sex in farming activities

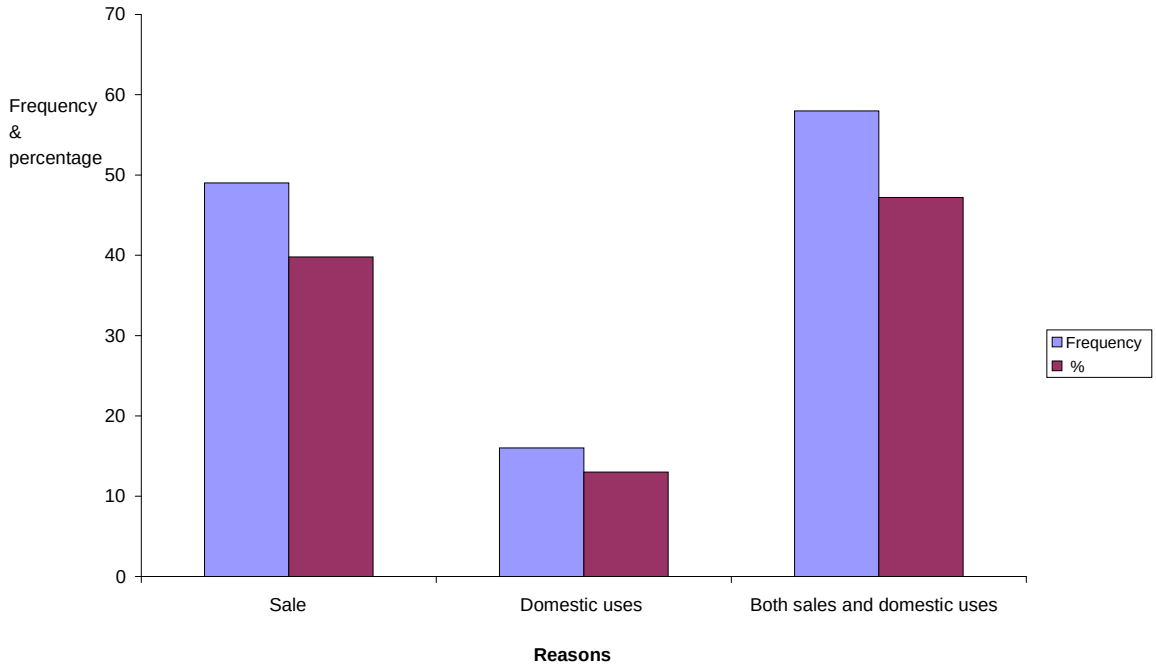
Age group	Sex	Frequency	Percentage
Below 16 years	Male	136	57.4
	Female	101	42.6
Total		237	100
Between 16-45 years	Male	81	47.4
	Female	90	52.6
Total		171	100
Between 46-60 years	Male	23	60.5
	Female	15	39.5
Total		38	100
Above 60 years			
	Male	22	45.8
	Female	26	54.2
Total		48	100

It was noted during this study that there are many reasons for sunflower production by respondents' households (Table 5 and Figure 5). About 38.4% of respondents indicated that they engaged in sunflower production for selling and hence increasing their household income; while 14.5% indicated that sunflower production was for domestic use as oil, animal feed and compost. However, it was interesting to note here that about 47.1% of the respondents produce sunflower for both selling and domestic uses.

Table 5: Reasons of farmers for growing sunflower in the four wards of Singida District

Reason	Ward				Total
	Mtinko (N=33)	Ikhanoda (N=35)	Ihanja (N=36)	Ikungi (N=34)	138 (100%)
Sale	33.3 %	34.3 %	41.7%	44.1 %	38.4 %
Domestic uses	18.2 %	5.7 %	16.7 %	17.6 %	14.5%
Both sales and domestic uses	48.5%	60.0 %	41.7 %	38.2 %	47.1 %

Figure 5: Reasons for growing sunflowers



4.2.4 Factors affecting production of sunflowers in the study areas

The data shown in Table 6 reveal that the production of sunflower in surveyed villages is strongly affected by such factors as unreliable or regularly fluctuating prices of sunflower products (60.9 %) and unreliable market (55.8 %). Other factors reported by respondents included affordability of inputs (29.0 %), poor extension

services (26.1%), unreliable supply of inputs (24.6 %), lack of a collection centre (10.9 %), lack of bargaining power (6.5 %), lack of market information (5.8 %), lack of processing plants (4.3 %), competition from other types of edible oils (4.3 %), high transport cost (4.3 %), lack of government support (1.4 %) and delay of payment from collection centres (0.7 %).

However, triangulated information from farmers, processors, traders, and consumers revealed that various strategies have been used by stakeholders, including government, in the surveyed district to overcome the above mentioned problems. Such strategies include ensuring good quality of sunflower products, reducing price of sunflower inputs and establishing good relationship with customers. Despite all strategies, the above mentioned problems are still threatening production and productivity of sunflower sub-sector in the district and therefore creating unfavourable environment for agricultural and livestock development policy of 1997 to achieve its objective of increasing agricultural productivity, promoting higher added value for agricultural produce, and improving producer price incentives.

Table 6: Problems affecting sunflower production in Siginda District

s/n	Problems	Frequency	Percentage
1	Unreliable market	77	55.8
2	Unreliable or regularly prices fluctuation	84	60.9
3	Lack of bargaining power	09	6.5
4	Lack of market information	08	5.8
5	Lack of collection centre	15	10.9
6	Lack of processing plants	06	4.3
7	Delay of payment from collection centres	01	0.7
8	Lack of government support	02	1.4
9	Competition from other types of edible oils	06	4.3
10	Poor extension services	36	26.1
11	Affordability of buying inputs	40	29.0
12	Unreliable supply of inputs	34	24.6
10	Higher transport cost	06	4.3

4.2.5 Income earned from sunflower production

According to the present study, it was noted that sunflower production enables generation of income at household at various levels (Table 7). The results show that 22.7% of respondents indicated that their household earned about Tshs 100,001 - 200,000 per year, while 21.2% earned from Tsh 200,001 – 300,000. It was noted further that about 6.1% of respondents reported their household to earn about Tsh 400,001 – 500,000 per year while another 6.1% of respondents reported to have an income of more than Tsh 1, 000,000 per year.

Table 7: Amount of income earned per year through sunflower production

Amount earned (Tsh)	Frequency	Percent
10,000 - 100,000	10	7.6
100,001 – 200,000	14	10.6
200,001 – 300,000	10	7.6
300,001 – 400,000	17	12.9
400,001 – 500,000	45	34.1
500,001-1,000,000	28	21.2
Above 1,000,000	8	6.1
Total	**132**	**100**

It was further revealed by this study that apart from sunflower production there were other economic activities contributing to household income. Table 8 shows that livestock keeping, salaried employment and businesses as the main sources of income apart from that earned from sunflower production. Other important sources of household income are various crops produced in the study area as indicated in Table 8.

4.2.6 Comparison of income earned from sunflower and other economic activities

The preliminary findings indicates that among the agricultural activities performed in Singida District, sunflower production ranks second to livestock keeping where the mean income is Tshs 414.015.20 compared to Tshs 572,288.9 of livestock keeping. Horticulture (onion) and finger millets follows with mean income of Tshs 358,575.4 and 304,000, respectively. This indicates that sunflower production stands a better chance of improving community livelihoods.

Table 8: Average income earned per year from various economic activities

Activity/Crop	N	Mean income (Tsh)
Sunflower	132	414,015.2
Maize	90	290,355.6
Sorghum	54	213,537.0
Sweet potatoes	12	142,000.5
Sugarcane	7	152,500.0
Pearl millet	42	222,428.6
Beans	13	223,846.2
Groundnuts	10	216,166.7
Cashew nuts	9	113,333.3
Cassava	8	226,666.7
Horticulture (Onion)	21	358,575.4
wheat	23	135,478.3
Finger millet	5	304,000.0
Livestock keeping	90	572,288.9
Business	64	431,187.5
Salaried employment	20	561,420.9

4.3 Analysis of Sunflower Processing

4.3.1 Characteristics of sample processors and their processing firms

The findings revealed that all processing firms in this study were owned by males (Table 9). Among them 15%, 75% and 10% were single, married and divorced, respectively. Large proportion (50%) of processors aged between 36 to 45 years. Those who attained secondary education were 30%, processors with Certificate /Diploma education were 15 %, while 25% attended adult education, 25% primary education and processors with informal education were only 5%.

The study went further to find out how long the sampled respondents have been engaged with processing sunflower. It was revealed that 65% have experience of between 6 – 10 years in this industry (Table 9). While 25% and 10% have experience of between 2 – 5 years and above 10 years, respectively.

Table 9: Characteristics of sample processors

Variable	Frequency	Percentage
Respondents' Sex (%):		
Male	20	100.0
Female	Nil	Nil
Total	**20**	**100.0**
Marital Status (%):		
Single	3	15.0
Married	15	75.0
Divorced	2	10.0
Total	**20**	**100.0**
Mean age of sample processor (Years):		
Distribution of Age (%)		
Between 25 - 35 Years	5	25.0
Between 36 and 45 Years	10	50.0
Between 46 - 56 Years	5	25.0 ++
Total	**20**	**100.0**
Education Level (%):		
Non formal education	1	5.0
Adult education	5	25.0
Primary education	5	25.0
Secondary education	6	30.0
Certificate/ Diploma level	3	15.0
Total	**20**	**100.0**
Distribution by Years in Experience of Processing Activity (%):		
Between 2 - 5 Years	5	25.0
Between 6 -11 Years	13	65.0
Above 10 years	2	10.0
Total	**20**	**100.0**

Regarding ownership of processing firms, the data in Table 10 show that 85% of them were owned individually and 15 % were under partnership. About 18 (90%) owners of the firms were engaged with processing activities fulltime and 2 (10 %) owners were engaged on part time basis. Only 17 (85%) of processors were the owners of the premises in which the processing activities are taking place. The rest (15%) rented the premises. This study found out that few (30%) processing firms had been registered while 70% were unregistered. This is probably the reason why it is difficult for some processors to get financial support from loan / credit facilities.

Table 10: Characteristics of sample processing firms

Variable	Frequency	Percentage
Ownership of the Firm:		
Individual	17	85.0
Partnership	3	15.0
Total	**20**	**100.0**
Nature of the business:		
Full time	18	90.0
Part time	2	10.0
Total		
Ownership of the premises:		
Rented	17	85.0
Owned	3	15.0
Total	**20**	**100.0**
Registration of the Business:		
Registered	6	30.0
Not registered	14	70.0
Total	**20**	**100.0**

4.3.2 Main sources of raw sunflower for the firms and approaches used in collection

The findings in Table 11 indicate that there are three sources of raw sunflower for processors. Those firms which collect raw sunflower from all sources (i.e. own farms, buying from other farmers, buying from traders) accounts for 45%. About 25% are getting raw sunflower through buying from farmers and traders, 20% buying from other farmers, 5% from the farm(s) belong to the owner of the processing firm and one processor is getting through buying from traders.

On the side of approaches used to collect raw sunflower, the study found that about 16 (80%) processors said that farmers and traders are the ones who brought directly raw sunflower to their processing firms (Table 11). While 2 (10%) and 2 (10%) of sample processors said that they collect raw sunflower by using public transport and private transport, respectively. Direct receiving from farmers and petty traders at the processing site appeared to be suitable and mostly used approach in Singida District probably due to urban nature of this area which reduces transportation cost, leading to break–even of the suppliers' businesses.

Table 11: Sources of raw sunflower for the firm and approaches used in collection

Variable	Frequency	Percentage
Source of sunflower raw materials:		
From own farms	1	5.0
Buying from other farmers	4	20.0
Buying from traders	1	5.0
Buying from both farmers & traders	5	25.0
From 1-3 above sources	9	45.0
Total	20	100.0
Mode of collecting raw materials:		
Public transport	2	10.0
Private transport	2	10.0
Brought by farmers and petty traders	16	80.0
Total	20	100.0

4.3.3 Processing operations conducted by sample processors

Table 12 present the processing operations performed by sampled processors. The operations identified includes purchasing packaging materials (85%), hiring labour (65%), storage of sunflower products (40%), transporting sunflower products (60%), collecting raw sunflower (30%) and advertising/promotions (25%).

Table 12: Processing operations practiced by sample processors

Variable	Frequency	Percentage
Collecting fresh sunflower as raw materials	6	30
Storage of sunflower products	8	40
Transporting sunflower products	12	60
Hiring of labour	3	65
Purchasing packaging materials	17	85
Advertising/ promotions	5	25

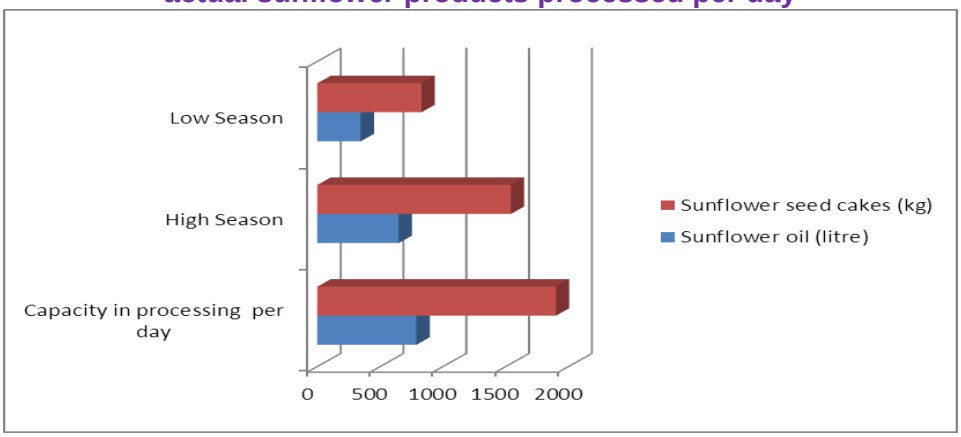
4.3.4 Capacity of processing machines used by sample processors and quantities of sunflower products produced

Figure 6 indicates mean capacity per day of processing plants in the study area. It was revealed that a processing firm has the capacity of producing 789.8 litres and 1900.0 kg of sunflower oil and sunflower seed cake per day, respectively. However, the findings indicated that the actual quantities of sunflower oil processed to be 689.9 litres and 345.4 litres during the high season and low season, respectively. Furthermore, findings revealed that the actual quantities of sunflower seed cakes were 1541.1 kg and 829.9 kg during high season and low season, respectively.

It can be seen from Figure 6 that processors in the study area were not able to utilize their capacities in both seasons, i.e. during high and low season throughout the year. However, the average quantities of sunflower oil pressed and sunflower cakes

produced per day by sample processors in the study area were relatively higher during high season compared to low season indicating that the processing firms were not able to utilize their capacities throughout the year partly due to unavailability of fresh raw sunflower.

Figure 6: Mean capacity of firms to process sunflower oil and sunflower cakes and the actual sunflower products processed per day



4.3.5 Quantity of sunflower products processed

The quantity of sunflower products that were processed by sampled processors in the district for years starting from 2005 to 2009 is presented in Table 13. The findings shows that from 2006 the quantities processed were increasing with years. However the quantities processed in 2005 were higher than that of 2006. The increasing trend observed might probably be due to increase in production and availability of raw sunflower coupled by high demand of the sunflower products, especially oil. Recently there is increasing awareness of health benefits of sunflower oil due to its low saturated fat. So it is considered by many people as healthy addition to a meal or diet <http://www.livestrong.com/article/82773-health-benefits-sunflower-oil>. November 2012.

Table 13: Average quantity of sunflower products processed between 2005/2006 and 2009/10 production period

Year of processing	N	Variable	Amount Processed
2009	20	Sunflower Oil in litres	91292.5
		Sunflower Cakes in Kg	208746.8
2008	15	Sunflower Oil in litres	88783.3
		Sunflower Cakes in Kg	203063.2
2007	12	Sunflower Oil in litres	79610.5
		Sunflower Cakes in Kg	179139.8
2006	12	Sunflower Oil in litres	52050.0
		Sunflower Cakes in Kg	197222.3
2005	10	Sunflower Oil in litres	54780.0
		Sunflower Cakes in Kg	131526.8

4.3.6 Factors affecting sunflower processing

In the current study processors were also asked to indicate the factors affecting their performance in the sunflower processing industry. The responses basing on multiple responses are summarized in Table 14. The study revealed about eight key factors which affect the performance of sampled processors in the study area. These included stiff competition from traders (75 %) who are dealing with processing and at the same time importing similar products, especially edible oil. Others factors included price fluctuation of raw sunflower (75%), unreliable market (75%), high transport costs (60%), high cost of electricity (40%), high cost of spare parts for the processing machines (20%), unreliable market (25 %), unreliable supply of raw sunflower (80 %) and inaccessibility/ unaffordability of credit facility (25 %). Of all mentioned problems, overall results suggest that unreliable supply of raw sunflower followed by unreliable market; price fluctuation and stiff completion from similar products are the main hindrances impairing good / optimal performance of processors in Singida District. These results to a great extent complement findings by Hawassi (2006) and Nyagori (2001) who found that small-scale food processors in Tanzania were greatly constrained by lack of markets and stiff competition from similar products.

Table 14: Factors affecting sunflower processing in district

Variable	Frequency	Percentage
Stiff competition with other similar products	15	75.0
Price fluctuation of raw sunflower	15	75.0
High cost of electricity	8	40.0
High cost of spare parts for processing machines	4	20.0
Unreliable market	15	75.0
Unreliable supply of raw sunflower	16	80.0
High transport cost	12	60.0
Unaffordability to credit/ loan	5	25.0

4.4 Analysis of Marketing of Sunflower Products

4.4.1 Marketing channels for sunflower products in the study areas

Figure 7 shows the marketing channels for sunflower products in the study areas. As can be seen from the figure, three marketing channels for sunflower products were identified. The first channel was sale of sunflower raw materials directly to processors and thereafter the processors sold their processed products through traders to ultimate consumers of sunflower oils. A similar picture was noted for sunflower cakes. The second channel was sale of fresh raw sunflower through traders to processors. Thereafter, the processors sold their processed products directly to ultimate consumers of sunflower oils. A similar picture was observed for sunflower cakes. The third channel was sale of fresh raw sunflower through traders to processors and thereafter the processors sold their processed products through

traders to ultimate consumers of sunflower oils. A similar pattern was also noted for sunflower cakes.

Figure 7: Existing sunflower marketing channel

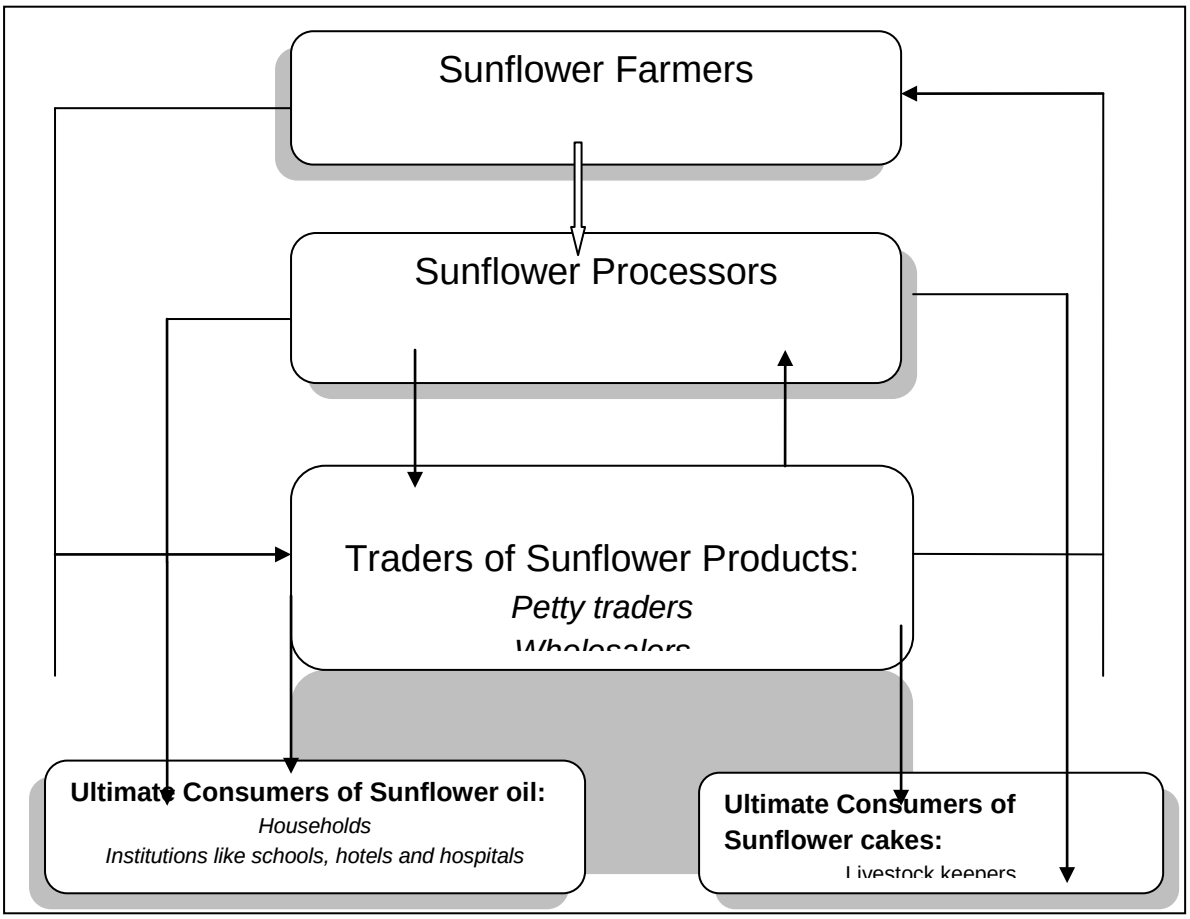


Table 15: Characteristics of sample traders

Variable	Frequency	Percentage
Sex		
Male	23	92.0
Female	2	8.0
Education level		
Adult education	4	16.0
Primary education	13	52.0
Secondary education	7	28.0
Diploma	1	4.0
Marital status		
Single	13	52.0
Married	10	40.0
Widowed	1	4.0
Separated	1	4.0
Age of respondent		
25 - 35 years	7	28.0
36 - 45 years	13	52.0
Above 46 years	5	20.0

4.4.3 Characteristics of business activities

Table 16 summarizes the characteristics of business activities performed by sample traders in Singida Districts. It can be observed from the Table that retailers appeared to be the dominant group. The large number of retailers in the business activities is partly an indication that the market for sunflower products was not monopolized by few individuals. This is in agreement with what Hawassi (2006) had observed on trading of processed fruits and vegetables in Dar es Salaam, Tanga, Iringa and Dodoma regions. The results also indicate that majority (80%) of traders are engaged in their business on fulltime basis.

About 48% of traders have been engaged in selling of sunflower products for five to 10 years, while 3 (12%) and 9 (36%) traders have experience of more than 10 years and between two to four years in this business, respectively. These findings suggest that about most of traders (i.e. about 60%) in the surveyed district had some experience in trading sunflower products; indicating that traders were in a better position to face the challenges related to the trading of sunflower products.

According to the findings presented in Table 16, relatively larger proportions (84%) of sample traders in Singida District had access to technical knowledge of their business activities. These findings indicate that a larger number of traders in the study area performed their business activities basing on technical knowledge acquired which could probably make them compete with others engaging with similar business activities.

During interviews with respondents, a majority (64%) of sample traders reported that the technical knowledge had been acquired through informal training, while 32 % said they got the knowledge through formal training. However, in terms of usefulness of the training acquired 52 % and 32 % said that the knowledge was very useful and useful, respectively. Nevertheless, some of sample traders (16 %) complained that technical knowledge related to business activities were moderately useful to them as they were still faced with problems of how to run their business successfully partly due to unpredictable prices of their sunflower products and lack of reliable markets. These findings partly imply that successful performance of any trading activity is not only determined by technical knowledge to business activities acquired by traders but also there are other factors such as prices and access to market prices.

Table 16: Characteristics of sampled business activities

Variable	Frequency	Percentage
Types of business/trade		
Retailer	**12**	**48.0**
Wholesaler	**4**	**16.0**
Both Retailer & Wholesaler	**9**	**36.0**
Nature of the business		
Full time	20	80.0
Part time	5	20.0
Average Experience in Sunflower Trading Activity (Years)		
Distribution by Years in Experience of Sunflower Trading Activities		
2 - 4 years	9	36
5-10 years	12	48
Above 10 years	4	16
Access to technical knowledge to business activities		
Have business knowledge	21	84.0
Does not haves not business knowledge	4	16.0
Source of business' knowledge		
Formal training	8	38.1
Informal training	12	57.1
Trial and error	1	4.8
Usefulness of acquired knowledge		
Very useful	12	57.1
Useful	7	33.3
Moderately useful	2	9.5

4.4.4 Main customers of sunflower products

Successful marketing of any product depends upon understanding customers and their consumption behaviour. In view of this, farmers, processors and traders were asked to mention the major customers of their products. The responses are summarized in Table 17. The findings show that traders (54.3%) were main customers of sunflower product seeds produced by sample farmers. With regard to processors, they reported that traders, households, livestock farms and institutions as the main customers of both sunflower oil and sunflower seed cakes. This accounted by 65 % of all sampled processors.

Similarly, traders identified retailers, wholesalers and household which accounts to 88% as the main customers of sunflower oil, while livestock farms and household were mentioned as the main customers of sunflower seed cakes (84%).

Table 17: Main customers of sunflower products

Variable	Frequency	Percentage
Farmers' response		
Processors	34	24.6
Petty traders	75	54.3
Both processors & petty traders	29	21.0
Processors' responses		
Traders and Households	7	35.0
Traders, Households, Livestock farms and Institutions	13	65.0
Traders responses		
Customers of oil		
Both retailers and wholesalers	3	12.0
Retailers, wholesalers and Household	22	88.0
Customers of Sunflower cakes		
Livestock farms	4	16.0
Both Household and livestock farms	21	84.0

4.4.5 Main form of sunflower products sold by different actors

The findings presented in Table 18 indicate that fresh raw sunflower was the main form of sunflower products sold by 66.7% of sampled farmers in the study area. The remaining farmers (33.3%) said that they sell both raw sunflower and sunflower products. During the interview a good number of farmers argued that they get more income by selling the products obtained after sending the raw sunflower to processing plant where they just have to pay in cash the cost relating to the processing activities but they get back home with sunflower oil and/or sunflower seed cakes which they can sell to other households or petty traders.

Nearly both sample processors and traders were sold to two forms of sunflower products (Table 18). These included sunflower oil and sunflower seed cakes. The results indicate that 85% of processors sold both sunflower seed cakes and sunflower oil while 15 % of them sold sunflower oil only. In terms of traders, 68%, 20% and 12% sold sunflower seed cakes and oil, sunflower oil and sunflower seed cakes, respectively.

Table 18: Main form of sunflower products sold by different actors

Variable	Frequency	Percentage
Farmers		
Raw sunflower	92	66.7
Raw sunflower and products	46	33.3
Processors		
Sunflower oil	3	15.0
Both sunflower oil and sunflower seed cakes	17	85.0
Traders responses		
Sunflower oil	5	20.0
Sunflower cakes	3	12.0
Both sunflower cakes and oil	17	68.0

4.4.6 Quantities of sunflower products marketed in the study areas

4.4.6.1 Quantities of sunflower seeds marketed by sample farmers

Tables 19 and 20 present analysis of variance for actual quantities of raw sunflower marketed by sample farmers and their prices, respectively. The results indicate that there were significant differences for amounts sold in various years ($P < 0.001$) and between the wards ($P < 0.05$) in the study area (Table 19). Quantities sold by farmers were increased from mean 21.6 bags in year 2005/06 to mean 37.2 bags in year 2009/10 (Table 23). Ikhanoda (30.6 bags) and Ihanja (29.7 bags) farmers sold significantly higher amount of raw sunflower than their counterparts from Mtinko and Ikungi wards. The prices of raw sunflower were significantly ($P < 0.001$) influenced by the year of production (Table 20). Study findings revealed that the prices per a bag of 70 kg were increasing with years. In year 2009/2010 the mean price was highest (24 821.1 Tsh.) while it was lowest (14 966.5 Tsh.) in year 2005/2006 (Table 21). However the prices received by farmers did not differ significantly between the wards. The increasing trend with years in quantities sold by farmers in the study area may partly reflect high demand of the products and probably due to the improved in market price which follow the same trend as that of the yields of sunflower seeds.

Table 19: Analysis of variance for fresh sunflower sold by farmers

Source of variation	DF	Mean square	F Value	Pr > F
Year	4	4343.2	13.9	<.0001
Ward	3	1253.3	4.0	0.0077
Residual	566	312.9901		

Table 20: Analysis of variance for price received by farmers for a 70 kg bag of raw sunflower

Source of variation	DF	Mean square x 10^4	F Value	Pr > F
Year	4	1481414.1	47.96	<.0001
Ward	3	1299.5	0.42	0.7382
Residual	566	3089.0		

Table 21: Average quantities of fresh sunflower (in 70 kg bags) sold by farmers and their corresponding prices (Tsh) in the study area

Factor	N	LS Means ± S.E (Bags of 70kg)	LS Means ± S.E (Tsh.)
Overall mean	574	28.7 ± 0.74	20493.7 ± 230.6
Production Year		***	***
2009/2010	138	37.2 ± 1.5^{a}	24821.1 ± 473.5^{a}
2008/2009	137	29.7 ± 1.5^{b}	21505.9 ± 475.3^{b}
2007/2008	121	25.8 ± 1.6^{bc}	20334.9 ± 505.6^{b}
2006/2007	98	23.9 ± 1.8^{c}	17686.3 ± 561.9^{c}

Factor	N	LS Means ± S.E (Bags of 70kg)	LS Means ± S.E (Tsh.)
2005/2006	80	21.6 ± 2.0[c]	14966.5 ± 622.0[d]
Ward		**	
Mtinko	142	25.9 ± 1.5[ac]	19950.4 ± 468.6
Ikhanoda	154	30.6 ± 1.4[b]	20027.6 ± 453.1
Ihanja	141	29.7 ± 1.5[bc]	19410.6 ±468.6
Ikungi	137	24.4 ± 1.5[a]	20055.1 ± 478.7

** P < 0.01; *** P < 0.001; Least squares means with similar superscript do not differ significantly

4.4.6.2 Quantities of sunflower products marketed by sample processors and their prices

The mean sunflower oil and sunflower seed cakes processed in Singida district were 71715.1 litres and 168669.6 kg, respectively (Table 22). While the mean prices of sunflower oil and sunflower seed cakes were 1480.4/= and 2700.7/=, respectively. Quantities of sunflower oil and sunflower cakes processed and their prices significantly (P < 0.05) were influenced by year. There were positive trends of increment for the quantities of oil processed from year 2006 to 2009 however the mean oil processed in year 2006 was smaller than that of year 2005. Sunflower cakes processed were increasing with year. There was significant increase from the quantities processed in 2006 and 2006 comparing with those in advanced years.

Prices for both products were increasing with years of processing. The highest prices for both sunflower oil and sunflower seed cakes were 1565/= per litre and 2810/= per kg, respectively which were observed in year 2009. The lowest prices for both sunflower oil and sunflower seed cakes were 1390/= per litre and 2535/= per kg which were reported in year 2005.

Table 22: Least Square means + SE of quantities of sunflower products sold by processors and their prices between 2005/2006 and 2009/10 production period

Factor	N	Product	Amount Sold (litre/ kg)	Price per litre / Kg (Tsh)
Overall mean	69	Sunflower oil in litres	71715.1 ± 3274.7	1480.4 ± 5.2
		Sunflower Cakes in kg	168669.6 ± 7397.1	2700.7 ± 9.4
Year of processing			***	***
2009	20	Sunflower Oil in litres	89094.8 ± 6084.1[a]	1565.0 ± 9.7[a]
		Sunflower Cakes in Kg	209886.9 ± 13710.7[a]	2810.0 ± 17.4[a]
2008	15	Sunflower Oil in litres	80113.0 ± 7025.3[a]	1500.0 ± 11.1[bc]
		Sunflower Cakes in Kg	200533.3 ± 15831.7[a]	2740.0 ± 20.01[b]
2007	12	Sunflower Oil in litres	69591.66 ±	1462.5 ± 12.5[c]

Factor	N	Product	Amount Sold (litre/ kg)	Price per litre / Kg (Tsh)
			7854.5[ab]	
		Sunflower Cakes in Kg	177426.6 ± 17700.4[a]	2712.5 ± 22.5 [b]
		Sunflower Oil in litres	50595.8 ± 7854.5[b]	1408.3 ± 12.5[d]
2006	12	Sunflower Cakes in Kg	114945.2 ± 17700.4[b]	2595.8 ± 22.5[c]
		Sunflower Oil in litres	52250.0 ± 8604.2[b]	1390.0 ± 13.7[d]
2005	10	Sunflower Cakes in Kg	92400.0 ± 19389.8[b]	2535.0 ± 24.6[c]

*** P < 0.001; Least squares means with similar superscript do not differ significantly

4.4.6.3 Quantities of sunflower products marketed by sample traders and their prices

Table 23 presents actual quantities of sunflower products marketed by sample traders in Singida district. Trend-wise the overall results revealed that the average quantities of sunflower oils marketed by sample traders in the study area declined from 2005 to 2006 business year and thereafter increase with the largest quantity recorded in 2009. Sunflower seed cakes that were sold by sample traders the trend did not show a clear pattern. The highest (8544.6 kg) quantities that were sold was in 2007 business year and the mean lowest (3367.0 kg) quantities of sunflower cakes marketed by sample traders was reported in 2008 business year.

For both products, prices were increasing with business years. The mean lowest prices for sunflower oil (1877.8/=) and sunflower seed cakes (2966.7/=) were observed in 2005 trading year while the mean highest prices for Sunflower oil (2358.0/=) and sunflower seed cakes (3806.0/=) were reported in 2009 trading year.

Table 23: Least Square means + SE of Quantities of sunflower products marketed by sample traders and their prices from 2005 - 2009

Factor	Product	N	Amount marketed	Price per litre / Kg (Tsh)
Overall mean	Sunflower oil	**84**	40886.2 ± 2542.1	2146.4 ± 12.6
	Sunflower cakes	**84**	5932.6 ± 456.4	3469.0 ± 21.0
Year of business			**	***
2009	Sunflower oil in litres	25	53529.9 ± 4679.6[a]	2358.0 ± 23.2[a]
	Sunflower cakes in kg	25	5383.2 ± 840.4[a]	3806.0 ± 38.6[a]
2008	Sunflower oil in litres	23	38687.0 ± 4679.6[b]	2124.0 ± 23.4[b]
	Sunflower cakes in kg	23	3367.0 ± 841.5[b]	3608.0 ± 38.7[a]
2007	Sunflower oil in	16	39131.9 ±	2100.0 ± 32.2[bc]

Factor	Product	N	Amount marketed	Price per litre / Kg (Tsh)
2006	litres		6489.4[b]	
	Sunflower cakes in kg	8	8544.6 ± 1164.9[c]	3238.5 ± 53.5[b]
	Sunflower oil in litres	10	29491.7 ± 6754.4[c]	2004.2 ± 33.6[c]
	Sunflower cakes in kg	4	7916.7 ± 1212.5[c]	3104.2 ± 55.7[b]
2005	Sunflower oil in litres	8	29600.0 ± 7799.3[c]	1877.8 ± 38.7[d]
	Sunflower cakes in kg	3	8166.7 ± 1400.0[c]	2966.7± 64.3[c]

** P < 0.01; *** P < 0.001; Least squares means with similar superscript do not differ significantly

4.4.7 Problems affecting marketing of sunflower products in Singida district

In this study the traders were specifically asked to give the problems affecting marketing of sunflower products. Table 24 presents the responses from them. The most critical problem according to majority of traders was low market prices for their product which accounts for 72 %. This implies that the sunflower marketing system was not efficient enough to provide price incentive for traders in study area. This was closely followed by unreliability of market (60 %). Other problems were high transport cost (48%), competition from similar products (40 %), poor infrastructures (32 %) and unaffordability of getting credit / loan (32 %).

Table 24: Problems affecting marketing of sunflower products

Variable	Frequency	Percentage
Competition from similar products	10	40.0
Low market price	18	72.0
Unreliable market	15	60.0
High transport cost	12	48.0
Poor infrastructures	8	32.0
Unaffordability of getting credit / loan	8	32

4.7 Analysis of demand for sunflower products

4.7.1 Socio-economic characteristics of consumers

The findings in Table 25 indicate some of the characteristics of sample consumers. About 38 (74.5%) were males while 13 (25.5%) were females. The status of consumers in the household revealed that 70.6% and 9.8% had male and female as head of household, respectively. Furthermore 11.8 % and 7.8 % were housewife and sons/ daughters, respectively.

Regarding marital status of sampled consumers, 84.3% were married, 13.7% singles and 2.0% widowed. This finding reflects that sunflower products were used highly by households with married couples than other groups. In terms of level of education, 3.9%, 47.1%, 43.1% and 2% reported to attain adult education, primary education, secondary education and diploma education, respectively. Majorities (51.0 %) of consumers were aged between 36 – 50 years and only 11.8 % were aged above 50 years (Table 25).

Most (33.3%) of consumers are involved with crop production as their main occupation, followed closely with those engaged with both crop production and livestock production (31.4%) while those who depend on salaried employment were 15.7% (Table 25).

Table 25: Characteristics of sample consumers

Variable	Frequency	Percentage
Sex		
Male	38	74.5
Female	13	25.5
Status of respondent in the household		
Head of the household (male)	36	70.6
Head of the household (female)	5	9.8
Housewife	6	11.8
Son/daughter	4	7.8
Marital Status		
Single	7	13.7
Married	43	84.3
Widowed	1	2.0
Education level of respondent		
Adult education	2	3.9
Primary education	24	47.1
Secondary education	22	43.1
Diploma	2	3.9
Degree	1	2.0
Age of respondents		
18 -25 years	12	23.5
26 - 35 years	7	13.7
36 - 50 years	26	51.0
Above 50 years	6	11.8
Main occupation of respondents		
Crop cultivation	17	33.3
Salaried employment	8	15.7
Crop production and livestock keeping	16	31.4
Fishing	2	3.9
Business and crop cultivation	3	5.9
Business	5	9.8

4.7.2 Extent of consumption or purchasing sunflower products

Results in Table 26 show the preference and reasons of consuming and/ or using sunflower products. The findings revealed that 64.7% and 35.3% prefer sunflower oil and both sunflower oil & sunflower seed cakes, respectively. The low levels of preference of sunflower seed cakes observed may probably imply that the majority of sample consumers are not aware of the importance of sunflower seed cakes as a livelihood strategy.

The reasons behind this pattern of consumption and/ or using of sunflower products were reported by consumers to be less expensive (27.5%), easily available (58.8%) and good quality (13.7%) of those products. From these results it can be concluded that frequency in consuming sunflower products will increase if the products will be easily available, less expensive and of good quality. This will result into processors' decision to increase the volume of production, influence traders' decision to sell more sunflower products to consumers and hence farmers could increase the levels of production of raw sunflower either by increase the size of land cultivated or by employing improved crop husbandry practices.

Table 26: Preference and reasons of consuming/ using sunflower products

Variable	Frequency	Percentage
Preference of sunflower product		
Sunflower oil	33	64.7
Both sunflower oil and sunflower seed cake	18	35.3
Reason for preference of sunflower products		
Less expensive	14	27.5
Easily available	30	58.8
Good quality	7	13.7

4.7.3 Frequency and reasons for consumption of a particular kind of sunflower product

The results in Table 27 indicate that 90.2% of 51 sampled consumers and 88.9 % of 18 of sampled consumers often consume or purchase sunflower oil and seed cakes, respectively. Consumers' reasons as to why they like to consume or purchase sunflower oil among others include: availability at right time (52.9 %), easily available at place (17.6%), personal preference (11.8 %) and affordability (9.8 %). For those (9.8%) who said they rarely consume sunflower oil, they associated it with unavailability of oil at right time which accounts to 4 (7.8 %) sampled consumers. On the other hand, reasons for regularly use of sunflower seed cakes, consumers said that this is due to good source of protein for their livestock, affordable and easily available which accounts to 55.6 % while others said that sunflower cakes are easily available at right time (11.1 %), easily available at right place (22.2 %) and good source of protein (11.1 %).

Table 27: Frequency of consumption / uses of sunflower products

Variable	Frequency	Percentage
Sunflower oil		
Often	46	90.2
Rarely	5	9.8
Sunflower seed cake		
Often	16	88.9
Rarely	2	11.1
Reasons for often/rarely consuming sunflower oil		
Easily available at right time	27	52.9
Easily available at right place	9	17.6
Not available at right time	4	7.8
Affordable	5	9.8
Personal preference	6	11.8
Reasons for using sunflower seed cake		
Easily available at right time	2	11.1
Easily available at right place	4	22.2
Good source of protein	2	11.2
Good source of protein, affordable and easily available	10	55.6

4.8 Analysis of existing sunflower value chain in Singida District

4.8.1 An overview

The value chain forms a useful unit of analysis in order to understand firm or sector competitiveness. Activities along value chains may involve concept inception, design, production, marketing, distribution, retailing, consumption and final disposal that may include waste management and recycling of good (UNCTAD 2010). Each link of the chain perform an activity and different forms add value at each stage of the activity e.g. Production or service provision. Development of value chains is determined by many factors among them accessibility to natural resources of fertile and well adapted land and climate, accessibility of labour, skills and skilled labour and technology (Porter, 1985). However, coordination of activities may differ between value chains and between different points in the same value chain. Overall, the value chain analysis entails drawing of a map showing the flows of goods and services within a chain. Mapping may include aspects such as firm size, value added and geographical distribution, and finally shows how chains are connected to activities elsewhere and their connection to final market. This study adopted this methodology.

4.8.2 Sunflower Farmers

Sunflower production in Singida Districts is dominated by smallholder farmers. These lack appropriate inputs, capacity for production, and access to reliable markets and processors to ensure a base for continued income. The smallholder producers have

very limited access to quality seeds and fertilizers due to high prices and employ local farming practices, which hamper productivity. Many small farmers rarely apply proper agronomic practices in land preparation, planting, weeding and use of fertilizers. Because of limited storage capacity and market information, majority of them normally sell their products right after the harvest instead of selling it at competitive prices at later stages. However from the findings of this study few of them nowadays tend to store some amounts of their produce to sell during the shortage of supply in raw sunflower. Others prefer to send their produce to processing plants and pay the fee for crushing the seeds and went back home with oil and/ or sunflower cakes which fetch high income comparing with what they get if they sold raw sunflower directly.

The poor infrastructure in Tanzania increases the cost of transportation all along the value chain, which will in the end increase the prices of inputs to outputs. This to a large extent discouraged smallholder farmers and hence the levels of production tend to increase at a slower rate.

4.8.3 Sunflower Processors

The processing of sunflowers normally includes bulking, seed crushing and refining. Bulking is normally done by packing the oilseeds into sacks and then storing them in a warehouse or collection centre prior to selling; the process of crushing includes weaning and removing of foreign particles, crushing, filtering, and oil storing. This is what is being done in many processing firms that were involved in this study in Singida district. Few firms were found to be involved in the refining processes.

The pressing machines in the sunflower chain act as market place for all forms of sunflower products. Privately owned processing machines are buying places for sunflower seeds from farmers, and also selling points for sunflower oil pressed out of the seeds bought. In addition farmers and traders who pressed their seed into sunflower oil also sell their oil in these premises especially when there was a ready buyer. Seed cakes which are retained by the processor are sold to, traders dealing with livestock feedstuff, livestock farms and individual households which keep livestock. Apart from the above mentioned buyers, there are also some traders who bought sunflower seed cakes and sell it to industries that make animal feeds in other parts of the country, particularly Dar-es-Salaam.

The limited storage facilities of the farmers necessitate the processor to purchase and store sunflower seeds. However the lack of refinery machines which was observed in majority of sampled processors hinder the process of improving the quality of the sunflower oils and the failure to label them appropriately, causes the loss of the potential added-value even from better refined sunflower oil products.

4.8.4 Sunflower Traders

Sunflowers are collected from small scale producers by the middlemen who are the individual traders, and then they are transported through public transport to the processors. Sunflower oil produced by processors is sold to the wholesalers, retailers and to consumers.

With limited capacity of storage, smallholder producers normally sold the raw sunflower directly to middlemen or processors. Wholesaling is mainly done if the oil is taken up-country, to urban centres, or to neighbouring countries. Normally, the wholesaler places his orders directly with the small or medium scale processors. Refined oil that is well-packaged and labelled can be sold in the retailer system in local markets including super markets. Most of sampled sunflower processors in Singida district sell the oil in containers with labelling. However there are little efforts which are being done in relation to market segmentation, promotion or advertising. So most sunflower processors need to develop a marketing concept for increasing their volumes of sales. Furthermore since sunflower cake is a key ingredient for livestock feed industry there is a need of promoting it among livestock farmers and farms. Historically, this product is largely exported to neighbouring countries.

4.8.5 Sunflower Consumers and users

Currently there is increasing demand of sunflower oil due to several health benefits it brings to human being. Among them sunflower oil lowers cholesterol through Lecithin which is present in sunflower oil which helps keep cholesterol levels low. Also sunflower oil among other benefits, it maintains healthy immune system, reduces cardiac problems, promotes a healthy nervous system, prevents asthma and colon cancer and improve heart health < http://www.3fatchicks.com/15-benefits-of-sunflower-oil/>. November 2012. However despite of the above mentioned benefits of sunflower oil it must be noted that the vegetable oil sector is highly competitive. The limited scale of production, high quality import products, and the lack of developed marketing mechanism from the sunflower industry (such as market segmentation, promotion, or advertising effort); place the sunflower oil industry at a comparative disadvantage in the competition with other edible oils.

4.8.6 Profit margins along the sunflower value chains in Singida

The sunflower farmers in Singida are subjected to higher production costs that are caused by fluctuations of inputs and labor costs in the markets. The processors and traders also incur high cost in processing and trading sunflower products. The cost of petroleum products in the World market has been increasing rapidly for the last three to four years and this has been causing prices of inputs and services like

transportation and ploughing to go up. However, the positive margins expressed by findings from Singida have been realized (Table 28).

The sub sector happens to be very profitable (value added per acre) to smallholder farmers in Singida (54940/=). The value additions after farm gate happen to be attractive as well at 84260/=.

Table 28: Profit margins along the sunflower value chains in Singida

Category of transaction:	Value	Value
Supply of inputs and production		
1. Sunflower seeds	6000	
2. Fertilizer	39000	
3.Transport	35000	
4. Labour	30000	
5. Ploughing	30000	
6. Packaging sunflower seeds	10000	
Total cost of inputs & production	150000	
Farm gate price	204940	**54940**
Transport, processing & handling	**40000**	
1. Transportation	204940	
2. Buying from smallholder farmer	80000	
3. Processing and packaging	20000	
4. Handling & Warehousing	344940	
Total cost transport, processing & handling	429200	**84260**
Price to the Tanzanian Market		

4.8.7 Providers of Supportive Services in the Value Chain

The findings from the current study revealed that there are some very important support service providers along the value chain, including seed producers, financial services providers, extension services providers, providers of sources of marketing information, transporters, providers of packaging materials and quality controllers.

4.8.8 Value Chain Development

Many products can be developed when processing of sunflower is considered in the value adding and diversification chains. Several application of sunflower may include:

- Use in making paints, vanishes and plastics
- Use as pesticide carried in the production of agrochemicals
- Use in the manufacturing of cosmetics and soaps
- Use in the development of Bio-diesel

CHAPTER FIVE: CONCLUSION AND POLICY RECOMMENDATIONS

Sunflower production in Singida district is nowadays considered as one of economic activities that can revamp the district from poverty. Production of sunflower in the area has been increasing year after year. Households are now earning income that enables them to meet the basic needs. Despite this fact production of sunflower in the district still faces a lot of challenges mainly associated with production, processing and marketing of the product. Among the factors affecting crop production are price fluctuations, unreliable markets, poor extension services, lack of market information, inadequacy of processing plants etc. This calls for deliberate efforts to improve the situation so as to increase productivity of the sunflower and hence increase income for households and thus reduce level of poverty.

Processing of sunflower is very critical and if done properly it increases value of the product. As revealed during this study majority of farmers do sell sunflower in its raw form and thus less earning. In addition processors are also facing a lot of challenges like high operational costs, price fluctuation, unreliable market and unaffordability of processing facilities. All these barriers pose a threat to profitability of the crop to farmers and their efforts to fight against poverty. It is therefore important that processing of sunflower be a pre-requisite and be done in an efficient manner to increase value of the crop and thus increase its contribution towards poverty reduction.

Improvement of marketing for sunflower produce like oil and cakes is the issue of urgency if sunflower production has to impact poverty reduction interventions. Without an improved marketing system, farmers will continue to earn less and thus be difficult to improve their livelihood.

It suffices to say here that despite the noted contribution of sunflower to household income, a lot remains to be done if such a crop has to have significant impact on reducing poverty at household level in Singida district. Addressing issues related to production, processing and marketing related factors is the issue of urgency.

SUGGESTED FURTHER WORK

Finalize the research report

Disseminate research findings to the relevant stakeholders

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APPENDICES

Appendix Table 1: Socio-economic characteristics of farmers

Characteristics	Ward				Total
Sex	**Mtinko (N=33)**	**Ikhanoda (N=35)**	**Ihanja (N=36)**	**Ikungi (N=34)**	**(N= 138)**
Male	66.7 %	80.0%	63.9 %	82.4 %	79.0 %
Female	33.3 %	20.0 %	36.1%	17.6 %	21.0 %
Status					
Head of household	60.6 %	85.7 %	75.0 %	82.4 %	76.1 %
Not head of household	39.4 %	14.3 %	25.0 %	17.6 %	23.9 %
Age					
below 20 years	3.0 %	2.9 %	5.6 %	2.9 %	3.6 %
21-40 years	45.5 %	37.1 %	44.4 %	55.9 %	45.7 %
above 40 years	51.5 %	60.0 %	50.0 %	41.2 %	50.7%
Level of education					
Non formal education	6.1 %	8.6 %	19.4%	2.9 %	9.4 %
Adult education	27.3 %	11.4 %	11.1 %	17.6 %	16.7%
Primary education	57.6 %	71.4 %	58.3 %	70.6 %	64.5%
Secondary education	9.1 %	8.6 %	11.1 %	8.8 %	9.4%
Marital status					
Single	6.1 %	8.6 %	22.2 %	11.8 %	12.3%
Married	90.1 %	91.4%	75.0 %	82.4 %	84.8%
Divorced	3.0 %	0 %	0 %	0 %	0.7%
Widow	0 %	0 %	0 %	2.9 %	0.7%
Separated	0 %	0 %	2.8%	2.9 %	1.4%
Main occupation					
Crop production activities	78.8 %	74.3 %	69.4 %	85.3 %	76.8 %
Salaried employment	9.1 %	5.7 %	8.3 %	2.9 %	6.5 %
Livestock keeping	3.0 %	0 %	0 %	2.9 %	1.4 %
Business	0 %	0 %	2.8 %	0 %	0.7 %
Crop and livestock production	6.1 %	20.0 %	19.4 %	5.9 %	13.0 %
Salaried/agricultural activities	3.0 %	0 %	0 %	2.9 %	1.4 %

Appendix Table 2: Sex of respondent by village

			Sex of respondent		Total
			Male	Female	
Village of respondent	**Mtinko**	Count	12	6	18
		% within village of respondent	66.7%	33.3%	100.0%
	Mjughuda	Count	17	6	23
		% within village of respondent	73.9%	26.1%	100.0%
	Malolo	Count	10	5	15
		% within village of respondent	66.7%	33.3%	100.0%
	Ngamu	Count	15	2	17
		% within village of respondent	88.2%	11.8%	100.0%
	Ihanja	Count	14	3	17
		% within village of respondent	82.4%	17.6%	100.0%
	Unyangwe	Count	13	1	14
		% within village of respondent	92.9%	7.1%	100.0%
	Ikungi	Count	12	2	14
		% within village of respondent	85.7%	14.3%	100.0%
	Muungano	Count	16	4	20
		% within village of respondent	80.0%	20.0%	100.0%
Total		Count	109	29	138
		% within village of respondent	79.0%	21.0%	100.0%

Appendix Table 3: Age of respondent by village

			Age of respondent			Total
			Below 20 years	21-40 years	Above 40 years	
Village of respondent	**Mtinko**	Count	0	11	7	18
		% within village of respondent	.0%	61.1%	38.9%	100.0%
	Mjughuda	Count	1	5	17	23
		% within village of respondent	4.3%	21.7%	73.9%	100.0%
	Malolo	Count	1	4	10	15
		% within village of respondent	6.7%	26.7%	66.7%	100.0%
	Ngamu	Count	0	8	9	17
		% within village of respondent	.0%	47.1%	52.9%	100.0%
	Ihanja	Count	1	7	9	17
		% within village of respondent	5.9%	41.2%	52.9%	100.0%
	Unyangwe	Count	1	9	4	14
		% within village of respondent	7.1%	64.3%	28.6%	100.0%
	Ikungi	Count	1	5	8	14
		% within village of respondent	7.1%	35.7%	57.1%	100.0%
	Muungano	Count	0	14	6	20
		% within village of respondent	.0%	70.0%	30.0%	100.0%
Total		Count	5	63	70	138
		% within village of respondent	3.6%	45.7%	50.7%	100.0%

Appendix Table 4: Education levels of respondents by village

Village		Level of education				Total
		Non formal education	Adult education	Primary education	Secondary education	
Mtinko		5.6%	22.2%	55.6%	16.7%	
	Count	1	4	10	3	18
Mjughuda	% within village of respondent	5.6%	22.2%	55.6%	16.7%	100.0%
	Count	3	3	16	1	23
Malolo	% within village of respondent	13.0%	13.0%	69.6%	4.3%	100.0%
	Count	1	5	9	0	15
Ngamu	% within village of respondent	6.7%	33.3%	60.0%	.0%	100.0%
	Count	0	1	14	2	17
	% within village of respondent	.0%	5.9%	82.4%	11.8%	100.0%
Ihanja	Count	2	3	11	1	17
	% within village of respondent	11.8%	17.6%	64.7%	5.9%	100.0%
Unyangwe	Count	5	1	5	3	14
	% within village of respondent	35.7%	7.1%	35.7%	21.4%	100.0%
Ikungi	Count	1	2	8	3	14
	% within village of respondent	7.1%	14.3%	57.1%	21.4%	100.0%
Muungano	Count	0	4	16	0	20
	% within village of respondent	.0%	20.0%	80.0%	.0%	100.0%
Total	Count	13	23	89	13	138
	% within village of respondent	9.4%	16.7%	64.5%	9.4%	100.0%

Appendix Table 5: Marital status of respondent by village

Village		Marital status of respondent					Total
		Single	Married	Divorced	Widow	Separated	
Mtinko	Count	1	16	1	0	0	18
	% within village of respondent	5.6%	88.9%	5.6%	.0%	.0%	100.0%
Mjughuda	Count	3	20	0	0	0	23
	% within village of respondent	13.0%	87.0%	.0%	.0%	.0%	100.0%
Malolo	Count	1	14	0	0	0	15
	% within village of respondent	6.7%	93.3%	.0%	.0%	.0%	100.0%
Ngamu	Count	1	16	0	0	0	17
	% within village of respondent	5.9%	94.1%	.0%	.0%	.0%	100.0%
Ihanja	Count	4	12	0	0	1	17
	% within village of respondent	23.5%	70.6%	.0%	.0%	5.9%	100.0%
Unyangwe	Count	3	11	0	0	0	14
	% within village of respondent	21.4%	78.6%	.0%	.0%	.0%	100.0%
Ikungi	Count	1	12	0	0	1	14
	% within village of respondent	7.1%	85.7%	.0%	.0%	7.1%	100.0%
Muungano	Count	3	16	0	1	0	20
	% within village of respondent	15.0%	80.0%	.0%	5.0%	.0%	100.0%
Total	Count	17	117	1	1	2	138
	% within village of respondent	12.3%	84.8%	.7%	.7%	1.4%	100.0%

Appendix Table 6: Main occupation of respondents by villages

Village		Main occupation						Total
		Farm activities	Salaried employment	Livestock keeping	Business	Farming/ livestock keeping	Salaried/ farming activities	
Mtinko	Count	15	2	1	0	0	0	18
	% within village of respondent	83.3%	11.1%	5.6%	.0%	.0%	.0%	100.0%
Mjughuda	Count	18	0	0	0	5	0	23
	% within village of respondent	78.3%	.0%	.0%	.0%	21.7%	.0%	100.0%
Malolo	Count	11	1	0	0	2	1	15
	% within village of respondent	73.3%	6.7%	.0%	.0%	13.3%	6.7%	100.0%
Ngamu	Count	10	2	0	0	5	0	17
	% within village of respondent	58.8%	11.8%	.0%	.0%	29.4%	.0%	100.0%
Ihanja	Count	10	3	0	0	4	0	17
	% within village of respondent	58.8%	17.6%	.0%	.0%	23.5%	.0%	100.0%
Unyangwe	Count	13	0	0	1	0	0	14
	% within village of respondent	92.9%	.0%	.0%	7.1%	.0%	.0%	100.0%
Ikungi	Count	10	1	1	0	1	1	14
	% within village of respondent	71.4%	7.1%	7.1%	.0%	7.1%	7.1%	100.0%
Muungano	Count	19	0	0	0	1	0	20
	% within village of respondent	95.0%	.0%	.0%	.0%	5.0%	.0%	100.0%
Total	Count	106	9	2	1	18	2	138
	% within village of respondent	76.8%	6.5%	1.4%	.7%	13.0%	1.4%	100.0%

Appendix Table 7: Size of households by village

Village	Household Size				Total
	1-2	3-4	5-6	Above 6	
Mtinko	1 (5.9%)	0 (0.0%)	4 (23.5%)	12 (70.6%)	**17**
Mjughuda	0 (0.0%)	1 (5.9%)	1 (5.9%)	15 (88.2%)	**17**
Malolo	0 (0.0%)	0 (0.0%)	4 (30.8%)	9 (69.2%)	**13**
Ngamu	1 (5.9%)	0 (0.0%)	2 (11.8%)	14 (82.4%)	**17**
Ihanja	1 (6.7%)	1 (6.7%)	4 (26.7 %)	9 (60.0%)	**15**
Unyangwe	0 (0.0%)	1 (8.3%)	6 (50.0%)	5 (41.7%)	**12**
Ikungi	2 (14.3%)	4 (28.6%)	4 (28.6%)	4 (28.6%)	**14**
Muungano	1 (5.9%)	2 (11.8%)	12 (70.6%)	2 (11.8%)	**17**
Total	**6 (4.9%)**	**9 (7.4%)**	**37 (30.3%)**	**70 (57.4%)**	**122**

Appendix Table 8: Acreage under sunflower production from 2006 – 2010

Village of respondent		Land size cultivated in acre in 2009/2010	Land size cultivated in acre in 2008/2009	Land size cultivated in acre in 2007/2008	Land size cultivated in acre in 2006/2007	Land size cultivated in acre in 2005/2006
Mtinko	Mean	2.4000	2.1667	3.0714	3.8000	3.5833
	N	15	12	14	15	12
	Std. Deviation	.91026	.83485	1.68543	2.83347	1.88092
Malolo	Mean	2.3333	2.2500	2.6667	3.5000	5.1000
	N	12	12	15	14	10
	Std. Deviation	1.48222	1.21543	1.44749	2.13937	7.18718
Mjughuda	Mean	2.5750	2.6944	2.7500	3.6000	3.9000
	N	20	18	22	15	12
	Std. Deviation	1.04220	1.56373	1.41211	2.59670	2.06706
Ngamu	Mean	2.1667	2.6364	3.5385	4.0000	4.0571
	N	12	11	13	11	7
	Std. Deviation	.83485	.80904	1.61325	1.73205	2.03540
Ihanja	Mean	2.1923	2.7692	2.6176	4.0333	3.5500
	N	13	13	17	15	12
	Std. Deviation	1.10940	1.64083	1.29337	3.18740	2.26134
Unyangwe	Mean	2.7500	2.5714	4.0000	4.5200	5.0000
	N	8	7	11	10	9
	Std. Deviation	1.03510	.97590	1.61245	3.02581	4.38748
Ikungi	Mean	2.2727	2.6818	4.7308	3.9444	2.5556
	N	11	11	13	9	9
	Std. Deviation	1.48936	1.97829	3.17946	2.21422	1.66667
Muungano	Mean	2.5312	2.4071	2.9375	3.0769	3.8000
	N	16	14	16	13	10
	Std. Deviation	1.11757	.83617	1.84278	1.49786	1.98886
Total	Mean	2.4065	2.4847	3.1942	3.9118	3.6790
	N	107	98	121	102	81

Village of respondent		Land size cultivated in acre in 2009/2010	Land size cultivated in acre in 2008/2009	Land size cultivated in acre in 2007/2008	Land size cultivated in acre in 2006/2007	Land size cultivated in acre in 2005/2006
Mtinko	Mean	2.4000	2.1667	3.0714	3.8000	3.5833
	N	15	12	14	15	12
	Std. Deviation	.91026	.83485	1.68543	2.83347	1.88092
Malolo	Mean	2.3333	2.2500	2.6667	3.5000	5.1000
	N	12	12	15	14	10
	Std. Deviation	1.48222	1.21543	1.44749	2.13937	7.18718
Mjughuda	Mean	2.5750	2.6944	2.7500	3.6000	3.9000
	N	20	18	22	15	12
	Std. Deviation	1.04220	1.56373	1.41211	2.59670	2.06706
Ngamu	Mean	2.1667	2.6364	3.5385	4.0000	4.0571
	N	12	11	13	11	7
	Std. Deviation	.83485	.80904	1.61325	1.73205	2.03540
Ihanja	Mean	2.1923	2.7692	2.6176	4.0333	3.5500
	N	13	13	17	15	12
	Std. Deviation	1.10940	1.64083	1.29337	3.18740	2.26134
Unyangwe	Mean	2.7500	2.5714	4.0000	4.5200	5.0000
	N	8	7	11	10	9
	Std. Deviation	1.03510	.97590	1.61245	3.02581	4.38748
Ikungi	Mean	2.2727	2.6818	4.7308	3.9444	2.5556
	N	11	11	13	9	9
	Std. Deviation	1.48936	1.97829	3.17946	2.21422	1.66667
Muungano	Mean	2.5312	2.4071	2.9375	3.0769	3.8000
	N	16	14	16	13	10
	Std. Deviation	1.11757	.83617	1.84278	1.49786	1.98886
Total	Mean	2.4065	2.4847	3.1942	3.9118	3.6790
	N	107	98	121	102	81
	3.35718					

Appendix Table 9: Amount of sunflower produced per acre in surveyed villages

Village		Amount of sunflower produced (bags/acre)				
		2009	2008	2007	2006	2005
Mtinko	Mean	10.5	10.8	10.0	10.0	6.7
	N	13	12	7	7	12
	Std. Deviation	3.86	3.11	2.00	5.13	2.46
Malolo	Mean	9.7	9.8	9.5	10.1	8.1
	N	13	12	8	8	11
	Std. Deviation	2.49	3.19	4.47	4.00	2.55
Mjughuda	Mean	8.9	11.2	8.7	12.4	10.0
	N	20	18	15	8	13
	Std. Deviation	3.61	10.26	3.57	5.78	3.92
Ngamu	Mean	10.3	9.7	10.0	9.0	7.4
	N	12	12	8	6	7
	Std. Deviation	4.37	3.36	3.93	4.05	1.90
Ihanja	Mean	9.5	9.6	9.8	10.0	7.7
	N	12	12	4	3	12
	Std. Deviation	5.14	4.37	2.45	2.00	1.44
Unyangwe	Mean	9.3	9.3	9.8	12.5	7.4
	N	7	7	2	2	9
	Std. Deviation	5.85	4.31	0.35	7.78	1.74
Ikungi	Mean	10.8	11.9	13.0	11.8	8.4
	N	12	11	6	6	9
	Std. Deviation	4.52	3.52	3.35	3.25	2.95
Muungano	Mean	7.4	7.9	8.0	9.4	7.2
	N	16	11	6	5	13
	Std. Deviation	3.36	2.12	3.41	2.19	0.89
Total	Mean	9.1	9.8	9.6	10.4	7.9
	N	105	95	56	45	86
	Std. Deviation	4.08	5.43	3.53	4.30	2.55

Appendix Table 10: ANOVA for the effect of level of education to the sunflower yield

Variable	Source of variation	Sum of Squares	df	Mean Square	F	Sig.
Total amount produced in 2009/2010	Between Groups	103.484	3	34.495	2.142	.100
	Within Groups	1626.478	101	16.104		
	Total	1729.962	104			
Total amount produced in 2008/2009	Between Groups	150.594	3	50.198	1.743	.164
	Within Groups	2620.311	91	28.795		
	Total	2770.905	94			
Total amount produced in 2007/2008	Between Groups	.799	2	.400	.031	.969
	Within Groups	683.058	53	12.888		
	Total	683.857	55			
Total amount produced in 2006/2007	Between Groups	103.276	3	34.425	1.989	.131
	Within Groups	709.524	41	17.305		
	Total	812.800	44			
Total amount produced in 2005/2006	Between Groups	35.473	3	11.824	1.873	.141
	Within Groups	517.727	82	6.314		
	Total	553.201	85			