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Investment Analysis of Sunflower Farming and Prospects of Raising Household income in Iramba District, Tanzania

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Abstract— *Sunflower production has a potential to play great role in poverty reduction in Tanzania. It grows well indry land like Iramba district where other crops cannot perform well. Despite this potential, poverty prevalence in Iramba district is still alarming as 52% of Iramba households are poor with an average earning of 85,125Tsh/month. This paper assessed contribution of sunflower production towards reduction of income poverty in Iramba district by using Gross Margin, Return on Investment (ROI) and poverty analysis methods. Stratified sampling technique was used to select 107 sunflower farmers for interviews. Focus Group Discussion and desk review of literature supplemented data collected through interviews.*

Findings of the study revealed that sunflower production achieved a gross profit margin of Tanzanian shillings 41,540.78/acre (18.71USD/acre) and a Return on Investment of 16% per acre. However, poverty analysis showed that the level of sunflower returns per acre had little contribution in terms of meeting the international poverty line. This is equivalent to only daily per-capita earnings of 167.63Tsh (0.07USD) that is far below income poverty line of 4,009Tsh/day (1.90 USD).

It is therefore recommended that large scale sunflower processors engage in sunflower farming through backward integration taking on board out grower schemes. The schemes will help small holder farmers gain new knowledge on best farming practices to increase productivity and gain access to reliable market for their produce. Additionally, further research on comparison of costs and benefits for monoculture onfarm/onstation sunflower production trials by using improved seeds should be conducted. The research should also investigate efficiency of mixed cropping patterns practiced by farmers to find out the contribution of each crop in the farming systems towards income poverty alleviation.

Keywords— ***Sunflower Farming, Household income, poverty reduction.***

I. INTRODUCTION

Sunflower sub-sector contributes about 32% of national edible cooking oil in Tanzania (Iringo, 2013); whose main production (61%) equivalent to 267,274 MT is grown in central corridor of Dodoma and Singida regions (RLDC-Tanzania, 2015). The rest is grown in other regions including Iringa, Ruvuma, Rukwa and Mbeya in the south corridor and Morogoro region in the East. Generally, Tanzania ranks the tenth world sunflower producer and second Africa's sunflower production accounting for 2.4% and 35% of the world and Africa's production respectively (factfish, 2010; Komba *et al.*, 2017). Production of sunflower oil seeds in Tanzania is dominated by small-scale farmers amounted to 4,000,000 households (URT, 2016) equivalent to 24 million residents which is about half of Tanzanian population. This implies that development of the sector can serve as a potential tool for improving the livelihoods and welfare of majority of the poor in the country (Zeng, 2011).

Singida region accounts for two third of all sunflower produced in the country with all of its districts engaged in sunflower production (Agricultural Census 2010/11). Meanwhile Iramba is the main sunflower producer accounting for 55.7% of the regional production whose

residents (39,376 households) are engaged in the production with an average density of 1.3ha/household, and productivity of 0.7ton/ha (URT, 2008).

Sunflower's good performance in poor soils and dry conditions puts the crop in a position to be up-scaled throughout the country; particularly in marginal areas where other crops cannot perform (URT, 2016). Moreover, sunflower production has relatively higher profitability amounting to$750/ha than other crops which can be grown in semi-arid areas like maize, sorghum and millet with profitability of $300/ha, $690/ha and $260/ha respectively (Tran –SEC, 2017). Its performance in poor soils and dry conditions; and higher production profitability identifies it as a climate smart crop that can serve a great role in poverty reduction and national economic development at large.

It can be acknowledged that significant growth trends in sunflower production has been experienced in Tanzania from less than 500,000 metric tons in 2008 to about 2.9 three million metric tons in 2016 (URT, 2016; Balchin et al., 2018). Despite the growing trend of sunflower; the sector has been facing challenges that hindered smallholder farmers and stakeholders at large to deploy its benefits to its full potential. Insufficient accessibility to quality certified sunflower seeds, lack of public and private partnership, non-compliance to international food safety requirements and inadequate extension services, dependence on rain-fed agriculture, poor mechanization for cultivation using hand-hoe and dependence on smallholder farmers whose farming target the subsistence level are among challenges that have been facing agricultural sector and sunflower subsector in particular.

Various stakeholders (including Government, development partners and researchers) have devised numerous efforts to address poor yields of the crop and poverty reduction among smallholder farmers. The **Government** initiated Kilimo Kwanza in 2010 to address commercialization and modernization of Agriculture sector (including sunflower sub-sector) by improving productivity and Tradability of Agricultural products. Moreover, the government established Market Infrastructure and Value Added, Rural Finance (MIVARF) programme in 2011 to tackle limited access to financial services and poor market infrastructure in Singida region under sponsorship of International Fund for Agriculture and Development (IFAD) and the African Development Bank (Mlay, 2017). This was followed by enactment of the National Agricultural Policy 2013 (URT, 2013) that promotes production, productivity; competitiveness and profitability of agricultural sector through strengthen agricultural research services. The Policy' objectives were targeted to be achieved through research services on plant breeding, development of biotechnology techniques, promotion of various irrigation techniques and efficient utilization of agricultural mechanisation among others. Moreover, development of Sunflower Sector Development Strategy 2016-2020 (URT, 2016) for improvement of accessibility to high quality certified sunflower seeds, development of public private partnership for increasing production, enhancing business environment, assurance of compliance and adherence to international recognized food safety standards for improvement of marketability of sunflower seeds and sunflower seeds' products to international markets. Others include imposing of 10% on imports of crude Palm oil in 2016 to promote sunflower subsector in the country production and processing of locally produced sunflower seeds.

Development partners' contribution is also acknowledged through various efforts. The Rural Livelihood Development Company (RLDC) targeted to lessen high poverty prevalence in Dodoma and Singida regions. The Company aimed to improve livelihoods of people through making market systems work better for the welfare of rural subsector. This was done through establishment of Rural Livelihood Development Programme (2004-2015) aimed to improve livelihoods of smallholder producers and related enterprises in the Central Corridor of Tanzania through increased income and employment opportunities. In Phase V (2012-2015) RLDP supported contract farming focused on three crop sub-sectors of rice, cotton and sunflower (Gross et al., 2016).

Various **authors** have documented diverse knowledge on sunflower subsector. However, these studies focused on upgrading sunflower value chain (Ugulumu and Inanga, 2013; Mgeni et al., 2019); identification of the sector's potentials in the entire economy (Liberio, 2012; TEOSA, 2012; Komba et al., 2017); investigated impact of contract farming in sunflower production (Henningsen et al., 2015); and examined the institutional and policy analysis governing the sector (Tran-SEC, 2017; Balchin et al., 2018).

Despite the aforementioned efforts; the national sunflower seed production to date stands at only three million tons per annum with an average productivity of 1.2 tons/ha compared to the national production potential of 10 million tons per annum (URT, 2016) and potential yield of 3tons/ha (FAO, 2010) leading to underutilized processing plants' capacities and continued poverty prevalence in semi-arid areas like Iramba district. According to Tanzania Livelihood Baseline Profile (2015), more than half (52%) of households in Iramba district are either very poor or poor (Tanzania livelihood Baseline Profile, 2015; 2016). The remaining households (48%) fall in the middle and better-

off (TLBP, 2015). The 22% (very poor) of households in the district earn an average of TZS 85,125 per month and normally own one cheap cell phone, 1-3 acres of land and manage to cultivate up to two acres only for different crops. In most times of the year these households are featured with food insecurity because during the cropping season, they normally work on both their fields and fields for the better off households. The 30% (poor) earns averagely TZS 98,375 per month. Only 14% (better off) households earn an average of TZS 380,333 per month. This paper seeks to assess contribution of sunflower production on poverty alleviation in Iramba district. Specifically, the paper intends to describe socioeconomic characteristics of households; to estimate Gross Profit Margin, Return on Investment and carries out poverty analysis based on poverty line among sunflower farming households. Information from this study is important for governments to improve policy and regulatory framework, private sector to make informed decision on investment portfolios and development partners to facilitate promotion of sunflower sub-sector.

II. METHODOLOGY

The study used cross sectional research design. A sample size of 107 was selected through multi-stage and stratified sampling techniques from four wards of Iramba district namely: Kisisiri (30), Kiomboi (30), Ulemo (17) and Urughu (30) as representatives of smallholder farmers. Primary data was collected pertaining to address objectives of the study. For social economic characteristics, variables included household demographics, education levels of household heads, farming tools, farm size and other income generating activities. For gross margin analysis, returns on investment and poverty analysis; the data collected pertained variables on sunflower yields, production cost per hectare, selling price per 65kg bags and household composition structure. These data were collected through interviews, focused group discussion and observation. Moreover, secondary information on Adult equivalent units, national basic needs poverty line, national food poverty line and international poverty line were solicited to complement the data from field work.

Data were analysed by using four methods: descriptive statistical methods, Gross Margin Analysis, Returns on Investment and Component Poverty Analysis Approach. Statistical Package for Social Science version 20 (SPSS, 20) was used for descriptive statistics that include univariate frequency distribution, bivariate analysis & measures of central tendency; while excel was used to undertake Gross margin analysis, Returns on Investment and Poverty analysis.

The GMA was done to assess costs of production incurred by sunflower farmers and revenue obtained after sale of sunflower produced; that in turn revealed gross profit earned. Gross Margin represents proportion of total sales revenue retained by a farmer after subtracting the direct costs associated with produced sunflower. The higher the percent, the more the farmer retains on each unit of money of sales to serve his other obligations. Essentially, gross margin measures how efficient household uses its raw materials and labour in producing sunflower; and indicates the household's financial health.

Gross margin (GM) was assumed to be the ratio of gross profit to the total revenue (TR). The gross profit in this case refers to the difference between Total Revenue (TR) and Operational Costs (OC). The Gross margin then is presented on equation 1

$$GM = \frac{TR-OC}{TR} \quad \text{..... (1)}$$

Then, Total revenue (TR) was thought to be a product of the quantity of sunflower produced (bags) [Q_{sn}] times the price of the sunflower produced [P_{sn}] as presented in equation 2

$$TR = (Q_{sn})(P_{sn}) \quad \text{..... (2)}$$

On the other hand the operational costs taken into consideration for sunflower production include: costs of hiring land (C_{ld}), costs for purchasing seeds(C_{sd}), planting costs (C_{pl}), weeding costs (C_{wd}), costs of purchasing pesticides (C_{ps}), costs of harvesting (C_{hr}), costs of fertilizers (C_{ft}), costs of extension services (C_{ext}) and transportation of the yield back home (C_{tr}) as displayed in Equation 3

$$C_{TT} = \sum(C_{ld}+C_{sd}+C_{pl}+C_{wd}+C_{ft}+C_{ps}+C_{hr}+C_{ext}+C_{tr}) \quad \text{..... (3)}$$

Empirically, equation (1) can also be written as displayed in equation 4

$$GM = \frac{(Qsn)(Psn)-\sum(Cld + Csd + Cpl + Cwd + Cft + Cps + Chr + Cext + Ctr)}{(Qsn)(Psn)} \quad \text{..... (4)}$$

Then, as described above Returns on Investment is the ratio of gross profit (TR – TC) to the costs invested (TC). In other words, how many cents can be earned when a shilling have been invested in the sunflower production. The computation of the ROI was done using equation 5 below

$$ROI = \frac{TR-TC}{TC} \quad \text{..... (5)}$$

Empirically, ROI was computed using equation 6 as follows

$$ROI = \frac{(Qsn)(Psn) - \sum(Cld + Csd + Cpl + Cwd + Cft + Cps + Chr + Cext + Ctr)}{\sum(Cld + Csd + Cpl + Cwd + Cft + Cps + Chr + Cext + Ctr)} \ldots \ldots (6)$$

Then, the adjusted household size was (HHS_{adj}) was computed to reflect the costs of living per adult person used in estimation of basic needs poverty line, using OECD modified equivalency scale whereby the first household member was assigned with 1 unit, each additional adult member 0.5units and each child of less than 18 years was assigned with 0.3units.

The Per capita income ($Inc._{pc}$) was computed by dividing the monthly Gross Profit (TR - VC) from sunflower production to adjusted household size (HHS_{adj}) using equation 7 below

$$Inc._{pc} = \frac{TR - TC}{HHSadj} \ldots \ldots (7)$$

Finally, contribution of sunflower production to poverty reduction (%Pov) was worked out with the percentage proportion of the monthly income per-capita ($Inc._{pc}$) divide the national basic need poverty line of Tsh 36,482 per adult equivalent stipulated by World Bank Group (2015) times 100 using equation 8

$$\%Pov = \frac{Inc.pc}{36,482} X\ 100 \ldots \ldots (8)$$

III. RESULTS

3.1 Household socio-economic characteristics

Sunflower farmers in Iramba district also perform other income generating activities. These include: animal keeping, trade activities, employment, Beekeeping, mining, and bricks make (Table 1). Animal keeping dominated (62%) other income generating activities among respondents. The animals kept include Cattle, Goat, Sheep, Donkey, and Pig. To sunflower farmers animal keeping is very crucial as it saves three main purposes: generation of manure that is used to fertilize the farm, ploughing farm land and transporting harvested seeds from the farmland back to their homestead. These finding is similar to findings by Singida Region Agricultural Sample Census (2007/08) who revealed that majority of households (53%) were involved in both crop and livestock production.

Table 1: Income generating activities among sunflower farmers in Iramba district

Income generating Activities	Frequency	Percentage (%)
Animal keeping	67	62.62
Trade activities	31	28.97
Employed	4	3.74
Beekeeping, mining and bricks making	5	4.76
Total	**107**	**100.00**

Age of respondents:

The average age of people engaged in sunflower production ranged between 22 to 65 years with the mean age of 38.2. This was dominated (88%) with youth farmers aged between 18 and 41 years; followed by adults aged between 42 – 59 years that composed 9% and elders with at-least sixty years of age accounting for only 3%. This implies that any intervention geared improvement of the sunflower production will trickle down to the whole society as most farmers have family responsibilities. This finding is different from the finding by Liberio (2012) and Tuntufye (2013) who discovered that sunflower is more cultivated by farmers aged between 41 and 50 years in Mlali ward and Mvomero District of Morogoro region. The probable reason could be the social set up differentials in the study areas. In the central zone where Iramba District is found, people get married earlier compared to Eastern zone. Therefore, residence of Iramba become accountable for family responsibilities earlier than those of the eastern zone.

Education levels of sunflower farmers: Sunflower farmers had different education levels in the study area. Farmers with primary education dominated (82%) other education groups (Table 2). This implies that sunflower production serves marginalized group of people with lower education levels who have no alternatives to other employment opportunities. Therefore, interventions geared towards improvement of the sunflower would improve livelihood of the marginalized group of people regarding alternative employment opportunities. The findings regarding education levels are similar to that of Liberio's (2012) and Tuntufye (2013) who found that sunflower farmers are dominated by farmers with primary education accounted for 77% and 78% in Mlali ward and Mvomero district respectively.

Table 2 Education levels

Education level	Frequency	Percentage (%)
Informal education	1	0.93
Primary education	88	82.24
Secondary education	11	10.28
Tertiary education	7	6.54
Total	**107**	**100.00**

Farming tools

Sunflower farmers employed diverse farming tools. However, these tools were dominated by ploughing that used by 95% of respondents (Table 3). Application of ploughing in the study area might explain the fact that small holder farmers cultivate relatively bigger farm size (6acres/household) compared to the most experienced of up to two acres/household elsewhere in the country on other crops. This result is different from that reported by Tuntufye (2013) that show that 88% of all sunflower farmers in Mvomero district use hand hoe. The reason behind this difference can be associated with the fact that, a big number of sunflower farmers in Iramba District are animal keepers, something that does not exist for the sunflower farmers of Mvomero District. Actually, animal production was raised to cater for three main functions (i) production of manure for fertilizing the land and (ii) ploughing land for tilling purposes and (iii) transporting harvested yields back to their homestead.

Table 3 Farming tools employed in sunflower farming

Farming tool	Frequency	Percentage (%)
Hand hoe	3	2.80
Plough	102	95.33
Tractor	2	1.87
Total	**107**	**100.00**

Sunflower farm size: Sunflower farmers in Iramba district cultivated mean farm size of 6 acres/household with the minimum farm size two acres/household and maximum farm size of 30acres/household. Moreover, most sunflower farmers (72%) cultivated farms with sizes between 1-5 acres that was followed by farmers cultivating between six and ten acres/ household (18%) (Table 4). The intervention can be done to think on how to intensify the crop through the use of improved agricultural inputs such as improved seeds and pesticides to improve productivity. The finding tallies with the findings by ASA & RLDC's (2012) who revealed that most (58%) of farmers in the central corridor grown sunflower in less than 5acres. MMA (2009) also found similar results that value chain is in its infancy with low volumes of production due to few households which on average grow less than 4 acres.

Table 4: Sunflower farm size

Acres	Frequency	Percentage (%)
1-5 acres	77	71.96
6-10 acres	19	17.76
11-15 acres	4	3.74
16-20 acres	2	1.87
21-25 acres	1	0.93
26and above acres	4	3.74
Total	**107**	**100.00**

3.2 Gross Margin and Returns on Investment

Table 5 shows that a farmer accrued revenue of 300,762Tsh/acre with a gross profit of 41,540.78Tsh/acre. Moreover, the associated Gross Margin for sunflower production was 13.8% while the return per shilling invested of 16%. The return on investment seems to be little since it is similar to the current normal banking lending rates in the country that ranges between 16% and 25% per annum. Moreover, the household raising sunflower on farm size of 6acres/year in mixed cropping pattern, was able to earn only 249,244.68 per annum from sunflower production. In this situation, the investment in sunflower production can only suffice to repay banking interest rate. Although assessment of profitability for sunflower production seem to be unviable for someone to invest, it should be noted that farmers practice mixed farming with other crops such that the operational costs of the farm can be shared among all of the crops raised, that in turn raise the profitability of sunflower production. The results from this study regarding profitability is different from findings by MMA (2009) in Tanga region who revealed the gross margin of up to 60% among smallholder farmers. Moreover, the results also differ from findings reported by Ugulumu (2008) with an average profit margin of USD 257 equivalent to 359,800 Tsh/acre in Singida region.

Table 5: Gross Margin and Returns of Sunflower Production

S/N	Cost Items	Cost (Tsh)	(%) composition
1	Land hiring costs (Tsh/acre)	25,327.33	9.8
2	Seeds cost (Tsh/acre)	32,476.67	12.5
3	Tilling costs (Tsh/acre)	48,666.67	18.8
4	Planting Costs (Tsh/acre)	12,959.33	5.0
5	Weeding Costs (Tsh/acre)	55,881.33	21.6
6	Fertilizer Costs (Tsh/acre)	6,928.67	2.7
7	Pesticides Cost (Tsh/acre)	4,336.67	1.7
8	Harvesting Cost (Tsh/acre)	38,386.00	14.8
9	Extension Services Costs (Tsh/acre)	7,55.33	2.9
10	Transport Costs (Tsh/acre)	26,707.33	10.3
11	**Total Cost per acre [1+2+3+4+5+6+7+8+9+10]**	**259,221.3**	**100**
	Revenue computation		
12	Sunflower seeds Harvested (Bags/ acre)	6.0	
13	Price of sunflower seeds (Tsh/bag)	50,127	
14	Total Revenue per acre [12*13] (Tsh)	300,762	
15	**Gross Profit [14-11] (Tsh/acre)**	**41,540.78**	
16	**Gross margin [15/14] (%)**		**13.8**
17	**Return On shilling invested [15/11] (%)**		**16**

Moreover, gross margin analysis revealed costs involved in sunflower production (Table 5). The weeding costs dominate (21.56%) costs involved in the sunflower production. This is followed by tilling, harvesting, seeds and transport costs that compose 18.77%, 14.81%, 12.53% and 10.30% respectively of the total costs incurred. These five cost components account for more than three quarters of the total costs incurred amounting to 259,221Tsh/acre. Hence whoever wants to intervene in sunflower production have to think on these cost components as key drivers of investment in that venture and hence its profitability. However, the cost of producing sunflower seeds in Iramba district is more or less similar to the costs of sunflower production in Ilonga, Morogoro that stood at 380,000/Tsh/acre (Mpangalile et al. 2008).

Through Focused Group Discussions (FGDs), it was revealed that smallholder sunflower producers normally work collectively in the farm of one farmer after another rather than hiring labours. However, these costs can be regarded as implicit costs since farmers were to work to the neighbours' farm in some days to compensate works done to his farm. This would even lower further earning from sunflower production to losses. Implicit costs incurred in the study area include costs of cultivation, costs of weeding, costs of harvesting and costs of transporting the yields to their homestead though was out of the scope of this study.

3.3 Contribution towards poverty reduction measures

Findings from poverty line analysis showed that sunflower production contributes by 13%, 19%, and 4.18% of the national monthly basic needs poverty line, national food poverty line and international poverty line of USD1.90 respectively. The adjusted household size equivalent was found to be 4.13 persons based on OECD modified equivalence scale. Thus the Annual per-capita income from sunflower production of 60,249.80Tsh (249,244.68T ÷ 4.13). This income is equivalent to per-capita monthly income of 5,029.15 (60,249.80 ÷ 12) is far below the national basic needs poverty line and food poverty line of 36,482Tsh and 26,085Tsh respectively. In fact, income from sunflower production contributes to 13% and 19% of basic needs and food needs requirements reflecting the fact that $[(5{,}029.15/36{,}482)*100]$ and $[(5{,}029.15/26{,}085)*100)]$ respectively. The daily per-capita income from sunflower production of 167.36Tsh (5,029.15 ÷ 30) equivalent to (0.76$/day) was attained. This is far below the international poverty line of $1.90 (4,009Tsh) with the exchange rate of $1 = 2,220Tsh during data collection. Hence, the 167.63Tsh (0.07USD) contributed only 4.18% to the international basic need poverty line. Although income earned from sunflower production cannot suffice farmers from poverty, the fact that sunflower production is done using mixed farming with other crops; isolation of costs pertained to only sunflower farming could yield a meaningful result since costs of production is shared among other crops. The crops grown in tandem with sunflower are mainly maize and millet. Furthermore, the households growing sunflower

were also engaged in other income generating activities such as animal keeping (62%) and trading activities (29%) to buffer the income from sunflower production. It can be concluded that sunflower production alone could not suffice the basic household needs; that necessitate farmers to adopt copying strategies like practicing the mixture cropping pattern with other crops and engaging in off-farm activities.

The generated income from sunflower production had multiple uses: purchase of food, clothes, shoes and kitchen utensils. Moreover, the money earned were also used to pay school fees, raising capital for trading activities, buying cattle for ploughing building materials, mostly bicycle and motorcycle (Table 6). In this case it can be concluded that sunflower production contribute to the improvement of the livelihood in the study area. However, the campaigns towards improvement of sunflower productivity and the income from the venture is necessary for up scaling the crop production and expand the income earned from the production at large.

Table 6 Spending of the income generated from sunflower production

Income expenditure	Frequency	Percentage (%)
Buying home needs	50	46.73
Paying school fees	15	14.02
Raising capital	8	7.48
Buying cattle, building materials, transport vessels (bicycle and motorcycle).	34	31.78
Total	**107**	**100.00**

IV. CONCLUSIONAND RECOMMENDATIONS

Sunflower production in Iramba district was found to be a profitable venture with a Gross profit of 41,540.78Tsh/acre and a Gross Margin of 13.8%. Meanwhile, its return on investment stood at 16% meaning that every shilling invested in sunflower production would yield a profit of an average of 16 cents that is just recovering the normal bank lending rates in the country. This income was able to contribute by 13% and 19% of basic needs and food needs per capita poverty line respectively. Moreover, this contribution is far below the international poverty line of $1.90 whereby it contributes to 4.18% of the international poverty line.

To reduce income poverty among sunflower smallholder farmers; pro-poor efforts geared towards lowering production costs and increasing the crop yield are pre-requisites. In this case, development and adoption of high yield and high oil content cultivars needs attention; since currently farmers mostly use open-pollinated cultivars that yields less that 3tones of sunflower seeds per hectare.

Firstly, the National Agricultural Research Institutes (NARI) and other developmental partners interested in seeds breeding can serve the purpose. The hybrid seeds must take into considerations different ecological zones in Tanzania. Secondly, increased irrigation facilities for commercial producers be established with out-grower schemes having contract farming to enhance not only increased production but also reliable market for the produce. This can be coupled with growing of sunflower in wetland during the dry seasons. Moreover, proper agronomic practices must be emphasized for the new cultivars developed. In fact development of improved seed varieties should be accompanied with development of irrigation schemes under monoculture cropping patterns to test the yields of the seeds during dry season. Production of sunflower during off-season would serve processors to make more raw material available hence increasing the utilization of processing plants installed capacity. High value varieties for sunflower seeds canbe produced on farm such that farmers learn the practices.

Investment in the irrigation facilities along the semi-arid regions (such as Singida) be subsidized. Investment of commercial sunflower farming that serves as market for the sunflower seeds grown by smallholder farmers but also spread modern agronomic practices among them.

Further research could compare the costs and benefits of the on-farm sunflower production practicing monoculture with improved seeds, and mixed farming to take on board the risk mitigating strategies for farmers practicing mixed cropping pattern in the study area. The study would reveal how costs are shared among various crops grown with sunflower in the study area.

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