SOCIO-ECONOMIC DETERMINANTS OF SUNFLOWER SEED PRODUCTION IN SINGIDA REGION, TANZANIA

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ABSTRACT

Sunflower seed production has been a response of rising demand for sunflower oil in the local and export market of Tanzania. The use of certified sunflower seeds has increased production of sunflower oil among the producers for local and export market. This work aimed at investigating the socio-economic determinants affecting sunflower seed production in Singida region of Tanzania. The cross-section research design with a sample size of 140 respondents was used to obtain information regarding determinants of sunflower seed production in the study area. The findings of the study shows that, the level of technology used by seed producers and suppliers ($P<0.01$), the use of skilled labor in the factories ($P<0.05$), the market demand ($P<0.01$), disasters and diseases ($P<0.01$) were the key factors having a direct effect on sunflower seed production. The extent of seed production was measured based on tons of seeds produced in the years 2016 to 2020, and the study also found that sunflower seed production was low compared to the market demand at the same period. The study concluded that the rate of sunflower seed production and supply in the market can be increased by upgrading the technology used in sunflower seed value chain in Tanzania.

Keywords: Sunflower seed, production, producers, suppliers, value chain and technology.

1. INTRODUCTION

Sunflower is one of the most important oilseed crop on a global scale and it is grown on a total of over 22.81 million hectares worldwide (Basavarajappa, 2017). Due to the vast areas in which it is grown worldwide, this crop requires the use of high-quality seed (Vujaković *et al.*, 2019) and this is especially because crop growers have increased awareness on the importance of seeds that are capable of quick and uniform germination in different environmental conditions, as required by the modern methods of agricultural production (Mrdja *et al.*, 2018). The use of modern methods in agriculture has fostered the global production of sunflower seed increase to 22% in 2018 compared to other oil seeds like coconuts 18%, sesame 16%, and shea 15.4% (Feddel, 2020).

Sunflowers were first commercially produced in the Russian Federation and today the largest producers are the Russian Federation (25%), Ukraine (22%), and the European Union (22%) whereby African countries account for 5.5 % of the world's production, with strong growth experienced in the past decade (2005–2014) in the United Republic of Tanzania, Uganda and South Africa (URT, 2015). To be able to meet the increased grower demand for sunflower improved varieties that are of as high quality and as high-yielding as possible, the current improved varieties range must be rapidly replaced with a new set of improved varieties that are better, more productive, and more stable. The development of high-yielding varieties coupled with the use of appropriate agronomic practices reduces the impact of limiting determinants in sunflower production and contributes to the increase of sunflower yields (Willker, 2017).

In Tanzania, 6% of the land under production is used for the cultivation of sunflowers (Duku *et al*; 2019). In areas like Mbeya (Southern Highlands) and Dodoma and Singida (Central Corridor), the area under sunflower varies from 1 - 10 acres per household (Willen, 2018). According to FAO (2019), the average yield of sunflower is 979 kilogram per hectare. Despite the relatively good agricultural land and business environment for producing sunflower, Tanzania remains a net importer of edible cooking oil whereby average of 395,000 tons of cooking oil are imported from Malaysia annually (TASUPA, 2022). The sunflower oil produced by local processors only meets 40% of the national cooking oil requirements (Zhihua, 2017). According to Mchopa, (2020), the estimated minimum national demand was around 330,000 tons of sunflower oil per annum in 2019, a figure that was expected to increase by 3 % annually. The cost of producing sunflower oil in the United Republic of Tanzania is lower than for other oilseed crops (sesame, groundnuts) (URT, 2015) which makes sunflower at a comparative advantage over the other seed crops. Additionally, there is an active local market demand for sunflower oil for domestic use as well as demand for the by-product: seed cake for livestock feeding. Thus, despite these socio-economic potentials, national production of sunflower seeds in Tanzania has been decreasing over the years; for example, in 2017 the production of sunflower seeds was 438,909 tons, in 2018 was 378,452 tons and in 2019 was 233,563 tons, a figure that was expected to decrease as production decreased by 2% (URT, 2015). Given the socio-economic potentials of sunflower seeds and the decrease rate of sunflower seeds production over the years, there is a need to investigate the socio-economic determinants leading to low production and accessibility of sunflower seeds in the market that is essential for increasing sunflower production and hence sunflower oil in the market. The study specifically looked at the extent to which the socio-economic determinants affect sunflower seed production in Tanzania.

The study, finding is anticipated to contribute to the frontier of knowledge on determinants discouraging or encouraging sunflower seed production. In addition, this study may offer inputs to the regulatory bodies and policymakers toward the required changes on sunflower seed productivity and accessibility to smallholder farmers.

The study undertakings were guided by the theory of production (production function) which involves some of the most fundamental principles of economics. These include the relationship between the prices of commodities and the prices (or wages or rents) of the productive determinants used to produce them and also the relationships between the prices of commodities and productive determinants, on the one hand, and the quantities of these commodities and

productive determinants that are produced or used, on the other (Dorfman, 1987). The theory underlies the assumptions basing on the decisions a business enterprise makes about its productive activities can be classified into three layers of increasing complexity. The first layer includes decisions about methods of producing a given quantity of the output in a plant of a given size and equipment. It involves the problem of what is called short-run cost minimization (Dorfman, 1987).

The second layer includes the determination of the most profitable quantities of products to produce in any given plant, deals with what is called short-run profit maximization. The third layer, is concerned with the determination of the most profitable size and equipment of the plant, relates to what is called long-run profit maximization (*ibid*). The theory provides guidance for sunflower seeds producers on the decisions of means of production in the short-run cost minimization, short-run profit maximization and in the long- run profit maximization. These involve the relationship between the price of sunflower seeds and the prices (or wages or rents) of the productive determinants used to produce them and the technology applied in production. This relationship can determine the quantity and quality of sunflower seeds production. Also, the relationship between the causing determinants (independent variables) and the effect factor (dependent variable) of the study were described using (Figure 1)
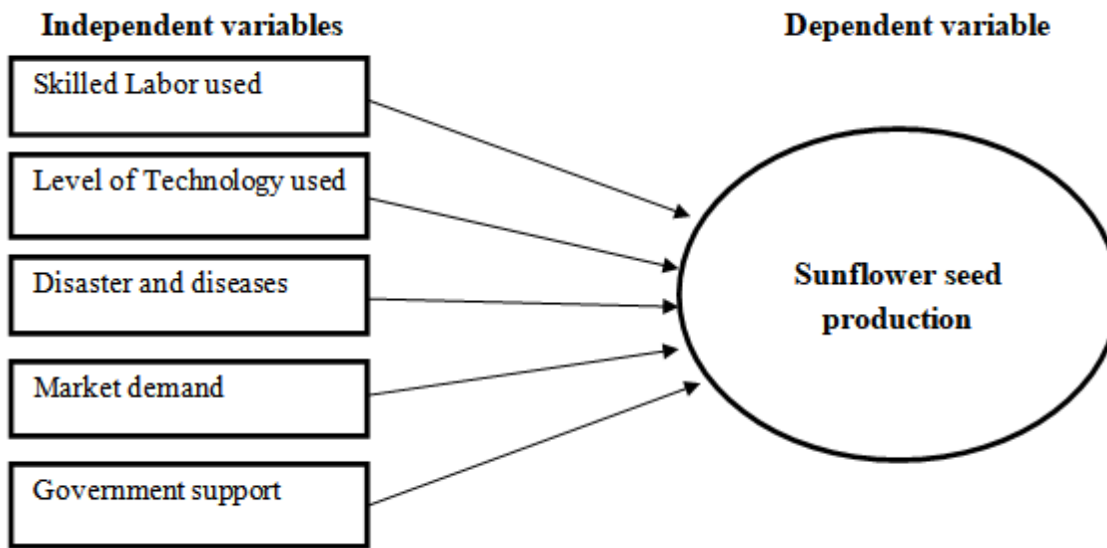

Figure 1: Conceptual framework; Source: Researcher's design (2021)

2. MATERIALS AND METHODS

Multiple variables with varied characteristics were collected using a cross sectional design (Labaree (2009) and Rindfleisch, *et al*., 2008)). Data were also examined at a single point in time and the associations and patterns of variables were determined (Bryman, 2012). Mixed methods approach was used since the utilization of quantitative and qualitative techniques was possible in the collection and analysis of data to triangulate the findings (Saunders, *et al* 2012). Data were collected from sunflower seeds suppliers and producers to determine socio-economic

determinants affecting sunflower seeds production. Production was measured based on the annual volume of production (in tons). Simple random sampling technique was employed and an initial sample size of 150 respondents was used in the study as calculated from the sampling formula given by Fisher (1954).

$$n = p \times q \, [z/e]\,2 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(1)}$$

Where:

n= was minimum sample size required

p = the proportion belonging to the specified category

q = the proportion not belonging to the specified category

z = the value corresponding to the level of confidence required (90% certain=1.65, 95% certain= 1.96 and 99% certain=2.57)

e = the degree of variability in the sample (0.5 is maximum and lowest risk)

e % = the margin of error required

When the population is greater than 10,000 the sample need to be adjusted according to minimum sample size formula as shown below:

n.'= n. / (1+n./N) where;

n.' = the adjusted minimum sample size

n. = the minimum sample size (as calculated)

N = the total population

Using;

p=50%, q=50%, z=1.96 (95% certain) e= 5% (i.e. within plus or minus 5% of the true percentage, the margin of error that can be tolerated), N=?

n. = 50x50x [1.2247/5]2

= 2500x 0.06

= 150

The study employed structured questionnaires in quantitative data collection that were pre-tested and revised accordingly prior to data collection. Qualitative data were gathered by using Key Informant Interviews (KIIs). A total of 5 KIIs were conducted with purposively selected technical and administrative personnel based on their knowledge of the production of sunflower seeds and community development. Qualitative data were transcribed, categorized, coded (open coding and axial coding), and thereafter grouped into themes pertaining to the objective and analyzed using constant comparison technique. Descriptive statistics (mean, median and mode) were used for analysis of the socio-economic determinants while the Ordinary Least Square (OLS) model was employed for regression of the socio-economic determinants affecting sunflower seeds production. The model chosen was guided by the nature of the dependent variable (production) which is the continuous variable measured in the number of tons.

$$\gamma = \alpha + \beta_0 X_0 + + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \dots \beta_p X_p + \mu \dots\dots\dots\dots\dots\dots\dots\dots\text{(2)}$$

γ= Represents the level of sunflower seeds production in tons

α = intercept of the equation

$\beta 1$ to βp = predictor variables regression coefficients

X1 to Xp = predictor variables (Labor, Technology level, Disasters and diseases, Demand, Government support and priorities)

μ = error term

3. RESULTS AND DISCUSSION

The 150 questionnaires were distributed to potential respondents including sunflower seeds producers and suppliers. 140 respondents returned the filled questionnaires as were required by the researcher constituting 93.3% of the respondent rate (Table 2).

Table 1: Distribution of Respondents

Category of respondents	Target Number	Actual Number
Sunflower seeds producers only	54	51
Sunflower seeds suppliers only	45	41
Sunflower seeds producers and suppliers	51	48
Total	**150**	**140**
Percentage	**100%**	**93.3%**

3.1 The socio-economic challenges facing sunflower seeds producers in Tanzania

The study sought to analyze the socio-economic determinants leading to the increase in production of sunflower seeds. Under this section the study employed the linear model using the Ordinary Least Square (OLS) to capture the relationship between the identified socio-economic challenges and their effects on sunflower seed production in the study area. The study included socio-economic determinants such as level of technology, level of skilled labor, market demand, government support and disaster and diseases as independent variables, also the study included sunflower seed production among producers as a dependent variable. The measurement of the sunflower seed production was based on the number of tons produced in the specific year, 2021. The regression output of the dependent and independent variables are presented (Table 3)

Table 2: The marginal effect of sunflower seed production (2021)

Linear regression	Number of observation			140
	R-squared			0.8271
	Root MSE			16179
Sunflower seeds production	Coef.	Std. Err.	t	P>t (Significance)
Level of technology	32.9096	2.5291	13.01	0.000***
Disaster and diseases	-14013.65	2785.53	-5.03	0.000***
Skilled labor	14547.61	5458.09	2.67	0.009**
Market demand	15738.73	4195.79	3.75	0.000***
Government support	-685.75	5027.89	-0.14	0.892
_cons	15.194	0.81464	18.65	0.000***

Dependent variable: Sunflower seeds production, Standard errors in parentheses (*** p<0.01, **p<0.05, * p<0.1)

The accuracy of the prediction (R^2) which shows how much of the model was explained by the independent variables was 82.71% which implied that the goodness of fit of independent variables were significantly high to measure the production of sunflower seeds. The findings in Table 3 showed that the level of technology was statistically significant (*P<0.01*) in determining the level of sunflower production where by the increase of 1 unit of technology leads to the increase of sunflower seeds production by almost 33 units, this implies that advancement of technology on sunflower seeds production increases the rate of production and distribution of sunflower seeds. The increase of seeds technology on a proper seeds production criteria and application of advanced technology on pest and diseases management, irrigation storage, pollination, seed treatment, packaging and seed standard increase the rate of seeds production. The findings were supported by Tuntufye (2020) who found that, advancement of technology on sunflower seeds production including using breeding technologies, technology of seeds storage and seeds supply increases the sunflower seed production and accessibility to the smallholder farmers which fosters the increase in production of sunflower cooking oil.

The study also found that, disaster and diseases were statistically significant (*P<0.01*) in a model determining sunflower production and had a negative relationship with sunflower seeds production. This implies that a unit increase of disasters and diseases leads to the decrease of sunflower seeds production by 14,013.65 units. This means that disasters and diseases have a direct effect on reducing the rate sunflower seeds production whereby the two determinants destroy seeds plants and reduces the rate of seeds production. The use of skilled labor among the seeds producers was statistically significant (*P<0.05*) to determine the level of sunflower production and it had a positive relationship. The findings implied that an increase of 1unit of skilled labor leads to the increase of sunflower production by 14,547.61 units; this means that the use of skilled labor in sunflower seed production increases the volume of production of seeds. Dhurma (2021) found that, the number of skilled labors contributes to 75% of sunflower seeds production especially for the growers depending on the use of manpower instead of using machines during seeds production.

Market demand was one of the factors determined sunflower seeds production and the variable was statistically significant (*P<0.01*) in the model, the variable had a positive relationship with sunflower seeds production. The finding of the study implied that an increase of 1 unit of market demand leads to the increase of sunflower production by 15,738.73 units in a specific year. The study also found that the extent of sunflower seeds produced among producers was determined by the demand of sunflower seeds among growers and small-scale farmers.

Government support was perceived not to be a direct factor affecting sunflower seed production. This may be because, this factor affects other direct factors that affect the production as increased skilled labor in the value chain, making available the technology to be used by sunflower seed producers and control of demand by controlling the importation of oils to lift the internal markets (Farm Africa report, 2022; Bank of Tanzania Working paper No. 10, 2012). With this therefore, government intervention is an essential element towards increase in

sunflower seed production by controlling other direct factors affecting production of sunflower seed and other factors along the sunflower value chain.

3.2 The extent of sunflower seeds production in the last five years
The study sought to analyze the extent of sunflower seeds produced in the last five year (from 2016 up to 2020) among the sunflower seed's producers in Singida region. The trend of sunflower seeds production in the specified period of time were measured in term of tons of seeds produced and tons of seeds demanded in the market (Figure 2). The findings of the study show that the extent of sunflower seeds demanded in the market was higher compared to the extent of sunflower seeds produced which means in the last five years there was scarcity of sunflower seeds in the market. In the year of 2016, 2017 and 2018 the production rate was 674 tons, 389 tons, 427 tons respectively. In the year of 2019 the production rate rose to 1089 tons because of the influence of the market demand of sunflower oil in the world although the production rate did not meet all demands of sunflower seeds and in the year of 2020 the production rate decreased to 567 tons compared to the production rate of 2019.
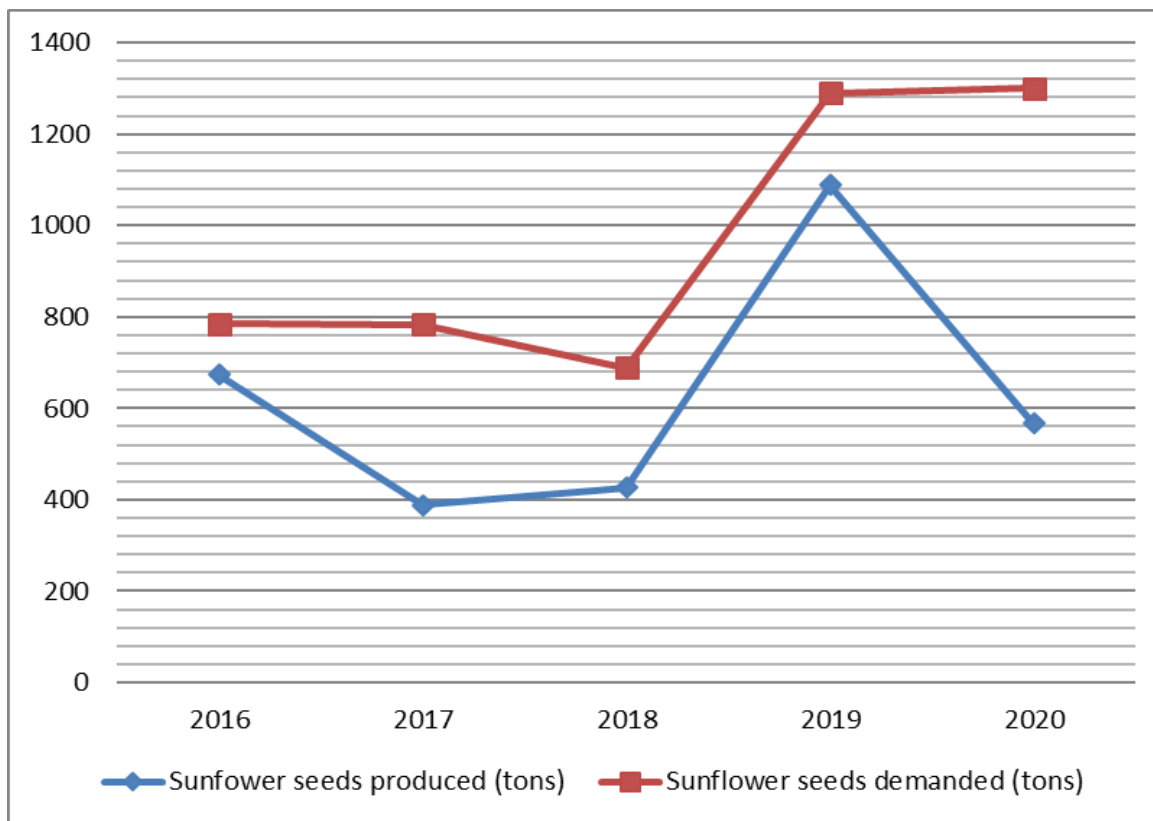

Figure 2: The extent of sunflower seeds production and market demand in the last five years

The findings also shown that in the year of 2016, 2017, 2018, 2019 and 2020 the market demand of sunflower seeds were 785 tons, 836 tons, 689 tons, 1290 tons and 1349 tons respectively (Figure 2). The findings of the study implied that the production rate of sunflower seeds was below the market demand rate of sunflower seeds in the last five years. The study reveals that

main determinants contributed to low production were disaster and diseases, technology as described in the study.

3.3. The sunflower seed value chain in Singida

According to information obtained from TOSCI, Sunflower seed production in Singida is dominated by QDS seed producers with few certified class seed producers in the year 2016 to 2022. With these observation, it looks like the only seed variety that is produced in large quantities in Singida is records since the QDS producers cannot embark into production of hybrid seed despite the fact that sunflower hybrid varieties are also cultivated by farmers.

This study established a number of elements along the sunflower seed value chain and all other areas affecting the production of sunflower seed. These includes, Demand for sunflower seed, producers of sunflower seed, suppliers of sunflower seed, small scale sunflower producers and enabling institutions and service providers along the value chain.

3.3.1 Demand for sunflower seed

The value chain of the sunflower seeds production starts with the market demand. The demand for sunflower seed is created by the scarcity of cooking oil in Tanzania especially when comparing the production of sunflower with the population increase. As of now, the country imports coking oil since the internal production cant suffice the need for cooking oil in the country. For increased sunflower productivity it is essential that sunflower farmers adhere to technological advances in agriculture, use of good quality seed be among the advances that are needed. This then will trigger the demand for seed of improved high yielding varieties and hence increase business in seed production.

3.3.2 Producers of sunflower seed

Sunflower seed producers, these are those registered seed dealers dealing with production of sunflower seed. Their production is largely affected by demand for sunflower production that in turn is created by cocking oil demand and animal feed demand.

3.3.3 Suppliers of sunflower seed

These are those companies or registered seed dealers that usually buy and sell sunflower seeds, distributing the seeds to the end users of the product who are farmers producing sunflower for end use, either oil extraction, selling, or animal feed.

3.3.4 Farmers of sunflower

For increased production in their farms, small scale and large scale farmers are advised to use certified seed. These will in turn create demand for sunflower seed and the producers of the seed will increase productions as the demand force has been created. Some small scale farmers are still using local seed of sunflower that a not high yielding and not of acceptable quality standard, this in turn is a challenge that leads to low production potential for the crop. The government then needs to invest in awareness creation on the benefits of using certified seed.

3.3.5 Enabling institutions and services providers

The study identified key enabling institutions and services providers on sunflower seeds production. Financial institutions and extension services provided by the government observed to

foster the production of sunflower seeds and enabling smallholder farmers in agricultural advancements. Table 5 shows the number of sunflower seeds producers from the value chain who accessed financial supports from financial institutions and the group seeds producers and smallholder farmers accessed the extension services.

Table 3: Number of sunflower seeds producers, suppliers and smallholder farmers benefited with financial institutions and government's extension services.

Enabling institutions and service providers	Respondents	Frequency	Percent
Financial institutions	Sunflower seeds producers	14	27
	Sunflower seeds suppliers	17	45
Extension services	Sunflower seeds producers only	6	12
	Smallholder farmers	22	27

Source: Research Data (2021)

- **Financial institution**

Financial institutions have been playing a vital role of enabling seeds producers and suppliers financial credits and trainings on financial investments. The study shown that about 27% of the sunflower seed's producers have accessed credits from different financial institutions for sunflower seeds production and 45% of the sunflower seeds suppliers accessed credits from different financial institutions

- **Extension services**;

Government extension services promote high productivity among small holders' farms and seeds producers through trainings and coordination of inputs and product market. The findings of this study show that, 12% of seed producers and 27% of small holder farmers of sunflower benefited from extension services supported by the government. One of the respondents benefited with extension services noted saying;

> *"Extension officers have helped us to understand the importance of using certified seeds for sunflower production from the source approved by the Tanzania Official Seed Certification Institute (TOSCI), use of cultural practices such as proper land preparation, time of sowing, spacing, seed rating, fertilization, irrigation, weeding and intercultural, earthing, supplementary pollination, plant protection against diseases, pests, harvesting and threshing".*

4.CONCLUSION AND RECOMMENDATIONS

This study identified socio-economic determinants affecting sunflower seeds production using Singida region as a case study. Based on the analysis of the collected data from the seed producers, seeds suppliers and other key informants it was found that the level of technology used by sunflower seeds producers and suppliers, the use of skilled labor in the factories, the market demand, disasters and diseases were the key factor having a direct effect on sunflower seeds production. The extent of seeds production was measured basing on tons of seeds produced in the year of 2016 up to 2020, and the study found that, sunflower seed production was low compared to the market demand at the same period of time. Based on these findings, it can be concluded that the rate of sunflower seed production and supply in the market can be increased

only if sunflower seeds producers use advanced technology in seeds production and availability of new improved sunflower varieties, and certified to seeds. The use of skilled labor among the seeds producers, disasters and diseases were the other key determinants contributing to low sunflower seed production which are to be put in place with policy makers for a quick intervention to increase the rate sunflower seeds production.

6. ACKNOWLEDGEMENT

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