Analysis of Round Potato Marketing in Tanzania: The Case of Rungwe District, Tanzania

Nyunza Godfrey
Mwakaje Agnes E.G

Institute of Resource Assessment
University of Dar es Salaam
P.O Box 35097, Tanzania

Abstract

Round potato is one of the most traded food commodities around the world yet; producers in developing countries have remained poor. The objective of this study was to find out the relative benefits obtained by players in the potato marketing chain in Tanzania with the focus of Rungwe District and investigate factors that affect the crop profitability. A sample of 120 farmers was selected randomly for interviews. There was also a discussion with focus groups and key informants. Findings showed that farmers earned only 8% of the total gross margin (GM) compared to 30.9% for the wholesalers. Through regression analysis it was revealed that selling volumes ($p<0.0.05$) and selling price ($p< 0.01$) had significant impact on the crop profitability. Although education and land size were not significant, they had positive relationship with GM. Farmers' GM could be enhanced through improved education, productivity, bargaining power and access to market information.

Key words: round potato, farmers, marketing, Tanzania, Developing countries

1.0 Introduction

Agriculture is the foundation of Tanzania's economy. It plays a very significant role in food security, employment, and export earnings. It accounts for an average of 50% of Gross Net Product and about 66% of the total export earnings (URT, 2007). The importance of agriculture is also reflected in food security. Over 70% of Tanzania's population depend on subsistence agriculture for food production. Despite the fact that agricultural employment declined from 60% in 2000/01 to 50% in 2007, agriculture has remained the main source of employment and livelihood for rural and peri-urban communities in Tanzania (URT, 2009). Agriculture is also one of the country's main sources of foreign exchange earnings. Traditional export crops such as coffee, tobacco, tea and sisal play a key role in export earnings although the trend is declining. In 2007 and 2008 the government of Tanzania earned a sum of USD 648 millions from traditional export crops. It was projected that agricultural export earnings would increase to about USD 741 and 816 million by the year 2010/11 and 2011/12 respectively (URT, 2009).

However, the sector's GDP growth rate has been not stable over the years. Available data shows that in the years 2005, 2006, 2007 and 2008 agricultural GDP growth rate was 4.3%, 3.8%, 4.0% and 4.6%, respectively. In the year 2009 agricultural GDP growth rate declined even further to 2.4% (URT, 2009).

There are a number of factors that affect agricultural sector development in Tanzania. Among others these includes rainfed agriculture (Majule, 2008), poor farming technology which is dominated by hand hoe and limited input use. In addition, a high proportion of the agricultural commodities are sold in the form of raw-materials with insignificant value addition. The sector also is highly vulnerable to climate change (NAPA, 2007). Other factors include inadequate access to markets, insufficient market information, limited access to finance, lack of capacity of agricultural marketing institutions, lack of entrepreneurial skills, non existence of product standards, high transaction costs, poor coordination and integration of marketing channels and policy uncertainties (Maro, 1999; Mwakaje, 2010). Rungwe district is among the potential areas for agriculture in Tanzania. It has good climatic conditions that favour production of varieties of crops including round potatoes. The district produces about 25% of the round potatoes consumed in the country (URT, 2010).

Following the market liberalisation and commercialisation of round potatoes in 1980s, the crop plays a key role as both food and income source. However, despite the high production of round potatoes in Rungwe district, income from the crop to farmers has remained low (Namwata, 2010).

Literature suggests that there is a much correlation between market efficiency and farm income. For example areas with poor rural infrastructure experience a tendency where buyers' reliability is not assured (Mwakaje 1999). Mwakaje (1999) also revealed that price varied from one location to another depending on the marketing infrastructure and the level of production, implying a varying market outlet from one group of farmers to another. In Mwakaje's (1999) opinion, this happened because of the asymmetric information in agricultural marketing. Traders know better about market information than farmers. Also a high source of market information for farmers is the traders or buyers of the farm crops. Nevertheless, apart from this theoretical and hypothetical thinking there is inadequate empirical evidence on case specific issues of crop marketing and profitability.

The main objective of this study was to come up with an understanding of the round potato marketing in Tanzania and its implication on farmers' GM and factors affecting the profitability of round potato profitability with the focus of Rungwe district. Specifically, the study was guided by the following specific objectives; (1) to identify the marketing chain of round potato in Rungwe District and key players at the different levels of the marketing chain; (2) to investigate the pricing mechanism and relative GM by players in round potato marketing and; (3) to determine factors affecting round potato farming and marketing in the study area. This information is important for policy and decision makers, researchers, development agencies, farmers and traders.

2. The status of round potato production and marketing in the world

Round potato (*Solanum tuberasum*) has emerged as the fourth most important crop in the world. It is among the major food crops grown in more than 100 countries in the world and is consumed by more than one billion people all over the world after wheat and maize. The overall round potato production in the world reached 314 millions tons by the end of the year 2008 (FAO, 2008). China ranks first, in round potato production followed by Russia, USA, Ukraine, Germany and Poland all of which constitute about 62% of total production. For example, by the end of 2009, China produced about 570.6 tonnes, Russia federation 372.7 tonnes and India 344 tonnes. This is about 26.4%, 17.2% and 15.9 of the world production, respectively (Bhajantri, 2011). In 1961, potatoes produced in the developing countries accounted for only 10.5% of the global output. Today, they amount to about 47.2%. It is not surprising that round potato have also emerged as one of the most important food crops in Asia and the Pacific region.

The world round potato marketing has been categorized into seed potato, frozen chips, fresh potatoes, crisps and other potatoes snacks and starch. Studies show that the world frozen chips export is leading, followed by fresh potatoes. The frozen chips marketing grew rapidly in the past decade and exceeded the value of fresh potatoes export for the first time in 1998 (Ferris *et al*., 2003). However, only about 2% – 3% of about 322 million tons of the world potato production is traded internationally. Import and export of fresh potatoes to and from developed countries account for 86% and 83% of the total world trade, respectively. The export share of developing countries for fresh potatoes is 14.3% and for frozen potatoes is only 2.9%. The export of potatoes from developing countries faces several constraints such as lack of cold storage, poor transportation (flights and shipping facilities) and limited market opportunities (Ferris *et al*., 2003). Round potato global markets show that developing countries including Tanzania are still lagging behind on marketing processed round potatoes.

2.1 Round potato production and marketing in Tanzania

In Tanzania round potatoes are generally grown in areas between 1,800 and 2,700 metres above sea level the most important area being the Southern Highlands, particularly the Iringa and Mbeya regions. Round potatoes are also grown in suitable areas to the west of Mt. Kilimanjaro, notably in Arusha region, and in Kagera Region west of Lake Nyanza near the Ugandan border. Minor production occurs in Mara, Tanga, Kigoma, Rukwa, and Ruvuma Regions and possibly elsewhere (Macha *et. al*., 1982).

Round potatoes in Tanzania rank the 8th position in the list of principal food crops. The national level production data show that by the year 2008 about 650,000 tons were produced (FAO, 2009). Data from Rungwe District show that production of the crop has increased from 75,000 tons in 2003/04 to 95,000 tons in 2007/08 (URT, 2009) about 15% of the national production.

Although round potatoes are not a major staple food crop for rural areas, there is rapid increase in the consumption rate of potatoes in some urban areas such as Dar es Salaam, Mwanza, Dodoma and Zanzibar.
Despite its importance, round potato farming is entirely for the domestic market. There is no competitive advantage to penetrate the frozen chips and fresh potato markets though opportunities for regional and international trade exist (Namwata, 2010). Nevertheless, there are cross border trade ongoing in fresh round potatoes between Tanzania and for countries such as Zambia, Malawi and Kenya Sokoni (2001).

2.2 Crops marketing chain and actors

Farmers are the first link in the crop market chain. They sell the crop to any buyer of their choice, including fellow farmers, local traders, and buyers coming from other regions, or neighbouring countries. This widens the marketing choices for a farmer and hence leads to the growth of potential marketing channels which in turn contributes to better prices and high gross margins (Sokoni, 2001). According to Mwakaje (2010), when selling the crops very few farmers are able to hire trucks to take their products directly to the big markets, but the majority opt for local traders. Other best options by farmers include selling their crops to village assemblers; along the roadside; taking them to the weekly village markets or selling them to village retailers (IITA-FOODNET/CIP, 2001). Selling the crops to the village traders has the advantage in that it reduces farmers' transaction costs (Gabre-Madhin, 2001; Mwakaje, 1999). According to Sokoni (2001) the retailers link between wholesalers and consumers in marketing chains.

2.4 Factors affecting farmers' income in agricultural marketing

Farmers' income may be influenced by a number of factors. These include education level, means of accessing market information, household size, production costs, land size, farming experience and selling price (Mwakaje 1999). The following sections describe some of the factors that determine the farmers' income inn round potato production and sales.

2.4.1 Education level

Education is expected to improve the quality of labour. In a rapidly changing technological or economic environment, the impact of education is higher (Schultz, 1975). A study conducted in Babati District revealed that during selling of their grains, farmers generally had to agree with the local middlemen's or traders' price due to low education (Skjöldevald, 2008).

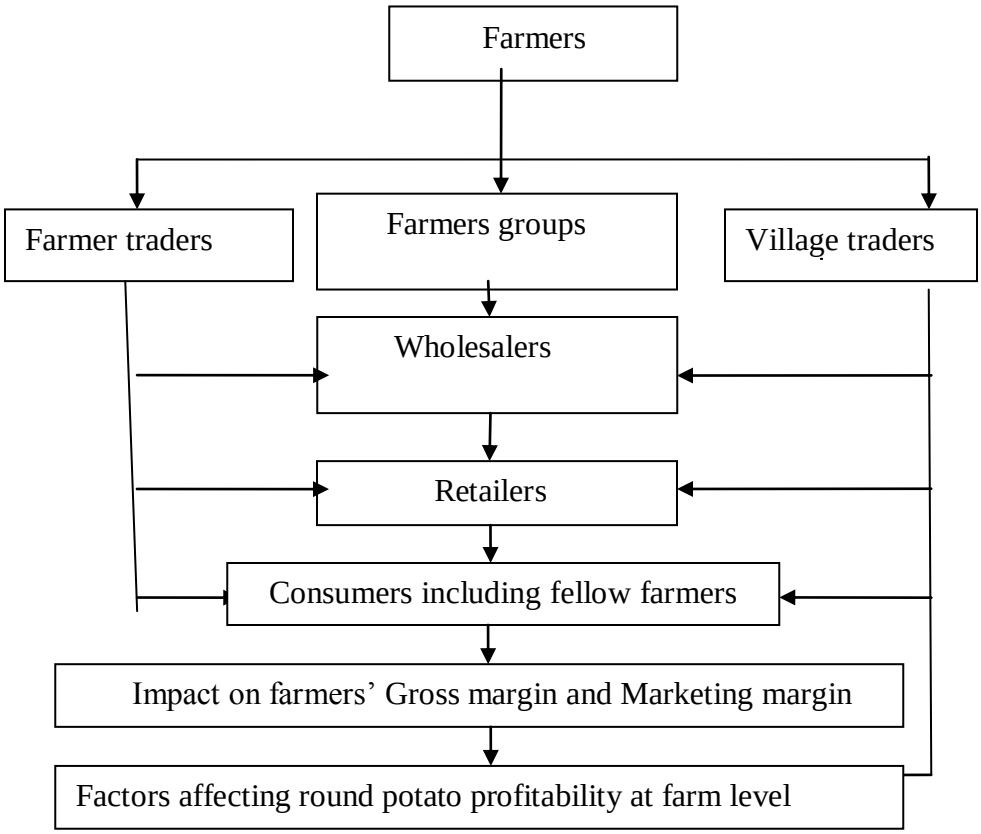
2.4.2 Access to market information services

Market information aids and places the producer and buyer on more equal bargaining basis and enables exchange of information, bringing up business related issues with one voice (Poole *et al.,* 1998). The availability of market information also enables farmers to check on the prices they receive *vis-à-vis* the prevailing market prices. In Indonesia, for example, vegetable farmers fixed prices following the rate that was being broadcast by their local radios and lower prices than that broadcast were not accepted by these farmers (Gabre-Mahhin, 2009; Shepherd, 2000).

2.5 Conceptual framework

A conceptual framework (Figure 1) was developed to guide the researchers in undertaking this study. To begin with, the framework views the position of a farmer as a producer relative to other players in the chain. According to this framework, a farmer may sell round potatoes to fellow farmers, village traders or farmers' group. A study by Sokoni (2001) indicates that farmers have a wide range of choice on selling their crops to any buyer including fellow farmers, local traders, and wholesalers and to urban retailers. The above three players in the chain can, in turn, sell the crop to wholesaler, retailer or consumers. In addition, the wholesaler can supply the crop to the retailer who, in turn, sells the crop to the final consumer. It is argued that the farmer's gross and marketing margins are determined by the number of people consuming the crop (demand), the marketing cost, production levels, farm size and the price they offer for the crop.

Figure 1. Conceptual framework



Modified after Mwakaje (2010)

3.0 Methodology

3.1 The study area

Rungwe district is found in Mbeya region, south west Tanzania. The district is located between longitude $80^{0}30^{'}$ and $90^{0}30^{'}$ South of Equator and longitude $33^{0}00^{'}$ and $34^{0}00^{'}$ East of Greenwich Meridian of Tanzania. Rungwe district covers a total area of 2,211sq.km of which 1,668.2sq.km (75%) of the total area is arable land used for agriculture. The remaining land is covered by 44.5sq.km of forest and 498.3sq.km is mountainous and residential areas (URT, 2010). Average rainfall ranges from approximately 900 mm in the lowland to 3300 mm in the highland zone.

Rungwe District is located between 770 metres and 2865 metres above the sea level. The District is divided into three agro-ecological zones, namely the upper, middle and lower zones. The upper/highlands zone is a continuation of Uporoto Mountains covering about 10% of the total area of the district with an altitude of 2865 metres above the sea level. Generally, the highlands zone is cold throughout the year with the average rainfall ranging from 1500mm to 2700mm per annum. The main crops grown include round potatoes, maize and pyrethrum (URT, 2010). The population in Rungwe District is estimated to be 334,924 by October 2011 (World Bank, 2011) with 139 inhabitants per sq.km. This is one of the densely populated districts in the country.

3.2 Data collection

Both secondary and primary data were collected for this study. Secondary data were collected from reports, internet material and other documented materials that were relevant to the study. Secondary information included trends of round potato production, access of farm inputs, marketing chains and cheating in measurements within villages.

Secondary data provided a general overview about farmer's earnings in crop marketing relative to traders. However, there was inadequate analysis of who gets what and what are the factors leading to that difference.
In collecting primary data a total of 120 households were selected randomly from the two villages of Ndaga and Ntokela. The choice of the two villages was purposive based on the high production of round potatoes. Village rosters were used as sampling framework. About 5 % (120 households) of round potato farmers were selected randomly in the two villages for interview. The study used both open and closed questions, to collect information. Structured questionnaires were used to collect both qualitative and quantitative data from round potato farmers and traders. The study also investigated measurements used by the buyers and perceptions on the measurements. There was also consultation with officials from the district headquarters; ward executive officers, and village executive officers. They provided insights on the general state of round potato marketing chains in their respective villages. The study also consulted agricultural and extension officers at the district and ward levels and conducted interviews with key informants. The interviews were conducted for one month from 1st March to 30th March 2011. Data collected were analysed using Statistical Package for Social Sciences (SPSS) and has been presented in tables and figures.

3.3 Gross margin analysis

To determine gross margin the following formula was used:
GM = TR – TVC
Where,
GM = Gross Margin (Tsh/bag); TR = Total Revenue (Tsh/bag);
TVC = Total Variable Costs (T shs/bag)

3.4 Marketing margin analysis

This study used marketing margin to measure marketing efficiency of the round potato produce at each node in the market chain. The marketing margin was calculated by finding the price variations at different levels in the chain and then compared them with the final price paid by the consumer using the following formula:

$$MM_i = SP_i - SP_{i-1}$$

Where:

MMi = Marketing margin of ith agent at a given point
SPi = Selling price by ith agent at a given point in the market chain in Tshs
SPi-1 = Selling price by a preceding agent (i-1), is the buying price paid by ith Agent at a preceding point in the market chain in Tshs

3.5 Regression analysis

A linear regression model was used to identify factors influencing farmers' income from round potato where farmers' GM was taken as a function of other 6 variables which included the level of education, land size, farming experience, production cost, and household size and selling price. The model for factors affecting farmer income was specified as follows:

$Y = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 X_5 + \alpha_6 X_6 + \varepsilon$

Where:
Y = Gross margin of the farmer (in TShs); α_0 = The intercept of regression equation
$\alpha_{(1-6)}$ = Coefficient of parameter estimates
X_1 = Education level (in years); X_2 = Production cost; X_3 = Land size (in acres)
X_4= Farming experience (in years); X_5= Selling price (in TSh); X_6 = Household size (in numbers of members); ε = Error term

3.6 Limitation of the Study

The study encountered a number of limitations. In some occasions respondents were not able to give the correct records of their round potato production, prices and earnings because of lack of record keeping. However, different techniques were used to overcome the problem. This included asking different questions for the same answer. Also information from focus groups including traders and extension workers complemented the information obtained from household survey.

4.0 Findings and discussion

4.1 Characteristics of the respondents

The result from the study shows that the age of respondents ranged from 15 to over 60 years with the majority (90.3%) aging 21-60 years. Family size ranged from 1 to 10 persons with an average of 5.2 persons per household. This is slightly higher than the national average of 4.9 persons as well as the district average of 4 persons. Household size has implication on family labour availability and cost (Mwakaje 1999). About 57.5% of the respondents were males and 42.5% females. This implies that farming activities especially that of round potatoes in the study area is more or less equally practised by both men and women and therefore efficient market could have high impact in the round potato growers' community. With respect to marital status, 7.5% were single, 75% married, 13.8% widow and 3.8% divorced. Marital status has implication on social organization and economic activities such as agriculture and resource management (Low, 2005).

Education-wise, the majority of the respondents (82.5%) in both villages had a primary school education with only minority having tertiary education. The very low level of education among the respondents could be an obstacle to farmers as it prevents them from getting opportunities other than farm such as formal employment, running business efficient and ability to bargain on the selling prices. Low education level can also lower farmers' effort towards forming groups to improve productivity and marketing structure. According to Schultz (1975), low education makes the farmer more vulnerable to bargaining power on crop prices and power to purchase inputs.

4.2 Land size and ownership

Land ownership and size are important attributes in crop production. The respondents were asked to give information on land size and ownership. The results indicated that about 95% of the respondents owned land customarily while 5% did not own any land. Respondents who have no land were depending on hiring and non-farm economic activities for livelihoods. With respect to size of the land owned, about 56.2% of the respondents owned between 4-6 acres. The median of land ownership in the study area was about 3 acres. According to Sokoni (2001), the problem of land shortage to most poor farmers in the area is due to the rapid expansion of round potato commercialization. This practice for example, has been observed in Uporoto Highlands in which round potato commercialization has accelerated richer farmers to purchase land from smallholders.

4.3 Economic activities

It was found out that the main occupation of the respondents in Ndaga and Ntokela villages was agriculture. When asked to mention the leading crops for their earnings, 49.5% of the respondents reported to depend on round potatoes as their main source of income while it was 33.3% and 10.5% for maize and cabbage, respectively. These finding are quite similar to those of Mwanukuzi (2010) who reports that in Mbeya Rural, round potato was accounting for 31% and maize 21% of the household's main income source. With such limited land it may imply that land is allocated to the most productive economic activities. Marketing system and margins are likely to have influenced land and labour resource allocation to the round potato production. However, if the gain from round potato does not reflect the opportunity cost of the left or reduced crops production, this could lead to aggregate decline in farmers' welfare. The study also revealed that due to the shortage of land, some farmers have been forced to depend on non-farm activities for their livelihoods. The main non-farm income sources were petty business followed by casual labour, local brewing and selling forest products. In many rural areas, agricultural activities alone cannot provide sufficient livelihood opportunities (Craig *et al*., 2001)

4.4 Yield of round potato per acre of land

Respondents were asked to report on round potato yield per acre and the results showed a great variation. The yield varied from 39 bags to 105 bags of round potato per acre with an average of 64.9 bags per acre. The average yield for the majority (60%) ranged between 55-74 bags per acre. The yield variation was due to a number of reasons including levels of farm inputs application, planting time (early or late), and soil fertility. Other reasons mentioned by respondents were type seeds used, quality of farm inputs used, ability to control pests and wilting. These findings are in agreement with the observation made by Gildemacher *et al*., (2009) that the low yield of round potato is attributed to diseases, pests and poor quality of seeds used. Studies in Kenya and Uganda show that only 4% of the farmers reported to have used clean seeds from the established centres.

On the other hand, a discussion with focus group discussions and key informants revealed that most of the farm input suppliers were cheating by either selling expired or low quantity/quality farm inputs. Furthermore, it was revealed that in order to maximize profit, suppliers of farm inputs used to mix DAP with NPK because DAP was sold at higher prices compared to NPK. The mixing of the two fertilizers resulted in poor quality fertilizer which reduced crop yield and low gross margin.

4.5 Trend of round potato production in the district by the respondents (2001-2011)

With regard to production trends, the proportion of the respondents (52%) reported that there had been no change in production trends while 25% of the respondents reported an increase in production. The remaining 22% of the respondents reported that production was declining.

However, DALDO's report (2009) shows that overall round potato production in Rungwe district has increased over the 5 years from 75,000 tons in 2003/04 to 95,226 tons in 2007/08 growing seasons. The observed difference from the respondents compared to that of DALDO's report could be partly explained by the poor record keeping for the majority of farmers. Minoe *et al.,* (2003) noted that lack of keeping farm records by farmers is more pronounced in subsistence economy due to high levels of illiteracy in most low resource African farming countries.

4.6 Round potato marketing chain in Rungwe District

Round potato marketing chain during the study period involved farmers who sold either to village agents, wholesalers or retailers or in some occasions to fellow farmers. The choice of buyers by farmers depended on the quality of the round potato produced, price information, education and family wealth. Most of the poor and low producer farmers were selling their round potatoes to village traders or fellow farmers, while big producers and rich farmers were selling to wholesalers in urban areas. This is because the poor cannot afford to take round potatoes to the larger markets. They also produce round potatoes in small quantities. A study by Mwakaje (2010) indicates that, when selling the crop, very few farmers were able to hire trucks to take their products directly to the big markets found in Mbeya or Dar es Salaam, but the majority sold their produce to the local traders.

Findings suggest that big producers and rich farmers were getting high profits compared to poor farmers because the former were able to take potatoes to the large markets in urban areas where there is more demand of round potatoes compared to rural areas and therefore they could sell at high prices in urban markets.

4.7 Marketing players at different levels of the marketing chain

Generally, the marketing chain in any agricultural production involves a number of players. These players may include the farmer or producers, village traders, wholesalers, retailers and consumers or a processor (Bhajantri, 2011). With respect to this study, the key players in round potato marketing chain were farmers or producers. Some of these farmers were indigenous to the study area (Ntokela and Ndaga villages) while others were immigrants from different areas including Tukuyu, Uyole and other neighbouring areas. These people moved into the study area and hired farms for round potato production. Most of these farmers produced round potatoes for commercial purposes.

The second players in the chain were village traders. Most of the village traders were indigenous to the study area and were reported not to involve themselves in round potato production. Most of them were young people aged between 20 and 45 years. Business in round potatoes was regarded to be their main source of income.

Wholesalers were the third players. It was revealed that most of the wholesalers were not indigenous to the study area but came to the area during the harvesting periods. Majority of the wholesalers had big capital. As a result they purchased the crop in bulk and transported it to dare s salaam as well as in and outside the county.

Retailers formed the fourth group of players in the round potato marketing chain. They were categorized into village and urban retailers. They usually had small capital, bought in small quantities and in most cases did not transport the crop to the larger markets. Their daily sales clients include consumers, eating establishments (such as restaurants and hotels) and some village families that do not produce the crop.

The final player in the round potato marketing chain was the consumer or processor. The consumers were categorized into village consumers, traveller consumers and urban consumers.

The consumers can influence the price of the crop at the farm level depending on the demand. Among the identified consumers, urban consumers were the largest and they usually consumed the crop in the form of chips and crisps. What was observed in the study area is supported by the study carried out by IITA-FOODNET/CIP (2001) which indicates that in East Africa over 50% of round potatoes are processed into chips or crisps and it is sold in urban hotels, restaurants and take-away (fast-food outlets).

4.8 Round potato marketing and prices in the villages

The average farm gate price of round potato in both villages ranged between Tshs 8,000/- and Tshs 22,000/- per bag. It was reported that prices varied depending on the variety of round potato, season and the buyer involved. The majority of the respondents (67%) reported that the price for the crop ranged between Tshs. 11,000/- and 16,000/- per bag of 100kgs. On the other hand, a small proportion of the respondents (10.8%) reported that the price ranged between Tshs. 8,000/- and 10,000/- and the remaining 22.6% reported that price ranged between Tshs. 17,000/- and 22,000/- per bag.

The red skinned potatoes fetched the highest demand by buyers than white skinned potatoes since the former are relatively less perishable. Seasonal market flooding and scarcity were termed to be the cause of fluctuation in round potato price. A survey showed that during harvest prices were very low in big markets and during post harvest period prices were about thrice of the peak harvesting price a findings that has been also been reported by Ashimogo (1995).

4.9 Marketing margins by players

The village traders' purchasing and selling prices and its marketing margin received by each of the actors along the marketing chain were computed. The results revealed that, on average, village purchasing was about Tsh 14,500 per 100kgs. Selling prices were about Tsh 17,900 per bag of 100kg of round potatoes. The average market margin calculated per 100kg bag of round potato was about Tsh 3,400.

The mean purchasing price of round potato by wholesalers from village traders was about 17,900 Tsh per 100kgs. The selling price average by wholesalers was about 50,000/- Tshs per 100kg bag at the Tandale market in Dar es Salaam while at Temeke Sterio, Kariakoo and Buguruni in Dar es Salaam markets. The marketing margins for wholesalers in Dar es Salaam were about 32,100 Tshs per 100kg bag of round potatoes.

A discussion with wholesale revealed that during high demand of round potatoes (January-March) farmers were getting better price compared to the harvesting seasons (July-December). During that time the average purchasing price for retailers in Tandale market in Dar es Salaam increases from 50,000/- Tshs per 100kg bag to 61,100/- Tshs per 100kg bag of round potatoes. Thus, the market margin for retailers in Tandale market was about 11,100/- Tshs per 100kg bag of round potatoes.

The price and market margins of round potatoes in the Tukuyu market shows that purchasing price was about 13,667 Tshs for 100kg bag of round potatoes. The selling price observed was about 22,667 Tshs to the bag of 100 kilogram. The marketing margin in Tukuyu Township was about 9,000 Tshs for every bag of 100kg. Findings at Uyole market shows a purchasing price of Tsh 15,300 and selling price averaged about Tshs 25,000 for a bag of 100kg of round potatoes. The market margins calculated for Uyole market was about Tshs 9,700 for a bag 100kg of round potatoes. Compared to the Tandale marketing margins, the marketing margins for Tukuyu market was about 81.1% of the Tandale GM (Dar es Salaam) price. This suggests that marketing margins increases with demand of the commodity. There is a high demand of round potatoes in Dar es salaam than in Tukuyu. However, it is quite difficult for the smallholder producers to reach the big markets individually. This could only be possible if they could form groups/cooperatives and sell their crop as a group. This could reduce transport and marketing costs and their increase marketing margins.

4.10 Gross margins obtained by players

Table 1 illustrates the GM by market players. Results show that farmers received the lowest of 4,229 Tshs while the wholesalers received the highest of T.shs 17,538. The lowest gross margin earned by farmers was caused by relative low price, high production costs, and poor access to the market information especially on demand and prices. The presence of village traders along the chain and overfilling of the potato bags (locally known *lumbesa*) also contributed to the reduced the GM for the farmers.

Other factors were poor quality of farm inputs, lack of extension services, round potato diseases such as bacterial wilt, potato tuber moth, late blight and red spider mite. This reduced round productivity and therefore reduced gross margins.

Like marketing margins, the GM also was increasing with increasing distance. In Tukuyu market, the GM was T.shs 8,700 Tshs followed by Uyole market with 9,367 Tshs and Tandale market had the highest GM of T.shs 10,700 per 100kg bag of round potatoes.

Table 1. Gross margin for different players (Tshs)

Actor	Total variable cost	Total revenue	Gross margin	% of marketing chain gross margin
Farmer	10127	14356	4229	8
Village trader	14500	17900	3400	6.4
Wholesaler in DSM	33700	50000	16300	30.9
Retailer (Tukuyu)	13967	22667	8700	16.5
Retailer (Uyole, Mbeya)	15700	25000	9267	17.6
Retailer (Tandale, DSM)	50400	61100	10700	20.3

Source: Survey data 2012

4.11 Regression analysis

Linear regression model for factors determining GM and its predictor variables was estimated using SPSS software. The dependent variables were GM and independent (predictors) variables were education (years in school), total production costs (T.shs), household size (number of persons), land size (acre), production volumes (kgs) and selling price (T.shs). Through its R-square value the model showed that 78% variation in GM is due to predictors and the remaining 22% was caused by predictors not included in the model. The statistical tests of the model itself showed that the explanatory power of the model was significant. With regard to the predictors influencing GM, the results indicated that 3 out of 6 parameters examined, significantly influence GM in the study area. Household size had positive relationship with the round potato GM and it was statistically significant ($p<0.05$). Thus, as household size increases round potato production will increase and therefore the GM will increase accordingly. This is partly because family labour is normally cheap compared to hired labour. Selling price also contributed significantly to the GM indicating that the higher the price the farmers are getting in selling round potato, the higher will be the GM. An act to reduce marketing costs will lead to high price at farm level and therefore more profitability of round potato *ceteris paribus.* The education level of farmers was found to have positive influence on GM but was insignificant. This implies that the level of education of the farmer cannot be attributed to the GM because the majority of the farmers interviewed had low level of education. Nevertheless, good education including extension services can enable farmers to produce and market round potatoes more efficiently and lead to high GM. According to Carter (1984), education positively affects agricultural profitability. Also production levels had positive relationship to GM but not significant. This is because most of the round potato farmers were subsistence farmers using rainfed agriculture with limited input use. Increasing farm productivity could enhance GM at farm level. Also facilitating farmers to form cooperatives will enhance marketing volume and gross margins.

Table 2 also show that land size/farm size to have positive relationship with round potato gross margins but was insignificant. Farmers with larger land size were expected to get higher gross margin than those with small land size. This could be explained in terms of economies of scale in production and marketing. However. it was not significant because many respondents had only small plots for round potato production.

Production cost had inversely related to round potato GM but was statistically insignificant indicating that as production costs increases the gross margin declines

Table 2. Linear regression model results on the determinants of round potato GM

Predictors	B	Std Error	t-ratio	Significance
(Constant)	4532.174	1139.055	3.979	0.000
Education level	1.812	4.284	0.424	0.674
Production costs	-0.007	0.025	-0.262	0.794
Household size	27.066	13.590	1.992	0.050**
Land size	0.202	8.166	0.025	0.980
Production levels	4.440	100.648	0.044	0.965
Selling price	0.239	0.015	15.999	0.000***

R^2 = 78%, Adjusted R^2=77, F-value= 44.088
** Significance at 5% *** Significance at 1%

4.12 Factors affecting round potato farming and marketing

In a multiple response question farmers were asked to explain factors that affect round potato production. A high proportion of the respondents reported diseases and pests (83.3%), low prices (70.8%) and high costs of input (62.5%). While the cost of purchasing of inputs was reported to be high, also the quality of inputs was a problem by 58.3% of the respondents. Other factors reported to affect round potato productivity were inadequate land (58.3%) and extension services (45.8%). Addressing these problems could improve round potato productivity and GM. These findings partly confirm that of Isinika *et al.* (2003) who reported that lack of extension services and credits to rural farmers were major impediments to most farmers in rural Tanzania. Also, a study conducted by Kamau (2005) indicated that many round potato farmers in Kenya were unable to control bacterial wilt and other related diseases such as potato tuber and late blight. Consequently, these diseases reduced round potato productivity in the area.

5.0 Conclusion

The study aimed at determining relative GM by players in the round potato marketing chain and factors affecting the crop profitability. The findings revealed a significant different of GM by market players where farmers were receiving the lowest and wholesalers received the biggest share of GM especially for those who used to transport round potatoes to the Dar es Salaam markets. Wholesale were well informed about market prices and trends than farmers and had big capital to run the business. Through a regression model analysis it was observed that parameters of selling volumes and selling price were key factors to determine GM by farmers while education and land size were not significant but had positive relationship with GM. Factors constraining round potato profitability at farm level were found to be low production levels, low level of education, high input costs, lack of marketing information, disease and pests.

The study recommends for the government to enhance farmers bargaining power through providing indicative prices, encouraging farmers to form groups and reduce transport costs through improved roads. The government should also ensure that farm inputs are available to the farmers in time and in good quality and for improved round potato productivity through improved extension services

7.0 References

Carter, M (1984), Identification of the Inverse Relationship between Farm Size and Productivity, Oxford Economic Papers.

FAO (2008), Potato and Biodiversity. IYP.

FAO (2009), International Year of the Potato. IYP.

Ferris, R.S.B., Okobi.G., Crissman, C, Ewell and Lemaga.B, (2003), Performance and growth prospectsbof Irish potatoes as component for development of strategic export in Uganda. ASARECA/IITA Monogragh 2.IITA, Ibadan, Nigeria. Pp44.

Gabre-Mahhin, Z. (2009). A Market for all Farmers: Market Institutions and Smallholder Participation. CEGA Working Paper Series No. AfD-0903. Center for Global Action. University of California, Berkeley.

Craig, C. and Gordon, A (2001), Rural non-farm activities and Poverty alleviation in Sub Saharan Africa. Policy Series 14, Natural Resource Institute University of Greenwhich.

Fontijn K., Delvaux D., Ernst GGJ and M Kervyn (2010) Tectonic control over active volcanism at a range of scales: Case of the Rungwe Volcanic Province, SW Tanzania; and hazard implications. *Journal of African Earth Sciences* 58: 764–777

Gildemacher PR, Demo P, Barker I, Kaguongo W, Woldegiorgis G, Wagoire WW, Wakahiu M, Leeuwis C, and Struik PC (2009). A Description of Seed Potato Systems in Kenya, Uganda and Ethiopia. American Journal Of Potato Research (2009). 86 (5): , Publisher: Springer New York : 373-382

Grossman, S.J. and Stiglitz, J.E. (1980). On the impossibility of informationally efficient markets, *American Economic Review*, June: 393-408.

Kamau. P. (2005) Farmers are now producing potato seeds. The news paper for sustainable agriculture in Kenya. Natural Resource (NR) .3 June.

Majule, A.E (2008), Climate Change and Variability: Impacts on Agric. And Water Resources and Implications for Livelihood in Selected Basins. Towards Climate Change Adaptation. In Went- Int. Weiter-bildung und Entwickwng gGmbH (publisher).: 978-3-939394-28-0.

Minoe, S., Barker, D., Dixon, J (2003), Status of Farm Data system and Farmer Decision Support in Sub- Saharan Africa, FAO Rome.

Maro, W.A (1999), Agricultural Marketing in Tanzania. Collaborator study prepared for report. Washington, D.C. International Food Policy Research Institute.

Mwakaje, A.G (2010). Inforamtion and Communication Technology for Rural Farmers: Journal of Information Technology Impact,.10 (2):111-128.

Mwanukuzi, P.K. (2010). Impact of non-livelihood-based land management on land resources: The case of upland watersheds in Uporoto Mountains, Western Tanzania. The Geographical Journal 177: (1) 27-34.

Namwata, B.M.L (2010), Adoption of improved agricultural technologies for Irish potatoes (Solanum tuberosum) among farmers in Mbeya Rurar district, Tanzania; A Case of Ilungu ward. *Journal of Animal and Plant Sciences.* 8, (1): 927- 935

Poole, N. D., Gomis, F.J., Igual, J.F. and Gimenez, V.F. (1998). Formal contracts in fresh produce markets. *Food policy*. Vol 23, (2),:31–14

Schultz, T.W. (1975). The Value of Ability to deal with disequilibria. *Journal of Economic Literature* 13: 827-846.

Sokoni, C. H. (2001). The influence of agricultural market reforms on highlands farming system in Tanzania. The case study of Uporoto Highlands, Mbeya Region. Dar es Salaam University Press (DUP), Dar es Salaam.

URT (2010): United Republic of Tanzania. Rungwe Socio-economic profile. http://travelingluck.com/Africa/Tanzania/Tanzania%20%28general%29/_150412_Rungwe%20District.html Accessed September 2012.

URT, (2007). United Republic of Tanzania, Poverty and Human Development Index. Mkuki na Nyota Publishers, Dar es Salaam, Tanzania,

URT (2002): Population and housing census general report. Central Census Office, National Bureau of Statistics, President's Office Planning and Privatization. Dar es Salaam, Tanzania, Government Printer.