East African Journal of Social and Applied Sciences (EAJ-SAS)
Vol.3, No.1 Publication Date: May. 20, 2021
ISSN: (Online) 2714-2051, (Print) 0856-9681
The current issue and full text archive of this journal is available at: http//www.mocu.ac.tz

Cite this article as: Mgema, J. M. (2021). The role of socio-economic groups on rural Irish potato seed obtainability in Lushoto district, Tanzania, *East African Journal of Social and Applied Sciences,* 3(1), 172-180.

THE ROLE OF SOCIO-ECONOMIC GROUPS ON RURAL IRISH POTATO SEED OBTAINABILITY IN LUSHOTO DISTRICT, TANZANIA

Japhet Methusela Mgema
Moshi Co-operative University, Kilimanjaro - Tanzania
Email: mgemajaphet@gmail.com or japhet.mgema@mocu.ac.tz

ABSTRACT
Quality Irish potato seeds play a significant role on improving productivity and ensuring food security to satisfy local and international market demands. The use of low-quality Irish potato seeds by smallholder farmers results into low productivity of Irish potatoes. This study aimed to assess the role of socio-economic groups on improving Irish potato seed obtainability. A cross sectional research design was used, four villages namely; Milunguli, Boheloi, Kwekitui and Maringo was purposively selected based on areas under potato crop cultivation in Lushoto district, Tanga region. A Cochran (1977) formula was used to calculate the sample size where each village had a representative sample of 100 to make a total of 400 farmers. Primary data were collected using questionnaire and key informants' interview from leaders of seed producer groups. The study was guided by the High Payoff Input Model (HPI) and Socio-economic Theory (SET). Findings revealed that through farmers socio-economic groups; seed production, storage, marketing, input procurement and resources mobilization were made possible; marketing services were enhanced where group members used the seeds and <40% non-members in the study area accessed the seeds at affordable prices. It is recommended that district government and private landowners be encouraged to lease out their arable lands to groups for seeds multiplication; provision of trainings and skills to potato producers on sustainable agricultural production, agribusiness and entrepreneurship skills to enhance seed productivity and obtainability.

Key words: *Socio-economic group, Irish Potato Seed, Obtainability*
Paper type*: Research paper*
Type of Review: *Peer Review*

1. INTRODUCTION AND IRISH POTATO SEEDS OBTAINABILITY CONTEXT

Over the years, Irish potato crop has been cultivated in the Andes of South America which since then has spread throughout the world (Chakraboty, 2015). Harton and Anderson (1992) reported that in many parts of the world Irish potato has provided famine relief during period of war and crop failure. For example, in the year 1840s Ireland experienced an overwhelming famine due to failure of the Irish potato crop. In the developing countries, Irish potato are essential for food security of hundreds of millions of people where annual consumption in the year 1963 and 2019 increased from 9 to 17 Kilograms per capita respectively (FAO, 2019). The crop is currently grown in many developing countries, especially in sub-Saharan African nations such as Tanzania. The crop ranks fourth in the world food crops production index behind maize, rice and wheat (FAOSTAT, 2019). However, quality Irish potato seeds play a significant role on improving production, food security and satisfying local as well as international market demands.

India reported increase in Irish potato production despite that the major problem in the production process was unavailability of quality seeds at the time of planting. Also, high costs associated with acquisition of quality seeds with regard to inadequate financial resources among smallholder farmers (Chakraborty, *et al*. 2015). The production programme was carried out in Bankura and Birbhum districts where farmer groups

organized to curb the situation on areas of quality seeds productivity, pests control strategies and accessibility. The programme provided promising results. Additionally, various methods used in Irish potato pre-basic seed production which was significantly achieved through group formation where tasks were distributed to group members including fibrocement tiles and articulated PVC gutters which highly, efficient and significantly increased productivity (FAO, 2010).

Despite that Irish potato ought to be the crop whose production and use were confined to industrial countries, in Tanzania the introduction of Irish potato started in 1920s where German Missionaries situated in the Southern Highlands of Tanzania began to cultivate in small scale areas, this was later adopted by the local farmers (Jakobsen and Mallya, 1976) and Macha *et al*., (1982). Since then, Irish potato cultivation has served as a means for food security as it is highly consumed in a form of fast food (Chips). However, its production is lower than it could have been due to limited quality seeds production, accessibility and obtainability. The use of unimproved seeds tubers, fertilizers and inadequate financial resources have resulted into production of lower quality Seeds which results into low crop productivity. The accessibility of quality seeds facilitate increase in production and quality produce to meet market specifications and creation of employment opportunities to rural communities and therefore increased GDP of the country at large (World Bank, 2013).

In the year 2010s, Irish potato consumption in Tanzania varied from 7 to 17 Kilograms compared to that of maize which varied between 58 and 70 Kilograms in the same year (FAOSTAT, 2019). Tanzania is thought to be producing more potatoes than neighbor countries such as Burundi and Mozambique (Ibid). In Tanga region, Lushoto district; potato, beans and maize are the main crops produced at the district for food security (CGIAR, 2016). The slight increase in production is due to production and obtainability of seeds through socio-economic groups. A study conducted by Consultative Group for International Agricultural Research (2016) serving in Lushoto district reported that seed prices are too high at planting and sometime four times the normal prices ranging from USD 2.5 to USD 10 per basket of approximately 10 kgs in 2013. This called for the need to establish socio-economic groups to curb the situation. Additionally, the annual production of Irish potato in Lushoto does not exceed 100,000 tons harvested in a large area of over 25,000 ha due to the usage of lower quality seeds and stringent conditions towards obtaining quality seeds from high costs seed suppliers; yield is very low compared to the area cultivated.

Studies have been conducted by different scholars on Irish potato production in Tanzania. A study by Mussei *et al*. (2000) examined the adoption of improved potato production technologies in Njombe district and that of Mwakasendo, *et al*. (2017) who assessed market for fresh and frozen potato chips in the ASARECA region and potential for regional trade. A study conducted by Mayona (1991) assessed the potentials and constraints of potato production in the Southern Highland Zone. However, these studies did not pave eye on the Irish potato seeds productivity and its obtainability and the significance of socio-economic groups, although the authors mentioned them in their studies. Additionally, Okoboi, (2011) studied potato production and marketing in Tanzania and the market opportunities for Rwanda. These studies had inadequate information in assessing the linkages between the socio-economic groups and improved Irish potato seed productivity, accessibility and obtainability to serve the growing demand. An emphasis on community centered groups and smallholder farmers' self-initiatives are essential towards filling these gaps in rural communities using a socio-economic approach. This mechanism is applied in Lushoto district, Tanga Region by smallholder farmers found in Milunguli, Boheloi, Kwekitui and Maringo villages through people-centered socio-economic group formation.

2. GUIDING MODEL AND THEORY

2.1 The High Payoff Input Model

The crucial factor to traditional agricultural sector transformation into a productive source of economic growth is an investment designed to make high –pay off inputs availability to farmers in poor countries like Tanzania (Udemezue and Osegbue, 2018). The challenges facing poor countries in agricultural sector include

poor quality of seeds used in agricultural activities, limited technologies and economic opportunities. The heart of high Payoff input model is emphasis on efforts to develop high productivity grain varieties which yields more returns and also the capacity of smallholder farmers to acquire new knowledge and the use of farm-inputs effectively. HPI model were employed in Mexico and Philippines in the year 1950s and 1960s respectively and yielded high output where community centered groups and engagement were the core factor towards yield realization (Ibid). Nevertheless, the realized high pay-off associated with the adoption of the new socially developed grain and associated managerial practices and technical inputs have led to rapid dissemination of the quality grains among smallholder farmers in several countries in Asia, Africa and Latin America. Therefore, this paper employs the HPI model to provide linkage between inputs and output relationship and the dynamics of agricultural growth in Irish potato seeds production through socio-economic groups into the changing sources of Irish potato seeds obtainability.

2.2 Social Economic Theory

Social Economic Theory (SET) presents the relationship between social and economic factors within the society (Baker, 2014). These factors determine how a given group or class behave within a given society, in these regards different socioeconomic classes may have different approaches and priorities in responding to their challenging environments. Socio-economic and community centered groups are normally formed to respond to a situation collectively by pulling together available individual resource for the betterment of the group. In this study, rural financial groups are the main sources of seed accessibility to smallholder farmers in Lushoto district. The socio-economic groups' mechanism used in Lushoto ought to have served to combat the seeds accessibility and obtainability puzzle by smallholder farmers who participate in all stages of seeds productivity and multiplication.

3. METHODOLOGY

This study used a cross sectional research design to obtain information from interested population at one specific point in time. Four villages were selected purposively which included Milunguli, Boheloi, Kwekitui and Maringo among of the 22 villages found in Lushoto district based on their engagement in Irish potato cultivation. Accordingly, 75 percent of Lushoto district is highlands which get an average of 800 – 2000mm rainfall per annum which cover a total of 2625 km2 of the total district area with the altitude of 1000 – 100m above sea level which is favorable for potato production.

The district had approximately a total of 418,652 (National Population and Household Census, 2012). The population intended for the study was not well known because village register for potato smallholder farmers was not available. But report from Climate Change, Agriculture and Food Security (2016) showed that there are more than ten thousand smallholder potato farmers in the study area. Basing on this fact, the sample size was selected following the formula developed by Cochran (1977) for large Populations (ten thousand and above) which resulted into 385 respondents:

$$n_o = \frac{Z^2 pq}{e^2}$$

where, n is the sample size, z is the selected critical value at 95% confidence level (1.96), p is the estimated proportion of an attribute that is present in the population assuming maximum variability equal to 50% (p=0.5) and q =1- p where e is the desired level of precision (0.05).

$$= {((1.96)\text{^}2(0.5 * 0.5))}/{(0.05)\text{^}2} = 385$$

However, to increase data reliability and validity 100 respondents were randomly selected from each village to make a total of 400 respondents. Primary data were collected using Key informants' interview in where leaders of seed producer groups provided key information about Irish potato seed production. The

interview guide was deliberately designed to give the respondents freedom to express their views on the role of socio-economic groups on potato seeds productions and obtainability. Questionnaire was used where open and closed questions were included. These data collection methods suited the nature of the study and elicited data that were reliable and valid. Secondary data were obtained from published scholarly papers/articles, non-scholarly papers/articles and grey literature which included district socio-economic profile, agricultural development department reports, ministry of agriculture reports and FAO reports and various regional and district agricultural working papers. Grey literature normally provides data not found within commercially published literature (Paez, 2017; Pappas and Williams, 2011). This helped to condense publication bias and nurtured a balanced picture of existing evidences. The performance of extensive Systematic Literature Synthesis (SLS) enabled the researcher to magnet data from published papers/articles in order to get reflections from comparable studies previously undertaken. Data were analysed using IBM SPSS Statistics v23.0.0 for Windows (+AMO+Data. Collection). Data were analysed qualitatively to enable in-depth description of the role of socio-economic groups on improving rural Irish potato seed obtainability by smallholder farmers organisations in a socially and economic approach through group formation.

4. FINDINGS AND DISCUSSION

4.1 Sex of respondents

Findings indicate that male dominated the potato crop production activity in the study area compared to female where 289 (72 %) were male and while 111 (28 %) were female as presented in table 1. There was no gender balance. The reasons for gender imbalance were as that pinpointed by Mwatawala and Kayunze, (2014); Mende, (2014) and Mgema and Komba, (2020) that in developing countries such as Tanzania when a crop is perceived to be profitable, men normally overrun female. Although females are sometimes involved in the small farming processes, however, this is not the case during marketing and selling of such agricultural products. The gender factor goes far beyond to land ownership due to patrilineal system in African countries. Land ownership is a significant hinderance factor for female to engage in agricultural activities

Table 1: Distribution of Respondents by Sex

Category	Sex	n=400	Percent (%)
Farmers	Male	289	72
	Female	111	28
	Total	**400**	**100**

Through a focused group discussion one female respondent commented;

> *"……Women are customarily known to be housewives in the patrilineal system. As such they are left far behind in access to engagement in economic activities and therefore lack opportunities in participating potato crop production…"*

The socio-economic groups formed in the study area for Irish potato seeds production and multiplications were dominated by male. However, despite that male dominance persists in many spheres of economic activities, there are various movements concerning women, gender equity and gender equality whereby women are empowered and encouraged to participate in development activities as much as male do. Through a gender sensitive groups formation, Irish potato seed productivity ought to improve to more than annual production of 100,000 tons harvested on a large area of over 25,000. Gender inclusivity involve engaging female in the whole processes of agricultural activities including potato seed cultivations in various strategic areas such as Southern Highland Zones.

4.2 Education level

This study revealed that most of respondents involved in potato seed production had primary education whereby 280 (70%), 108 (27%) and 12 (3%) of respondents had primary, secondary and college/university education respectively as shown in table 2. This imply that respondents were able to organise themselves in

groups for their activities and had ability to keep primary information concerning their potato production with respect to their educational backgrounds. It is obvious that low formal education level trigger-down farmers' efforts towards improved productivity (Mende, *et al*., 2014). This is also in line with a study by Mgema and Komba (2020) who opined that education level influences production decisions which include choice of quality raw materials and products even though in most of developing countries especially in rural areas access to formal education is a challenge.

Table 2: Distribution of Respondents by Education Level

Education Level	n=400	Percent (%)
Primary	280	70
Secondary	108	27
College/University	12	3
Total	**400**	**100**

4.1.3 Farmers' Household Size

Household size provides a base for the food consumption and family labor in most of African rural communities. Despite that this study focused on household heads as unit of analysis, the study revealed that the respondent mean proportion per household was between 5 to 7 persons which accounted for 236 (59%) where between proportions of 1 to 4 persons per household accounted for 21% and that of above 7 persons was 20% as shown in table 3.

Table 3: Farmers' Household Size

Category (Family members)	n=400	Percent (%)
1 to 4	84	21
5 to 7	236	59
Above 7	80	20
Total	**400**	**100**

This in one hand implies that more members per family ensure availability of family labor and results into reduced production costs. However, the potato seeds production costs are high when farmers hire laborer for pruning and planting purposes, contrary to the use of housed labor where all costs are absorbed by the family members. In this study, socio-economic groups formation reduced significantly the production costs. Mende, *et al*., (2014) opined that large household size in rural communities is an important asset in enhancing human labor and working together in a given household activities, only if a significant proportion of such members take part in the production processes. One respondent through interview commented that:

> *"…… A group member with more youth family members has more advantage towards reducing costs of hiring labor for farm activities. This is achieved only if a significant proportion of such members take part in the production processes. This is among the reason for people to bare more children …".*

4.1.4 Farmers' experience in Potato farming activities

This study revealed that most of the respondents had 1 to 12 years of experience in Irish potato cultivation. It was indicated that 281 (70%) respondents had Irish potato production experience of up to 12 years where 13 to 24 years' experience accounted for 98 (25%) in the study villages (Milunguli, Boheloi, Kwekitui and Maringo) as depicted in the table 4. Experience is an important factor in production activities as argued by Mende, *et al.,* (2014) that experience led to better managerial skills and nurtures various production avenues when utilized positively. This study revealed that potato seed used was of lower quality and the costs of obtaining the better-quality seeds such as daisy gold, red gold and red Pontiac were high which resulted into decreased potato yields as supported by the High Payoff Input Model (HPI). Therefore, there is a dare

need to organise into small groups and mobilize them to ensure quality seeds obtainability important as supported by the social economic theory (SET). However, it came to the researcher's attention that farmers' aging was seen to be a challenge which resulted into reluctant to change and join the movement towards improved productivity.

Table 4: Farmers experience in Irish Potato farming activities

Experience in potato Farming activities (Years)	n=400	Percent (%)
1 to 12	281	70
13 to 24	98	25
More than 24	21	5
Total	**400**	**100**

4.2 Farmer's Organisation

This study found that, farmers' organisation was the key for their improved Irish potato seed obtainability and cost-friendly production. Each of the members in the four selected villages was linked to Climate Change, Agricultural and Food Security (CCAFS) to obtain subsidized farm inputs. The groups were having a clearly defined constitution guiding their day-to-day operations under supervision of the district and village council. Accordingly, the selected members were identified as group responsible for seed multiplication functionality where their core responsibility was to produce seed as much as they can, distribute to other village members in a manner as clearly stipulated in their regulations until the seed multiplied to all villagers and later suited for marketing.

Moreover, socially organized groups performed various activities which included setting seed trials, seed production and multiplication, own potato seed collecting center, supply potato seed, provide training on seed production and multiplication and conducting informal and semi-formal financial services mobilisation (Muthoni and Kabira, 2014). Advantages accrued from being in groups included acquiring micro-loans, collective procurement of other farm inputs and owning a group bank account which enhance easier securing of financial facilities and other financial services. This is in line with a study by Mwatawala, (2016) who opined that being in a group gives also an opportunity to conduct a farmer field school (Demo-plot/trials-plot) clearly known in Kiswahili as *"Shamba Darasa"* which helps to improve farmers' hands-on skills practically and conduct group's financial arrangements.

4.3 Irish Potato Seed Production and Storage

4.3.1 Potato seed production and services

The study area is located at altitude of 1000 – 100m above sea level, average annual temperature is 17.3˚C and average of 800 – 2000mm rainfall per annum (www.lushotodc.go.tz/economic-activity/2021). This study revealed that the conducive environment enhances quality Irish potato seed production and its associated services are smoothly delivered. Groups were organized and potato tubers were distributed to groups and planted (taking care of spacing) at a well -controlled environment. A good mechanism of maintaining good health standard of potato seeds generation, is through the use of well-controlled seedling environments to produce more seeds using seedling tubers (Muthoni and Kabira, 2014). This study indicated that Potato seed needs a cold temperature ranging from 60˚F to 70˚F at night to enhance growing of root tubers in line with the HPI model. Farmers opt for small aged seed counted by cumulative day degree temperature for maximum productivity.

It was also found that, if two potato seeds are planted in different temperature for three days consecutive, say Seed A: 250˚C+200˚C+260˚C, total cumulative temperature would be 710˚C and Seed B: 180˚C+190˚C+200˚C, total cumulative temperature would be 570˚C. This implies that Seed B was the best seed to be used for growing seed tubers. However, farmers highlighted various factors that affects productivity of Irish potato seed which include the following: - ***Seasonality of potato seed production***; in the

study area potato are grown mainly in two seasons: First season ranges from April to July/August which is high rainy season and the second season ranges from September to December which is low rainy season. To ensure effective and high-quality potato seeds, farmers need to observe the seasonality of the crop production to provide a clear foundation for them to prepare for their farms and other related farm inputs and seeds for production during the season.

Other factor is ***Seed varieties;*** production of high-quality potato depends on varieties quality seed depicted on the color of the seed and flowers; Red, Pink or White. The highly multiplying potato seeds in the study area included Shangii, Asante, point 29, Point 22, point 0.1 and Point 9. Likewise, the named seed matches with the weather condition and seasonality of the study area. ***Physiognomies of Seeds;*** physiognomies of quality potato seeds in the study area centered on high yield per plant which yielded 3 times per season, customers/market preference, and early maturity from 90-100days, chicken egg size, its resistance to pests' attack and other infections resulting from cloud and bacteria wilt. Other diseases are fungus, viruses and nematodes to mention just few. This is in line with a study by Muthoni and Kabira, (2014) that the characteristics of the seed attract or draws attention of the market demand as it guarantees quality and increase productivity if and only if other factors remain constant.

4.3.2 Potato Seed storage services and Seed Value Chain Behavior

The study found that at the beginning of the season members were provided with varieties of seeds. These were Shangii, Asante, point 29 and Point 22. Seeds collected were stored on a recommended local storage facility funded by CCAFS under the International Center for Tropical Agriculture (CIAT). The study found that seed storage chain started at farms, where by individual had to separate seed from potato for food consumption after seed multiplication which improves seeds obtainability. Seeds collected from farm were domestic-chicken egg sized like structure and stored on wooden stick to be ready for processing. Nevertheless, potato seed which was collected wrongly with wrong seedling were removed before storage in order to avoid apical dominance by the others which eventually may affect the growth of the other seeds. Propagation of various bleeds may be possible if are kept together in various strategic positions in their tubers (Chakraborty, *et al*., 2015). Seeds selected were from several type of varied potato seed purposively selected at the beginning of the season. The Seed value chain behavior in the study area behaves as shown in the model in figure 1.

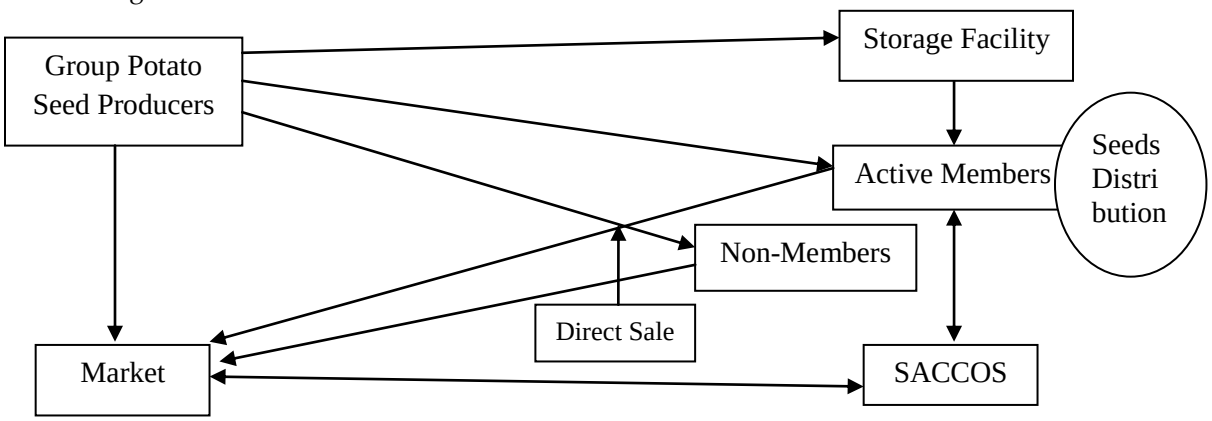

Figure 1: Irish Potato Seed value chain behavior

Findings revealed that there were also middlemen who come direct to the farmers during harvesting period. It was observed that few quantities of potatoes seeds were stored at home and the rest were sold on spot market by farmers. This was mainly caused by the need for immediate cash for meeting household living expenditures.

4.4 Common Marketing and Potato Seeds Inputs Procurement Procedures

Although the groups were arranged in seed multiplication phases, each individual in a group were tasked to investigate the quality of the seed. Findings indicates that no one of the group members is producing potato seeds for business purposes rather seed production is done for enhancing groups' productivity and aiming at increasing seeds accessibility. However, previously farmers groups had no collective inputs procurements procedure in hand where each farmer had to procure farm inputs individually. It was found that the farmers after collection of the seeds to the warehouse, group's leaders were responsible to control the distribution of seeds to members of the group during a new season of Irish potato cultivation which increased its accessibility and obtainability in the study area.

Moreover, the study indicates that other important inputs such as fertilizers were purchased on group basis approach where each group formed a Savings and Credit Association (SaCA) with a Bank account. It was revealed that other groups managed to link with existing Savings and Credit Co-operative Societies (SACCOS) in their locality to improve input supplies through access to micro loan/credit. According to Mgema and Komba, (2020) SACCOS are essential financial institutions found in rural setting ignored by formal financial sectors which provides micro loans that suits the needs of rural dwellers at a reasonable cost compared to other sources such as formal sectors or private lenders. A group lending approach was used enable members to obtain micro-credits and return as a loan with interest for a contracted period of time. The advantage of this inclusive business model is emphasis on financial inclusion and building the internal source of funds among smallholder farmers.

4.5 Economic Analysis and Sustainability of the Irish Potato Seeds Production and Marketing

Irish Potato Seeds market demand in the region is very high. There is a room to sell potato seeds which cater cost margins without selling potato as a food. This study revealed that various training provided to the smallholder farmers have improved productivity of Irish potato seed in the study area. In addition, potato growers managed to solve financial constraint by forming Savings and Credit Co-operative Society (SACCOS) which provides financial services to farmers. The study reveals that, this inclusive business models has enabled the farmers to collectively purchase farm inputs from various source such as Sellian Arusha Research Institute (SARI) which resulted into increased potato production. However, it came to researcher's attention that despite that production increase as well as their incomes but the increment doesn't portray the real household lives where most of them are living in mud houses, poor living conditions and unhealthy. This is contrary to the study by the Msambichaka, *et al.,* (2009) and Mgema and Komba, (2020) who pinpointed that the socio-economic activities of an individual should result into economic, attitude and behavioral change of that individual and his/her household members.

5. CONCLUSION AND RECOMMENDATIONS

Socio-economic groups have great potential on enhancing rural agricultural development. Socially organized groups perform significant role in setting seed trials, seed production and multiplication, own potato seed collecting center, supply potato seed, provide training on seed production and multiplication and increasing seeds obtainability to members and non-members. Potato seed production and services considers seasonality of potato production, seeds varieties and quality. Also, potato seeds storages take into consideration the entire potato value chain in preservation of the seed quality. Input's procurement was enhanced through forming of savings and credits association or linkage to savings and credit co-operative societies (SACCOS). Since the production processes of potato seed require large space, it is recommended that district government and private land owners should be encouraged to lease out their land to groups for seeds multiplication in favorable areas to improve seeds availability and obtainability. There are existing various good opportunities that may be used in the production of quality seeds and distribution mechanisms in fostering potato yield. Improving production as well as obtainability mainly depends on availability of suitable land and Agro-ecologies. Tanzania has a comparative advantage in the region in terms of land availability, highlands proximity to the sea and potential markets for Irish potato. The current

nebulous potato value chain in Tanzania clearly demonstrates significant improvement. Moreover, trainings and skills on sustainable agricultural production, skills on prevention and protections of various bacterial infections and diseases, agribusiness and entrepreneurship should be provided to group members where in return group members will turn to be trainers to their co-members and other non-members on similar potato seed production to enhance its obtainability.

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