FACTORS INFLUENCING COMMERCIALIZATION OF ROUND POTATO PRODUCTION IN RUNGWE DISTRICT, MBEYA REGION

STANTON MWAFUNGO LUMILILO

A THESIS SUBMITTED IN FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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ABSTRACT

This study was conducted in four villages in Rungwe District, Mbeya region in Tanzania to investigate factors that influence commercialization of RP production. Data was collected from a cross-sectional survey of 400 household heads. The survey was complemented by FGDs at village levels, in-depth interviews with key informants, and observation. Data was quantitatively and qualitatively analysed. Based on multiple linear regression results, socio-economic factors such as age, sex, education level, income level, land ownership, market, other activities, labour cost and acreage cultivated were found to influence commercialization of RP production. The study results from descriptive statistics involving Likert scale and chi-square test showed that smallholder farmers' perception of RP production considered it as drudgery work. Also, intensive input use, use of capital limited commercialization of RP production. Furthermore, based on descriptive statistics and chi-square tests, the results showed that biological factors such as diseases/insect pests, growing of RP without fertilizers, use of local varieties, and low soil fertility negatively influenced commercialization of RP production. Similarly, environmental factors such as the effect of low temperature, frequent frost occurrences, and heavy rainfall negatively influenced commercialization of RP production. This study concluded that socio-economic factors, smallholder farmers' perception towards commercialization of RP production, biological and environmental factors negatively influenced commercialization of RP production. This study makes a number of recommendations to the Rungwe District Council of improving commercialization of RP production: (i) invest in road infrastructure; (ii) educate farmers to use improved seeds of RP; (iii) use farm inputs (fertilizers, fungicides); (iv) encourage formation of farmers' groups; (v) connect farmers to financial facilities; and increase Agricultural Extension Agents.

DECLARATION

I, Stanton Mwafungo Lumililo do hereby declare to the Senate of Sokoine University of Agriculture that This thesis is my own original work done within the period of registration and that it has neither been submitted nor been concurrently submitted to any other institution.

_____ _____

Stanton M. Lumililo Date

(PhD Candidate)

The above declaration is confirmed by;

_____ _____

Prof. Malongo R. S. Mlozi Date

(Main supervisor)

_____ _____

Dr. Flavianus T. Magayane, Date

(Co-supervisor)

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DEDICATION

This Thesis is dedicated to my late father Lumililo Mwandapile and mother Keta Isengela who passed away before they could witness the outcome of the dream of this work.

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
BoT	Bank of Tanzania
^{0}C	Degree Centigrade
CA	Calcium Nitrate
CAWMA	Comprehensive Assessment of Water Management in Agriculture
CIP	International Centre of Potato
DAICO	District Agricultural Irrigation and Cooperative Officer
DAP	Diammonium Phosphates
DEO	District Agricultural Extension Officer
ESA	Eastern and Southern Africa
FAO	Food and Agricultural Organization of the United States
FAOSTAT	Food and Agricultural Organization Statistical Division
FGDs	Focus Group Discussion
GDP	Gross Domestic Product
GNP	Gross Net Product
HBS	Household Budget Survey
HH	Household
IFAD	International Food for Agricultural Development
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
IYP	International Year of Potato
Kg	Kilogram
KIs	Key Informants
Km^2	Square kilometres

m	Metre
MINAGRI	Ministry of Agriculture and Animal Resources of Ruanda
mm	Millimetres
NAPA	National Adaptation Programme of Action
NBS	National Bureau of Statistics
NER	Net Enrolment Ratio
NPK	Nitrogen Phosphate Potassium
NSGRP	National Strategy for Growth and Reduction of Poverty
OECD	Organization for Economic Cooperation and Development
PEDP	Primary Education Development Plan
RP	Round Potato
SACCOS	Servings and Credit Cooperative Organizations
SEDP	Secondary Development Plan
SES	Socio-economic Status
SPSS	Statistical Package for Social Sciences
TSP	Triple Supper Phosphate
TZS	Tanzanian shillings
UNDESA	United Nations Development for Economics and Social Affairs
URT	United Republic of Tanzania
USD	United States Dollar
USDA	United States Development Agency
VEO	Village Executive Officer
WEO	Ward Executive Officer
ZPHS	Zonal Plant Health Services

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Round potato (RP) (*Solunum tuberosum*) has become the fourth most commercialized important crop in the world. It is consumed by more than one billion people over the world after wheat, maize, and rice (International Centre of Potato (CIP), 2012). Potatoes are grown in most continents and come in an array of shapes, sizes, and colours. Round potato crop is currently grown on about 18 million hectares of land with a global production of 314 million tons per year with Asia and Europe being the two major potato growing continents for commercialization (Food and Agricultural Organization of United States (FAO), 2010). China ranks first, in the commercialization of RP production followed by Russia, India, USA, Poland, and Ukraine (CIP, 2012). In 1990, the emerging and developing countries which included both Russia and China, accounted for a slight majority of 55.5% of the total production and by 2010, the production by the emerging and developing countries accounted for nearly two-thirds (73.5%) of the total world commercialization of RP production, which is in contrast to 26.5% production share of developed countries (Food and Agricultural Organization Statistical Division (FAOSTAT), 2013).

Shifts in the regional supply patterns reflect the fact that the emerging and developing countries are cultivating a growing proportion of the total world potato production for commercialization. In 2011, Asia grew more potatoes than what was grown in any other single region. The continent produced close to 50% of the total world output (Table 1) (FAOSTAT, 2013). Europe continues to contribute a sizeable production (35% in 2011), though generally there is a decline of the share of the total production. In 2000, Europe

production accounted for 45.5% of the total global production, down from 60.1% in 1990. Potato production for commercialization in America has generally been declining for the past 15 years, and the area now supplies just slightly more than 6% of the world total production, which is a 2% decline since 2000 (FAOSTAT, 2013). In 2011, top-ranked China produced 88.4 million tons and approximately 24% of all potatoes grown in the world. In 2000, China produced 64.6 million metric tons of potatoes, representing 20% of the total world production (Table 1).

Table 1: The world round potato producers

Rank in the year 2000	Country	Quantity (Tons) in the year 2000	Quantity (Tons) in the year 2011	% increase
1	China	64 596 119	88 350 220	24.0
2	Russian Federation.	34 965 200	32 681 500	-3.4
3	India	22 242 700	42 339 400	11.0
4	USA	19 852 500	19 361 500	-1.3
5	Poland	19 378 900	8 196 900	-58.0
6	Ukraine	17 343 500	18 705 000	3.8
7	Germany	11 916 800	11 800 000	-0.49
8	Belarus	7 767 600	8 326 390	3.5
9	Netherlands	7 115 000	7 333 470	1.5
10	UK	6 649 000	8 016 230	9.3

Source: FAOSTAT (2013).

India, the second largest producer in 2011 produced less than half of the potatoes of the top-ranked China, though still accounted for 11% of the total production and 42.3 metric tons (Table 1). Poland experienced notable commercialization of RP production declines of nearly 58% due low prices and damaging floods (FAOSTAT, 2013). The share of production by the historically dominant regions of the USA, Russia, and the Western Europe declined from 27% in 2000 to 22% in 2011. The decline of Russian output in 2000 was due to pest pressure and weather challenges (FAOSTAT, 2013). The USA commercialization of RP production slipped slightly in 2000, with its global ranking

falling to the fifth position by 2011. In the 2010s, the RP produced by the developing countries amounted to about 47.2% with the world of RP commercialization been categorized into seed potatoes, frozen chips, fresh potatoes, crisps and other RP snacks and starch (Bhajantri, 2011). Studies show that frozen chips is the world's leading export followed by fresh potatoes (FAOSTAT, 2013). However, only about 2% to 3% of about 322 million tons of the world's RP production is commercialized internationally; and imports and exports of fresh potatoes to and from developed countries account for 86% and 83% respectively of the total world commercialization (FAOSTAT, 2013).

However, there are some challenges that affect commercialization of RP production in many of these countries. For instance, in China, seasonal aphid pressure is high and potato virus, drought, and late blight (*Phytophtora infenstans*) from July to September are the major factors limiting RP yields (in a single cropping). In the USA, potato crop faces a problem of diseases such as late blight, which is caused by fungus such as *Oomycete phytophtora infenstans* and *Rhyzoctonia selerotinia*, black leg, powdery mildew, powdery scab, and leaf roll virus. Insect pests include potato tuber moths and the green peach aphids (*Mycus persicae*). All these contribute to lowering the commercialization of RP production.

In Germany, weather extremes lead to difficult growing conditions for the crop (cold and wet weather). These factors limit the supply of RP and raise the prices of the crop making it necessary to compensate for the shortfall through imports (Asian Development Bank (ADB), 2013). In the Russian Federation, pests and diseases are the major problem since as much as 4 million tonnes are lost annually to Colorado beetle, late blight, viruses, and the challenges of weather condition (FAOSTAT, 2013). In Ukraine, a large part of the crop is lost each year to pests, mainly the Colorado beetle and inadequate storage.

However, in Italy, commercialization of RP production has been declining because large areas are unsuitable for the potato crop production necessitating the imports of tons of raw and processed potato so as to satisfy the domestic demand (FAOSTAT, 2010 and CIP, 2010). Poland has been experiencing declines of commercialization of RP production due to low prices and damaging floods (FAOSTAT, 2013).

The average world potato consumption by region was estimated to be around 32.6 kg per person (Table 2). Asian population consumes 26.2 kg per person annually while Europe produces fewer potatoes but with a relatively smaller population and supplementary imports, the region consumes the largest average annual per capita at 85.5 kg (FAOSTAT, 2013). On the other hand, Africa has relatively low consumption of about 15.9 kg per person; although developing nations on the continent are cultivating increasing amounts of potatoes; thus, consumption may increase overtime with the improve of cultivation practices (FAOSTAT, 2013).

Table 2: World potato consumption by region

Region	Total consumption (Tons)	Kilogram per capita
Africa	14 823 633	15.5
Asia	105 934 808	26.2
Europe	63 003 549	85.5
South America	10 771 097	27.7
North America	18 749 149	54.9
WORLD	217 253 003	32.6

Source: From USDA Economic Research Service, UN and FAOSTAT (2013).

In Africa, some African countries Algeria, Egypt, Ethiopia, Kenya, Malawi, Nigeria, Rwanda, South Africa and Uganda have adopted commercialization policy of RP production through transforming subsistence agriculture to sustainable economic growth. In Sub-Sahara Africa, 52% is potatoes harvested area and 45% of this is in the East and Central Africa (Scott *et al.*, 2013). Yields per hectare are low of less than 10 tons per

hectare in these countries, but this could be increased to above 30 tons per hectare due to better crop management practices, and availability of appropriate varieties. However, the economies of countries in the Sub-Saharan Africa are expected to grow by 5% per year (IMF, 2012). A study by Diao *et al.* (2012) in Washington DC noted that an increase in commercialization of agricultural productivity would reduce poverty through improving the standard of living of producers and through additional effects such as the reduction in food prices for urban consumers, facilitation of growth opportunities for rural non-farm activities, and the emergence of new employment opportunities due to expanded migration (Alderman, 2009).

The export share of developing countries is 14.3% for fresh potatoes and only 2.9% for frozen potatoes. In Africa, Egypt is the biggest producer of round potato for commercialization with the annual output of about 2.6 million tons followed by Malawi, South Africa, Algeria, and Morocco (CIP, 2010). In total, Africa produces 6% of the world's round potatoes that are commercialized and Algeria, Egypt, Malawi, Morocco, and South Africa produce more than 80% of all round potatoes commercialized in the region (CIP, 2010).

These countries experience challenges of commercializing RP production; and these include among others a decline in the land-labour ratio, disparities in the distribution of land within a small farming sector and imminent landlessness among smallholder farmers (about 25%) (FAO, 2010). On average, landholdings are 0.11 ha/capita in general, 0.02 in Ethiopia, 0.03 in Rwanda, while 70% of the households in Malawi have less than 1ha (FAO, 2010). Other challenges include stagnant food crop productivity due to low input use, limited fertilizer application, and limited irrigation, lack of green revolution and the use of recycled seeds that may be of low quality. Usually, essential improved seeds are

either expensive or lacking when needed (FAO, 2010). In Kenya, commercialization of RP production constraints are diseases such as bacterial wilt and pests such as potato cyst nematode (*Globodera restochiensis*) (FAOSTAT, 2010). Major challenges for commercialization of RP production in these countries include lack of sufficient quantity of quality seeds, lack of inputs, clean seeds, lack of fertilizers and pesticides, lack of organization in the marketing chain particularly amongst producers (Hegazy, 2009; FAO, 2010). All these factors have prevented effective RP commercialization.

Table 3: Africa's top 15 round potato producers

Rank	Country	Quantity (tons)	Harvested area (ha)	Yield t/ha
1	Egypt	2 600 000	105 000	24.8
2	Malawi	2 200 402	185 000	11.9
3	South Africa	1 972 391	58 000	34.0
4	Algeria	1 900 000	90 000	21.1
5	Morocco	1 450 000	60 000	24.2
6	Ruanda	1 200 000	133 000	9.0
7	Nigeria	843 000	270 000	3.1
8	Kenya	800 000	120 000	6.7
9	Uganda	650 000	93 000	7.0
10	Angola	615 000	120 000	5.1
11	Ethiopia	525 657	73 095	7.2
12	Tunisia	350 000	24 550	14.3
13	Sudan	263 900	15 708	16.8
14	Tanzania	240 000	37 000	6.5
15	Madagascar	225 000	38 000	5.9

Source: FAOSTAT (2010) and CIP (2010).

In East Africa, Tanzania ranks the 4th in round potato production after Rwanda, Kenya, and Uganda (Table 4). The annual production of round potato for commercialization in Tanzania was 240 000 tons (Mpogole, 2012). In either case, the position of Tanzania in East Africa cannot change unless something is done to increase or improve production based on the land size and potentially arable land (Stein, 2010). However, in 2012, the commercialization of the total RP production in Kenya was about 5.6 million tons in an area of 143 000 hectares, while commercialization of RP production in Rwanda was 2338 million tons in 2012 from 165 000 hectares (MINAGRI, 2013). On the other hand, the commercialization of the total production of round potato in Uganda in 2012 was reported

to be 670 000 tons from the total area of 32 760 hectare (FAOSTAT, 2013). However, Burundi, Kenya, Rwanda, and Uganda, face similar challenges, which are viral diseases and soil borne diseases, bacterial wilt, high prices of inputs such as fertilizers, poor quality seeds small fragmented plots, pesticides, and fungicides (FAOSTAT, 2013).

Table 4: The East Africa round potato producers

Country	Year	Quantity (tons)	Harvested area (Ha)	Yield /ha
Kenya	2012	5 600 000	143 000	9.1
Rwanda	2012	2 338 000	165 000	10.5
Uganda	2012	670 000	32 760	6.8
Tanzania	2012	504 000	134 000	6.5

Source: FAOSTAT (2013).

In Tanzania, subsistence farming has proved ineffective in improving livelihoods of the rural population leave alone in achieving food security. The country has a policy of commercializing agriculture (URT, 2010). Commercialization of RP production is challenging in a situation where the majority of farmers are engaged in food crops, which are considered profitable (Shiferaw *et al.,* 2011). Although world commodity prices started to decline in the mid-2008, domestic staple food prices in several Eastern and Southern African (ESA) countries remained high throughout 2008 before peaking in early 2009 (Nicole *at el.,* 2011). However, the commercial engagement in selling and exporting major staples such as maize and rice was later restricted lowering the prospects for these crops to be marketed (Gabagambi, 2007). The importance of these crops was considered based on the area cultivated and the obtained production outputs. For instance, according to the country profile of the United Republic of Tanzania, maize was the dominant crop with a planted area of over 1.5 million hectares, followed by paddy (rice) with more than 0.5 million in recent years. However, in 2009 the FAO statistics showed a notable difference in the area planted with maize of 2961 million hectares, followed by dry beans with 1266 million hectares, cassava with 1081 million hectares, paddy (rice) with 0.904

million hectares (FAO, 2010), and lastly potatoes with 0.173 million hectares, which ranked in the 14th place.

In terms of measuring the quantities produced, the top three crops were cassava (5.9 million metric tons), maize (3.3 million metric tons), and bananas (3.2 million metric tons). Potatoes did not feature anywhere. Yet, potatoes came in the 10th place (with 0.7 million metric tons), with, maize, cassava, rice, bananas, potatoes, and pulses being the major food crops as they had the biggest volumes in tons (FAOSTAT, 2010). Following lowering the prospects of marketing major staples, there emerged opportunities for sub staples such as round potato to be commercialized in areas with favourable climatic conditions such as Rungwe District and other RP growing areas (URT, 2010). Round potato has been grown since 1920s in high altitude areas of the country. The falling of world market prices of some crops such as pyrethrum in the 1970s could have promoted the production of round potato for commercialization especially in Uporoto highlands (FAO, 2010*).* As opposed to figures in Table 5, figures in Table 3 on Africa's top 15 RP producers, show Tanzania as the least but second in the RP production with the production of 240 000 tons from 37 000 hectares and the average yield per hectare of 6.5 tons (FAOSTAT, 2008; CIP, 2008). However, figures in Table 5 show that the regions that produce RP in Tanzania in their order of importance include Iringa, Mbeya, and Kilimanjaro regions with the total production of 504 000 tons from 134 000 hectares and the average production of 4.3, 3.2, and 1.0 tons , respectively (URT, 2008).

In this case, these figures in Tables 3 and 5 were not consistent considering the fact that the area of production was the same. The information gaps surrounding RP production figures was a consequence of the fact that priority was given to the collection and documentation of data on the most important cash crops such as coffee, tea and cocoa

which were traded in international markets (Kabungo, 2008). Given the absence of weighing scales at farmers' level and that some produce were consumed at home, the reported statistics could be lower than they actually were. In this case, it was convenient to use the statistics from URT (2007) which were relatively higher than those reported by FAOSTAT (2008).

Round potato takes three to four months to mature, and the crop is more suited to in areas with high altitude, where maize, for instance, takes seven to ten months to mature (Namwata *et al*., 2010). According to URT (2010) study, about 504 000 tons of round potatoes are produced in Tanzania annually and most of these are produced in Iringa, Mbeya and Kilimanjaro regions. Iringa alone produces about 276 000 tons which is about 60% of the national production (Table 5).

Table 5: Important regions producing round potato in Tanzania

Region	Area under potato ha	Production in tons	Yield in tons/ha
Iringa	65 000	276 000	4.3
Mbeya	50 000	160 000	3.2
Kilimanjaro	19 000	19 000	1.0
Total	**134 000**	**504 000**	**8.5**

Source: URT (2010).

Commercialization policy in Tanzania was adopted in 1980s to improve livelihoods of the Tanzanian people through intensifying agricultural productivity using the available technologies (URT, 2010). The commercialization policy is in line with the Tanzania Development Vision of 2025, which stresses on improving the quality of people's livelihoods by increasing the level of productivity through economic transformation in all sectors. The National Strategy for Growth and Reduction of Poverty (NSGRP or MKUKUTA in Kiswahili) envisages that by 2025, Tanzania will have transformed into a middle-income country, characterized by high quality livelihood and peace, among other things.

In the minds of smallholder farmers of Rungwe District and the country at large, the term agriculture means an activity that can significantly improve their livelihoods. Smallholder farmers are aware that the agricultural sector plays a critical role in their livelihoods as it is a source of employment, income growth, poverty alleviation, socio-economic development and environmental sustainability in developing countries (URT, 2010). Agriculture is the single largest employer of the country currently employing 65% of the population. In 2015, it contributed to 29.0% of the DGP, while in 2016 it is estimated to have contributed to 29.1% of the DGP (Tanzania Economic Outlook, 2017). In addition, about 87% of the rural income is earned from agricultural activities. The sector also has consumption linkages with other sectors; as a result, it has remained the main source of employment and livelihood for rural and peri-urban communities in Tanzania (URT, 2012).

The importance of agriculture is also reflected in food security as over 70% of Tanzanians' population depends on subsistence agriculture for food production. This situation reflects the reality of life of smallholders who strive to earn a better living out of subsistence agriculture in the study area. Agriculture is also one of the country's main sources of foreign exchange earnings through the traditional export crops such as coffee, tobacco, tea, and sisal, which play a key role in export earnings, the current declining trend notwithstanding. For example, in 2010, 2011, 2012, and 2013 Agricultural Domestic Product growth was 6.4%, 6.9%, 7.0%, and 7.2%, respectively. Agricultural GDP declined from 7.2% in 2013 to, 7.0% in 2014 (IMF, 2014).

Based on subsistence nature of agricultural production, there are a number of factors that affect agricultural development, which include rain-fed agriculture, poor farming technology, the use of a hand hole, and the use of limited input. In addition, there are high proportions of agricultural commodities, which are sold as raw-materials with either

insignificant or no value addition (World Bank, 2009). Smallholder farmers who constitute the bulk of the rural poor have also not fully benefitted from agriculture because they have predominantly been practicing consumption-oriented subsistence agriculture which excludes them from enjoying the benefits from the sector (Pingali, 2010).

In Tanzania particularly in Rungwe District, the weather conditions in terms of rainfall patterns have changed and become highly unpredictable in recent years. This is in contrast to the previous years when rainfall was reliable for agricultural production. For example in 2015, smallholders of round potatoes experienced a long dry spell with untimely and late rains which affected commercialization of agricultural production (National Adaptation Programme of Action (NAPA), 2012). Other factors that affect commercialization of agricultural production include inadequate access to markets, insufficient market information, limited access to finance, lack of capacity of agricultural marketing institutions, lack of entrepreneurial skills, non-existent of product standards, high transaction costs, poor co-ordination and integration of marketing channels, and policy uncertainties (Mwakaje, 2010).

Therefore, subsistence oriented smallholders, have the greatest need of commercialization so as to satisfy the growing demand and uptake in the resultant income mediated benefits (Kirsten *et al.*, 2012). Commercial agricultural production is likely to result in welfare gains through the realization of comparative advantages, economies of scale, and the effects of dynamic technological organization and institutional change that arise from the flow of ideas due to exchange-based interactions (Kirsten *et al.*, 2012).

Table 6 indicates the estimated current trend of RP production for the period from 2011 to 2015 in Rungwe District. This reflects the situation on how smallholder farmers suffer from fluctuations of RP production.

Table 6: Estimates of round potato production in Rungwe District

Current year	Area cultivated (ha)	Production in (tons)	Previous year	Area cultivated (ha)	Production in (tons)	Production increase (tons)	(%) increase
2011	24 040	65 500	2010	23 190	52 800	22 700	+34.9
2012	24 512	48 900	2011	23 190	65 500	16 600	-33.0
2013	25 450	68 829	2012	24 512	48 900	19 929	+28.9
2014	26 550	41 058	2013	25 450	68 829	27 771	-40.3
2015	27 400	39 528	2014	26 550	41 058	1 530	+3.7

Source: Rungwe District (2016).

1.2 Definition of Commercialization

Commercialization is a process by which a new product or a service is introduced into the general market (Vijay, 2009). Commercialization is broken into phases from the initial introduction of the product, promoting mass production, and adoption. It (commercialization) depends upon technology transfer, knowledge, and resource sharing among different stakeholders. The term considers the production, distribution, marketing, sales, and customer support which are required to achieve commercial success (Vijay, 2009). However, the definitions of agricultural commercialization vary in focus and breadth, which has also influenced its measurement. Agricultural commercialization is defined as an increase of the proportion of the marketed output, or an increase of production of a cash crop, which is sold by farmers. Agricultural commercialization can take many different forms by occurring either on the output side of production with increased marketed surplus or on the input side with increased use of purchased inputs (Paradhan *et al*., 2008).

Others view agricultural commercialization as production involving farmers' behaviour in resource requisition and allocation (Jaleta *et al.,* 2008). On the other hand, Poulton *et al.* (2008) view agricultural commercialization as critical in defining the type of the product of commercial production, the scale of production or production allocation. This view

supports the broad view that defines agricultural commercialization as an agricultural transformation process in which farmers shift from mainly subsistence oriented consumption to commercial production (Pingali, 2008). This entails an increase of integration of farmers into the exchange economy, deliberate moves to competitively satisfy market needs for profit, an increase in the recognition of farming as a business venture, uptake of and investment in efficient technologies as well as having strong formal linkages with other value chain actors (Jaleta *et al*., 2008). Agricultural commercialization is triggered by driving forces that include population growth, urbanization, an increase in incomes, and the demand for both food, and non-food products and crops (World Bank, 2010).

The demand changes are expanded in cultural diversity, consumer life styles and consumption patterns due to globalization, migration, and urbanization (Pingali, 2008). Also, rapid growth, employment, information communication technology, and operational technology are the common features of commercialization (Kirsten *et al.,* 2012). Agricultural commercialization enhances a link between input and output sides of agricultural markets. Commercialization entails market orientation (agricultural production decision destined for market, based on market signals) and market participation offered for sale and use of purchased inputs (Gebremedhin, 2010). Access to appropriate technology and value chain integration can significantly improve efficiency, reduce transaction costs, and promote commercialization (Berret, 2008).

Therefore, smallholders with a high degree of market engagement can have better potential of enjoying better standards of welfare and have more impact on reducing poverty than the promotion of large ventures among farmers. Smallholders can have the potential to enhancing incomes and welfare outcomes and take smallholder farmers out of

poverty if constraining factors could be eliminated (Berret, 2008). According to the ongoing debate on agricultural commercialization, smallholder farmers are important players in the sector as they directly benefit from the growth of income and food supply (World Bank, 2010). Smallholder farmers are incorporated into the market system as there is an increase in the recognition of the use of inputs and investment technology and an increase in information technology (World Bank, 2010).

1.3 Problem and Justification

In Tanzania, studies on RP show that production and consumption have increased (Namwata *et al*., 2010). RP is grown in areas between 1,800 and 2,700 m above sea level, most of these areas are found in the Southern Highlands, particularly Iringa and Mbeya regions. RP is also grown in the west of Mt. Kilimanjaro, notably Arusha region (Table 5). Commercialization of RP production has a great potential in both national and regional markets due to the growing demand for chips and snacks/crisps which can be traced to many factors, including increased economic activities, urbanization, tourism and changing lifestyles, all of which are shifting consumer food preferences towards easy to cook and processed foods (CIP, 2010). RP is easy to cook and to process, it produces remarkable quantities of calories comparable to cereal crops (Scott *et al.,* 2013). This means that RP is more profitable than traditional staples as it has high yield per unit of land, matures earlier, and provides a larger income (Namwata *et al*., 2010). The maturity period of RP is about three months as opposed to maize (the major staple in Tanzania) which takes about seven to ten months to mature. Also, one acre of RP in Rungwe District produces 100 to 120 bags of 100 kg versus about 20 bags of maize. Also, the price per unit are comparable though often RP sales are higher than maize (BoT, 2010). For RP production, data show that it is a good income earner and because of its potentiality the crop is considered to be a hidden treasure for smallholder farmers (CIP, 2010).

Rungwe District in Uporoto high lands produces 25% of the RP crop in the country hence it plays a key role as both a food and income source for small holder farmers (URT, 2010). However, smallholders' livelihoods have never improved as incomes are becoming low (Namwata, 2010). Also, studies indicate that RP has not been produced to its full potential to take advantage of commercialization opportunities; for example, studies reveal that minimum yield for this crop in Rungwe and Mbeya Rural Districts was four bags per acre (10 bags/ha), and the maximum was 100 bags/acre with the average of 33 bags (8.25 tons per hectare) instead of 250 bags (25 tons per hectare) (Mpogole, 2012; BoT, 2010). Because of low yields of RP per acre, some of the smallholders decide to sell the land and migrate to urban areas while others opt for off-farm activities (Nyunza and Mwakaje, 2012). Hence, this study was set out to investigate factors that influence commercialization of RP production in Rungwe District, in Mbeya region. The study findings will help policy makers and stakeholders in agriculture to develop policies and strategies that would enable smallholder farmers to commercialize RP. Also, the study findings will be used by Rungwe District policy makers in designing mechanisms of improving livelihoods of RP smallholders and deter them from selling their land. Also, the study findings will be used by Agricultural Extension Officers working in the study areas in educating smallholders on effective commercialization process.

1.4 Objectives of the Study

1.4.1 Overall objective

The overall objective of this study was to investigate factors influencing commercialization of round potato production in Rungwe District in Mbeya region.

1.4.2 Specific objectives

(a) To examine smallholder farmers' socio-economic factors influencing commercialization of RP production in Rungwe District.

(b) To identify smallholder farmers' perceptions about commercialization of RP production in Rungwe District.

(c) To assess biological factors influencing commercialization of RP production in Rungwe District.

(d) To determine environmental factors influencing commercialization of RP production in Rungwe District.

1.4.3 Study hypotheses

Table 7: Summary of Data Analyses

Hypotheses	**Independent Variables**	**Dependent Variable**	**Statistic**
HO_1: There is no statistically significant relationship between respondents' socio-economic factors and commercialization of RP production.	Respondents' age, level of education, respondents' income, market, acreage cultivated, other activities, labour cost, land ownership,	Commercialization of RP production.	Multiple linear regression
HO_2: There is no statistically significant relationship between respondents' perception and commercialization of RP production.	Respondents' perception about commercialization of RP production	Commercialization of RP production.	Likert scale and Chi-square
HO_3: There is no statistically significant relationship between Biological factors and commercialization of RP production.	Biological factors influencing commercialization of RP production	Commercialization of RP production.	Licket scale and Chi-square
HO_4: There is no statistically significant relationship between Environmental factors and commercialization of RP production.	Environmental factors influencing commercialization of RP production	Commercialization of RP production.	Licket scale and Chi-square

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview

This chapter presents a literature review on how socio-economic factors of small holder farmers influence commercialization of RP production. The chapter tries to highlight smallholders' perceptions toward commercialization of RP production. The Chapter also reviews the effects of biological and environmental factors on commercialization of RP production. The Chapter shows how theoretical frame-work informs and relates to the study in question; it also shows how it is useful to apply the available variables to bring about a meaningful research concept.

2.2 SES of Smallholder Farmers

The socio-economic factors (marital status, house hold size, education level, land size etc.) influence the ability of smallholder farmers to access and use available resources. Such access and use would vary with location, time, and individual characteristics (Fisher, 2010).

2.2.1 Marital status

Marital status is said to positively influence farm practices, such as the use of proper crop spacing, the use of agricultural input, timely weeding, and the like (World Bank, 2010). Marital status has a positive implication on social organization and economic activities such as agriculture and resource management. This implies that married couples are more productive than single household heads due to the fact that the former have access to labour supply and other productive resources in the farm activities (Mende *et al*., 2014). In another study at Ahmadu Bello University, Samaru-Zaria, Nigeria, Voh *et al*. (2010)

revealed that a married farmer is more likely to adopt improved agricultural technologies as he/she needs to feed more mouths. This finding contradicts the one in a study by Kilima *et al*. (2010) in Central Regions of Tanzania who indicated that married household heads had significantly less area of maize under improved technologies than single household heads. Kilima *et al*. (2010) study found further that being a married household head reduced the probability of adopting improved technologies. The current study assumed that marital status influenced commercialization of RP production in Rungwe District.

2.2.2 Age

The age of the household head can have a positive or negative effect on farmers' participation to the market. It is a proxy measure of experience and accessibility to resources. It is more probable for older and more experienced heads to take better production decisions and have greater contacts which allow trading opportunities to be discovered at lower cost than is the case with younger ones (Enete and Igbokwe, 2009). On the other hand, it is more probable for younger heads to be more dynamic with regards to the adoption of innovations which would enhance their productivity and marketing at a reduced cost (Enete and Igbokwe, 2009).

Middle age is the age at which smallholder farmers are still energetic to actively be involved in production activities (Lupilya, 2010). Age is also reported to influence round potato production since activities associated with its production are labour intensive hence they require energetic people (Lupilya, 2010). Young people are perceived to be less conservative to changes than their elder counterparts and therefore the former are more likely to participate in commercialization of agricultural production. However, the level of participation tend to increase with the optimum age group after which participation starts

to decline with an increase in age (Aina, 2010). The current study looked for information that could justify whether or not age affected commercialization in the study area.

2.2.3 Sex

Sex is one of the components of household composition that determines the nature of work carried out by farmers as sex influences the social positioning of households within the society and their access to resources (FAO, 2010). Given the historical and cultural background, most of the female headed households have limited access to resources because either inheritance or institutional frame-work exclude them from development projects or decision making bodies (FAO, 2010).

Low participation of women limits their capacity to acquire technology and sustain their land resources. Also, the rate of women's of participation in business activities may vary because of gender role expectations and family dynamics in various countries (Henry *et al*., 2010). Similarly, according to the report by the Food and Agriculture Organization of the United Nations (FAO) (2010) agriculture underperforms because half of all farmers are women who lack equal access to the resources and opportunities that can enable them to be more productive. Also, limited access and rights to land by women is a significant barrier to increasing agricultural growth and expansion of the supply of staple food and crops of high market value for commercialization (Kinabo, 2014).

Women make an essential contribution to agricultural commercialization and rural livelihoods; however, their access to productive resources such as land and capital is often constrained (Ibnouf, 2011). In Africa, women also tend to control the income derived from semi-subsistence crops (Njuki *et al.*, 2011). Therefore, gender relations or the nature of gender divisions is complex and depends on the specific socio-cultural context. Generally,

gender relations are dynamic and can change as a response to agricultural commercialization and innovation (Ibnouf, 2011). Commercialization is sometimes associated with the adoption of new technologies which may further reduce the role of women (FAO, 2010). Therefore, the current study was done to find out if sex may have any influence on the commercialization of RP production.

2.2.4 Labour cost

A study by Doss (2009) in Washington, DC found that the bottlenecks of labour cost were common during the planting and harvesting seasons. Households with access to large sizes of household labour or those with the ability to mobilize non-family labour have an advantage over those without these factors. Farmers' access to off-farm labour, especially during critical periods influences both the adoption of technology and the level of production. Hired labour is paid in cash or in kind. Hired labour typically performs the most tedious tasks and the most easily supervised, including soil tillage, weeding, and harvesting. Thus, smallholders spend relatively large amounts in cash or in kind, hiring labourers (Renger-Metzger and Diehl, 2009). However, the quality of hired labour is lower than that of family labour and therefore, hired labour requires supervision and monitoring which are costly. In Zimbabwe, few smallholder farmers appear to hire labour due to expense (Rohrbach, 2009). Similarly, a study by Martey *et al.* (2012) at the University of Ghana, Legon Accra, found that family labour costs rose because of increasing off-farm employment opportunities while positive shifts in the market demand were triggered by urbanization and /or trade liberalization. Therefore, the current study tried to find out if labour cost had some influence on the commercialization of RP production in the District.

2.2.5 Household size

Household size has an implication on family labour availability because large households are considered to be an asset, particularly in the provision of labour on which the local

economy depends (Mwakaje, 2010). However, family labour is an asset only where almost all of the household members take part in production activities or service provision (Mwakaje, 2010). Household composition is also one of the socio-economic factors that influence the livelihoods of smallholder farmers. A study by Aydin (2010) in Turkey showed that the household composition (size, age, gender) puts the limits of determining the nature of work carried out by farmers. The total number of adults in the household that assists on the farm serves as a family labour supply for production activities; and in such a situation, family labour impacts positively on market participation (Olwande, 2010). It is argued that family labour sustains continuous development especially in the intensive agricultural systems because as the household size increases so is land productivity which finally exceeds subsistence requirements. This trend tends to lead to an increase in market surplus. However, the total number of adults may increase the household size thus demanding greater food intakes which might reduce market participation (Olwande, 2010). On average, the household size in Rungwe District is 4.1 (URT, 2012). Therefore, the current study assessed if household size in the study area influenced commercialization of RP production.

2.2.6 Education level

Education is expected to exert a positive effect on commercialization as an important human capital that enables farmers to participate in a range of activities (Enete and Igbokwe, 2009). It is urged that households with good education are endowed with better production and managerial skills. Education enables an individual to make independent choices and to act on the basis of the decision as well as increase the tendency of co-operating with other people and participating in group activities. Education can also increase the chances of the household head of earning non-form income. This can reduce the household's dependency on agriculture and thus influence commercialization of RP production (Enete and Igbokwe, 2009).

Education raises awareness and develops smallholders' understanding of the values and potentials of various technological options which are available thus influencing productivity and market access (Enete and Igbokwe, 2009). Education level, also influences the cost of information seeking and negotiating, and hence orientation (Astrat *et al*., 2010). Education level enables smallholders to adopt and use agricultural production technologies from different sources such as agricultural extension agents, publications, and mass media. Educated farmers are more profit-oriented than those with no formal education; as low formal education level can lower farmers' efforts of improving productivity, and hence of becoming vulnerable to poverty (Enete and Igbokwe, 2009). Education level of household is associated with a higher level of crop sales as education is positioned to influence a household understanding of market dynamics and therefore improve decisions about the amount of output sold, inter alia (Makhura *et al*., 2010).

Another study by Aikaeli (2010) in Dar-es-Salaam, Tanzania found that education leads to proficient household management and crucially improves economic performance of the household as a whole. In addition to agricultural activities, household heads with relatively higher education are more likely to have skills and opportunities to successfully diversify into other more lucrative income generating activities. Moreover, the productivity of individuals with higher education who are engaged in agricultural activities is also likely to be higher than that of low educated farmers. This study elicited information from smallholders on whether or not levels of education had some influence on commercialization of RP production in Rungwe District.

2.2.7 Level of income

The level of income of smallholder farmers and the income status determine the purchasing power, the ability of smallholders to meet costs of inputs required in

production, and the kind of technology to be adopted. The level of income on the other hand can affect farmers' choice over certain crop varieties. Poor households are more likely to choose traditional crop varieties because of the associated costs of production. Also, poor farming households are likely to choose varieties that suit them rather than the market. For instance, Smale *et al*. (2010) study in Mexico, Canada found that family's consumption of maize was the most significant factor for the choice of maize crop variety instead of suitability of the variety for market sale or its level of difficulty in producing it.

Mpogole *et al.* (2013) study in Southern Highlands of Tanzania noted that the choice of crop varieties for agricultural production can reflect the subsistence farming practices among smallholder farmers in many developing countries. The main occupation of smallholders in the study area is agriculture; as 49.5% of the respondents reported to depend on RP as their main source of income (Nyunza and Mwakaje, 2012). Hence, the current study focused on farmers' income as a resource that had an influence on commercialization of RP production in Rungwe District.

2.2.8 Land Ownership

Poor households generally lack land, capital and education to respond quickly to technological innovation and agricultural market opportunities (Rahut *et al.*, 2010). Land is the key determinant of commercialization as the land allows the farmers to increase production beyond subsistence needs and can diversify into cash crop production (Rahut *et al*., 2010). However, Rahut *et al.* (2010) study in the Himalayas, India noted that land ownership status of household significantly influenced the extent of crop commercialization in the sense that households that owned land, had lower extent of selling the crop than households that did not own land. Households that do not own land normally engage in markets in order to meet their financial obligations of their land

owners. At any given yield level, a household with lower land per capita has to devote a higher proportion of their land to food production so as to achieve a given level of self-sufficiency and spare just a small land if any for production of higher value crop for market; and this affects commercialization. According to a study by Olwande (2010) at Tegemeo Institute, Kenya, farm size may have indirect positive impacts on market participation by enabling farmers to generate production surplus to overcome credit market thus reducing postharvest losses and stimulating high levels of commercialization.

The issue of land in the study area is a challenge to most of smallholders, especially the poor ones. According to a study by Kinabo (2014) at Sokoine University of Agriculture in Morogoro, Tanzania, the problem of land is invariably leading to conflicts. Recently, this has been causing a lot of unrest in several areas of Tanzania and sometimes leading to serious conflicts and deaths (Kinabo, 2014). When population of a district increases, the area demanded for land automatically increases, but the land size is always the same. This study examined the aspect of land on commercialization of round potato in Rungwe District. Having a small farm land is a common aspect among smallholders in Tanzania.

According to Kinabo (2014) in Tanzania, smallholder farmers have small land sizes ranging from about 0.9 to 3ha. This affects the level of agricultural commercialization in the study area. As observed by Martey *et al*. (2012) in a study at University of Ghana Legon-Accra, Ghana, as farm size increases over a certain minimum level there are diminishing marginal returns which affect the volume of sales by percentage of household selling; implying that farm size influences the level of agricultural commercialization. This indicates that households with larger farm sizes are able to sell larger shares of their production compared to households with smaller farm sizes (Martey *et al*., 2012). Hence this study ascertained if round potato commercialization was affected by sizes of land ownership.

2.2.9 Markets

Market information arrangements guarantee producers with a flow of insights on market requirements and opportunity sets that enable them to plan effectively on the choices of enterprises and resource allocation. It also reduces the cost of searching for suitable prices (Martey, 2012). However, it is expected that smallholder farmers' decision of producing certain crop varieties is based on consumer demands. Nevertheless, (Organization for Economic Cooperation and Development (OECD) (2010) argues that often farmers start planting crops without knowing the market. Producing without knowing the market is contrary to the demand driven production which requires farmers to produce for the market. It is argued that the supply-driven production creates a mismatch between supply and demand. Whereas farmers complain of lack of storage or markets, consumers complain of low supply and /or low quality of commodities they need (OECD, 2010). This affects commercialization for agricultural products. Furthermore, an additional increase in the price of the crop can increase in the amount of crop sold. These findings confirm the assertion from economic theory that output price is an incentive for farm households to supply more produce for sale (Martey *et al.,* 2012). This finding is consistent with the findings in a study by Olwande *et al*. (2010) at Tegemeo Institute, Kenya and those of a study by Omiti *et al*. (2009) in Rural and Peri-urban, Kenya that output price is an incentive for sellers to supply more produce to the market.

Markets in the country pose a challenge to smallholders. However, traders and exporting firms facilitate financing of crops such as rice, but their investment in food crops, such as round potato is low. Poor markets of round potatoes in many African countries are caused by several constraints such as poor transportation and limited market opportunities (Kherallah *et al.,* 2010). Therefore; this study investigated the situation with regard to round potato marketing in Rungwe District to see if it had any influence on commercialization.

2.2.10 Other activities

A study by Mnenwa and Maliti (2010) in Dar-es-Salaam, Tanzania found that the role played by off-farm income is important because agriculture and related activities are generally not paying compared to off-farm activities. This is contributed to high input prices and lack of credit facilities which compel farmers to use lower quantities of purchased inputs in their farms. To cope with this situation, farmers respond by abandoning some crops especially RP and look for more rewarding economic activities (Mashindano and Festo, 2011).

A study by Nyunza and Mwakaje (2012) in Rungwe District, Tanzania, also, found that 49.5% of smallholders in Isongole ward in Rungwe District had RP production as their main source of income. However, 33.3% and 10.5% of maize and cabbages respectively were grown by some of the farmers while others were engaged in off-farm activities such as petty business, casual labour, selling of local brewing, forest products and the like. A study by Mende *at el.* (2014) in Makete and Mbeya Rural Districts, in Tanzania also noted that casual labour, local brewing, petty business, remittances, lumbering and renting out of houses were the main non-agricultural sources of income in RP growing areas. Livestock keeping was also one of the income sources for most of the households who did not deal with RP production. In this kind of context, the current study tried to find out if commercialization of RP production was influenced by other activities.

2.3 Acreage Cultivated

According to Rungwe District Council (2016), fluctuations of RP production based on the total number of acreages cultivated from one period of time to another. For instance, the period between 2010 and 2011years, RP production was 52 800 and 65 500 tons respectively which was an increase of 34.9% under respective production areas of 23 190

and 24 040 hectares. However, in the period of 2011 and 2012 years there was a decrease of about (33%) of RP production from 65 500 tons to 48 900 tons from 23 190 and 24 512 hectares respectively.

In the period between 2012 and 2013 years, the RP production shot up to 68 829 from 48 900 tons, which was an increase of about 28.9% from the respective production areas of 24 512 and 25 450 hectares. However, in the subsequent years of 2013 and 2014, the RP production dropped to about 40.3% from 68 829 to 41 058 tons from the cultivated area of 25 450 to 26 550 hectares respectively. In the year 2015, there was a slight increase to 39528 tons from 27 771 tons in 2013, an increase of 1530 tons, which is equivalent to about 3.7% from the cultivated area of 27 400 hectares. However, this was slightly lower compared to 41 058 tons which were harvested in 2014 from the cultivated area of 26 550 hectares. Fluctuations of RP production were due to low uses of inputs such as fertilizers, improved varieties, fungicides and pesticides because there were expensive to most of smallholder farmers. Therefore, the study investigated if the acreage cultivated was one of the factors influencing commercialization of RP production.

2.4 Smallholder Farmers' Perceptions

A study by Rao and Narayana (1998) defines perception as a process whereby people select, organize, and interpret sensory stimulations into meaningful information that works into their environment. They argue that perception is a single most important determinant of human behaviour and that 'there can be no behaviour without perception.' Similarly, social perception refers to constructing and understanding of the social world from the data we get through our senses (Michener, 2004).

In Tanzania, currently, there is a stigma attached to being a farmer. This stigma affects most of the youth who are employed in subsistence agriculture. The youth learn about

farming from friends and relatives who are also uneducated in the best farming methods. Many youth perceive farming as the work for the poor who have no formal education or skills. Yet, the youth think of the risks in agriculture. The risks cause the youth shun away from undertaking farming activities. The failure to cope with agricultural risks is not only confined to agricultural commercialization but it also affects nutrition, health, and education and contributes to inefficient and unequal intra-household allocations (Dercon, 2010).

According to a study by Mpogole *et al.* (2013) in Southern Highlands of Tanzania about profitability of RP production, most of the SACCOs which are village based and are expected to provide credits to their members are not ready to do so due to risk factors of RP production and slowness of the smallholder farmers to pay back the loan. Also, commercial banks and other microfinance institutions were reluctant to lend loans to smallholder farmers because of the associated risks and of having very poor transactions (Olomi, 2007). Therefore, smallholder farmers too have negative perceptions towards agricultural commercialization as it is risky. Farmers perceive agricultural commercialization as drudgery, capital intensive activity, as the only option, involves the use intensive input and is limited to farm support resource services, farmers' organization and co-operatives (FAO, 2012). Therefore, the current study was carried out to ascertain whether perception had a negative impact on the commercialization of RP production in the study villages.

2.5 Biological Factors

Among the biological factors that influence agricultural production include soil microbes, cultivars, and domesticated animals (Starling, 2010). Although there are biological resources that contribute to the quantity and quality of agricultural production such as soil

microbes, cultivars and the like there are also biological resources which have a direct effect on agriculture. For instance, noxious weed density, diseases and pests and the like can decrease crop profitability and affect commercialization.

Diseases such as viral and bacterial ones have been reported to contribute to the reduction of round potato yields in developed and developing countries. In China, seasonal aphid pressure is high and potato virus and late blight (*Phytophtora infenstans*) are the major factors limiting the yield of RP production (CIP and FAOSTAT, 2010). In the USA, potato crop faces a problem of diseases such as late blight which is caused by fungus like *Oomycete phytophtora infenstans* and *Rhyzoctonia selerotinia*, black leg, powdery mildew, powdery scab and leaf roll virus, there are also insect pests such as potato tuber moths and the green peach aphids (*Mycus persicae*). CIP and FAOSTAT (2010) revealed that in the Russian Federation and Ukraine, pests and diseases were a major problem and that as much as four million tons were lost annually to late blight, viruses, and Colorado beetle.

Also in Africa particularly in Egypt, viruses, soil-borne disease, and bacterial wilt are the major constraints to potato production (Hegazy, 2009). All these contribute to lowering the RP production and thereby negatively affecting commercialization. In Kenya, FAOSTAT (2013) study reported that RP production constraints were diseases, with bacterial wilt being the most prominent. For instance, a potato cyst nematode (*Globodera restochiensis*) is becoming a major problem. No biological or pesticide that is known to control the pest. The only way is to stop production on infested farms for up to seven years (FAOSTAT, 2010). This study too assessed the influence of diseases and pests to the commercialization of round potato production.

Soils that have poor fertility appear not to be potentially productive for agricultural production unless they are improved through the application of fertilizer. A study by Kamnizzaman and Takeya (2008) in rural Bangladesh noted that agricultural production technologies specifically chemical fertilizers, the selection of seeds or high yielding varieties, irrigation, and soil quality enhanced crop production and productivity of the land. In another study, Vein and Botiono (2008) in Tigray Region, Northern Ethiopia, Khartoum also, argued that the entry point for crop intensification is the use of organic and inorganic fertilizers because if soil fertility is not improved, the use of other technologies such as high yielding varieties will not have a significant impact. Therefore, since smallholder farmers complained about poor soil fertility, it is possible that RP production was affected following the failure of applying the right quantities of fertilizers. The current study assessed whether the RP production without fertilizers caused a negative effect to commercialization of RP production.

Normally, the status of improved and local varieties is determined by doing researches. For instance, one among many researches which were done based on different trials include that by Mekomen *et al.* (2011) study in Southern Ethiopia who did three trials with different levels of late blight resistance. In their trials, they found improved varieties showing higher yields without spraying fungicides. This indicates the economic opportunities of improved varieties. A study by FAO (2010) also, noted that the improved varieties had 10 ton/ha higher yield without spraying compared to the local varieties with 5 times spraying. FAO (2010) study observed that the use of local varieties with poor quality and low adaptability to marginal environments would reduce production and become less sustainable and competitive. In this respect, the current study was done to know if local varieties were not profitable for commercialization purposes in the study area.

Studies have shown that round potato produces remarkable quantities of calories comparable to cereals and that it is more profitable than other food crops (CIP, 2010; FAOSTAT, 2010). The crop serves both as food and income to the rural population. There are different varieties with varying characteristics such as dry matter content, taste, and high yield response to inputs and tolerance to diseases. The variations in round potato varieties indicate that there could be different markets for each variety and hence different profitability (FAOSTAT, 2010). Hence, smallholders' farmers have to produce varieties in accordance with the market preferences in order to win the market price (Mpogole, 2013).

Commercialization of RP production has been identified as a variable strategy for up scaling the income and living standards of rural population (Haule *et al.,* 2010; Hemachandra and Kodithuwakku, 2010). This strategy depends on the commercial oriented farmers taking advantage of the market conditions based on crop varieties of high market prices and time of sale to obtain price advantages and the form or varieties on which the product should be sold (Hemachandra and Kodithuwakku, 2010). Availability of seed tubers and market demands are the main criteria in the variety selection for round potato growing. Seed tubers create a challenge because all the year round moist soil makes the storage of the tubers for the next season to be difficult. Hence, the majority of smallholders have to purchase the seed tubers from some distant villages. Since, such tubers are not readily available; the yields are affected thus impeding commercialization (Mpogole, 2013). Typically, smallholders produce more than one variety at the same time but in different plots because of the difficulty in obtaining enough tubers of one preferred variety (Mpogole, 2013).

However, at the household level, there are certain variables such as aversion to risk and uncertainty, experience in farming, gender resource endowments, and intra-household

interaction that affect the choice of a variety. Such factors influence the cost of information seeking, negotiating, monitoring and enforcement and hence the variety choice and use (Kilima, 2010). A study by Williford and Zimba (2010) at Cambridge University, London, UK revealed that, in combination with chemical fertilizers, improved varieties/seeds are critical agricultural inputs that help farmers to obtain improved agricultural yields and increase productivity. The value of crops is improved through the genetic manipulation of selective breeding. However, the formal sector that supplies improved seeds should fulfil certain quality standards which are set by the national regulations (Bishaw *et al.,* 2012). Seeds that fulfil the quality requirements have a positive impact on the productivity of land. For instance, a study by Li *et al.* (2010) at Connecticut University, United States found that 30% of the growth rate of agricultural production was due to new varieties. The failure of smallholder farmers of using improved varieties/seeds of RP contributed to negative influence on commercialization of RP production. The current study assessed whether round potato varieties influenced commercialization of RP production.

A rich soil in plant food is a chief requirement of successful agriculture. It is essential as a support for plants as the main medium whereby water and all plant foods, except carbon dioxide, are brought to the roots of the plants where they are absorbed (de Janvry, 2010). Soils that are poor, either chemically or in texture, have low productivity both in amount and variety. Feeding the world's growing population is a serious challenge. Food insecurity is concentrated in developing nations where drought and low soil fertility are primary constraints to food production. Many crops in developing countries are supported by weathered soils in which nutrient deficiencies and ion toxicities are common. Many systems have declining soil fertility to inadequate use of fertility inputs, ongoing soil degradation and increasingly intense resource use by burgeoning population (de janvry,

2010). In Rungwe District, soils are volcanic in nature but poor in fertility, and need fertilizers to improve its status. This study, therefore, assessed smallholder farmers' opinions on soil fertility to see if they (farmers' opinions on soil fertility) influenced commercialization of RP production in Rungwe District.

2.6 Environmental Factors

Environmental factors influence agricultural production and so is the income of smallholder farmers. Environmental factors include: rainfall, temperature and frost. Kintomo *et al.* (2008) in a study in Ibadan and Lagos, South Western Nigeria revealed that low temperatures and the intensive land use by smallholders are some of the causes of the reduction in agricultural productivity and environmental quality.

Based on climatic condition of the study area, temperature is a limiting factor to RP production. This is attributed to the fact that low temperature affects the crop leading it to its death. In Rungwe District, low temperature, which is accompanied by fog and mist, is a threat to RP production especially during April and July (Mboya *et al.,* 2010). Similarly, Patsalos (2010) in Nicosia, Cyprus found that potato plant and other related crops are sensitive to very low temperatures. Therefore, the current study was done to find out if low temperatures contributed to negative influence on commercialization of RP production.

Potato plant is sensitive to very low temperatures especially at temperature of 3^0C as is the case in some parts of Southern Highlands of Tanzania such as Rungwe District, where temperatures range from 18 to 25^0C. As with all other highland areas in Rungwe District, temperatures may drop to a minimum range of 3^0C to 10^0 Ceven to minus 2^0C during the cold season. Fog and mist are also common (Mboya *et al.,* 2010). Serious damage of RP is caused by foliage and at temperatures below minus 2^0C causing the plants to entirely

freeze and die (Patsalos, 2010). This affects plant growth in the study area. However, ground frost occurs when the temperature of the ground falls below the freezing point (0^oC) and air frost occurs when temperature of the air falls below freezing points and many plants are damaged by frost (Patsalos, 2010).

The crops prone to frost damage include tomatoes, and round potatoes which suffer from leaf scorch, browning and even total plant death. The foliage of round potato plants which exhibit early symptoms of frost damage appear water-soaked and dark-green changing to black with time (Patsalos, 2010). These cause low supply leading to low prices. This study also assessed if frost in Rungwe District had an influence on commercialization of RP production.

Rungwe District is characterized by rainfall throughout the year ranging from an average of 900 mm in the low land zone to 3300 mm in the highland zone (URT, 2010). Heavy rainfall is reported to cause late blight disease through water mould *Phytopthora infenstans* which is a destructive disease of round potato and whose pathogen favours wet weather with moderate temperature (1.9^0C to 2.5^0C). Under high humidity and heavy rainfall, the disease can spread extremely rapidly and has the potential of defoliating fields completely within 3 weeks of the first visible infections if no control measures are taken (William *et al*., 2013). Round potatoes develop lesions which look watery soaked and expand rapidly. This condition is more damaging in round potato growing areas of the study area due to its wet climatic condition. In Poland, the major challenge in round potato production is heavy rainfall that leads to damaging floods (FAOSTAT, 2013). This study assessed if heavy rainfall in Rungwe District-the study area influenced commercialization of RP production.

2.7 Theories Informing the Study

A theory can be defined as a set of interrelated constructs or variables, definitions and prepositions that present a systemic view of phenomena by specifying relationships among variables, with the purpose of explaining natural phenomena (Creswell *et al.*, 2010). The study is based on different theoretical perspectives of smallholder farmers' production and sociological theories namely, theory of profit maximization, the new institutional economics theory and structural functionalism theory. Common theories of smallholder production generally fall under profit and utility. They have much in common in the starting point, approach, and logical method and sharing of certain key assumptions, meaning that they are variations on a single theme for instance where income is the only variable in the utility function, then profit maximization and utility maximization coincide (Poole and de Freece, 2010). In this study, profit maximization and utility maximization for a smallholder farmer were assumed to mean the same thing. However, lack of market information among farmers make them vulnerable and therefore lose their bargaining power against the middlemen and traders (Poole and de Frece, 2010).

2.7.1 Theory of profit maximization

Economic theory of profit maximization considers a firm as a transformation unit which converts into output (Penson *et al.*, 2010). In the process of such conversion, the firm tries to create a surplus value, called a profit. This implies that RP production business can be considered as a firm which is expected to give the total production or output through which a profit can be obtained after some processes have occurred. In other words, this is a business transaction which is expected to be done in the commercialization of RP production. According to Parkin (2010), the major objective of the firm is profit maximization. In the view of the author, while individual firms and entrepreneurs that run them can have many different objectives such as quality, product, growth, market share, and employee job satisfaction, all such objectives are only a means of fundamental and

perhaps a deeper objective of profit maximization. In this respect, the theory emphasizes that in commercialization of RP production as a firm, while focusing at maximizing the profit the great concern should be on improving RP quality, expanding the area of production, looking for a better market and considering the incentives to smallholder farmers as the major objective of RP production.

Profit maximization is considered as a rational behaviour of equilibrium assumption where marginal revenue is equated to marginal cost (Anderson and Ross, 2011). A firm which aims at maximizing profit will go on increasing its output till it reaches a maximum profit. Profit is the difference between total revenue and total cost (Penson *et al*., 2010). The bigger the difference between total revenue and total cost the bigger the profit. Therefore, profit is maximized when there is a maximum difference between total revenue and total cost (Penson *et al.,* 2010). The theory is therefore, stressing on the importance of realizing the profit as an important objective in any business; that, it is a synergy that stimulates the firm to produce more for the essence of maximizing the profit. In RP production, smallholders need to produce more in order to achieve commercial success in terms of a desired profit, which reflects a positive commercialization.

2.7.2 The new institutional economic theory

The new institutional economic theory states that, smallholder farmers' associations are diverse types of groups that act actively in order to benefit either as individuals or as a group (Poole and de Frece, 2010). This kind of association may be formal shared ownership or an informal set of social and business connections between farmers and traders. Poole and de Frece (2010) in their study in the East and Southern Africa, ACP Region revealed that the historic development has proceeded most frequently where economic activity has been supported by an institutional frame-work of incentives. Due to

lack of institutional development in developing countries, their economic development remains poor. Markets in developing countries are often characterized by weak institutional environment, which implies high transaction costs, significant business risks, weak information flow, and poor infrastructure (Valentinov and Baum, 2011). Following this situation, organizations such as co-operatives and associations are considered important in addressing market failures among smallholder farmers in rural areas like Rungwe District. Moreover, the ongoing debate on institutional and organizational interventions is strongly required to help smallholder farmers have access to inputs markets to increase RP production and improve RP commercialization in the study villages.

2.7.3 Structural functionalism theory

The structural functional theory sees the family as a social institution that performs certain essential functions of a society (Talcott, 2013). If these functions are not carried out, the family is said to be dysfunctional. The family is like our body that has different parts and each part has a different functions. Meaning that, the family is the backbone of a society and if it fails to pass on certain values and attitudes to its members then the society will be affected (Talcott, 2013). The theory further states that, each family performs four main functions namely, sex, procreation, economic, and socialization (Talcott, 2013). The members in a typically nucleus family are interdependent, and every one depends on each other for the proper functioning of the system; and with the structural-functionalism perspective, if one part or a person is not doing his or her part then, the family is said to be dysfunctional. From the functionalist point of view, the institution of the family helps meet the needs of its members and contributes to the stability of the society at large (Talcott, 2013). The functionalists attempt to explain the nature of social order, the relationship between the various parts (structures) in a society and their contribution to the stability of

the society by examining the functionality of each to determine how it contributes to the stability of the society as a whole (Talcott, 2013).

Commercialization of RP production in this case is exemplified as an output through which its stability is based on different factors of production as parts; and these include markets, producer prices, labour availability, input costs, farming costs, land costs, transport, road infrastructure and many others. In so doing, commercialization of RP production as an agricultural enterprise depends on a number of different agricultural factors of production as factors which are interdependent. Every factor depends on each other for stabilizing the commercialization process. On the other hand, to commercialize agriculture the underlying factors of production have to be effectively applied. The failure of one of these to offer its essential contribution is the dysfunctional of the whole system of commercialization of RP production.

2.8 The Conceptual Framework

The conceptual frame-work of this study looked at the potential and limitations of smallholders' socio-economic factors, smallholders' perception about commercialization, and biological and environmental factors that influenced commercialization of RP production. Basically these factors were taking place under the Tanzanian socio-economic context from which demographic characteristics created a larger picture about each respondent and the household in which the respondents lived. This reflected the real situation on how under this circumstance socio-economic factors influenced commercialization of RP production. Politically, the issue of adopting agricultural commercialization in the country originated from the government strategy that led to policy formulation of commercialization (URT, 2010).

However, from the cultural point of view, perceptions were the determining factor based on smallholders' behaviour through which they interpreted their sensory simulations into meaningful information that worked into their environment (Rao and Narayana, 1998). Environmentally, under Tanzanian surroundings or conditions in which a person, animal or plant lives or operates provided a room for commercialization of RP production to take place and therefore had an influence on it (Rao and Narayana, 1998).

The conceptual framework is comprehensive and specific in its identification of variables, particularly with respect to the manner in which characteristics of variables affected commercialization (Sabatier *et al*., 1980). It also, attempts to capture the dynamic nature of influence by focusing on the manner in which changes in socio-economic conditions, smallholders' perception, biological, and environmental factors affected commercialization of RP production. Ideally, it identifies the problem to be addressed, stipulates the objectives to be pursued in a variety of ways. The entire framework is presented in a very skeletal form distinguishing the two categories of independent variables constituting a dependent variable (Sabatier and Mazmanian, 1986) (Fig. 1).

The conceptual-frame work was based on the assumption that factors affecting commercialization of RP production under the prevailing context were influenced by a number of independent variables which were: Respondents' socio-economic factors, respondents' perception about commercialization of RP production, biological and environment factors (Fig. 1).

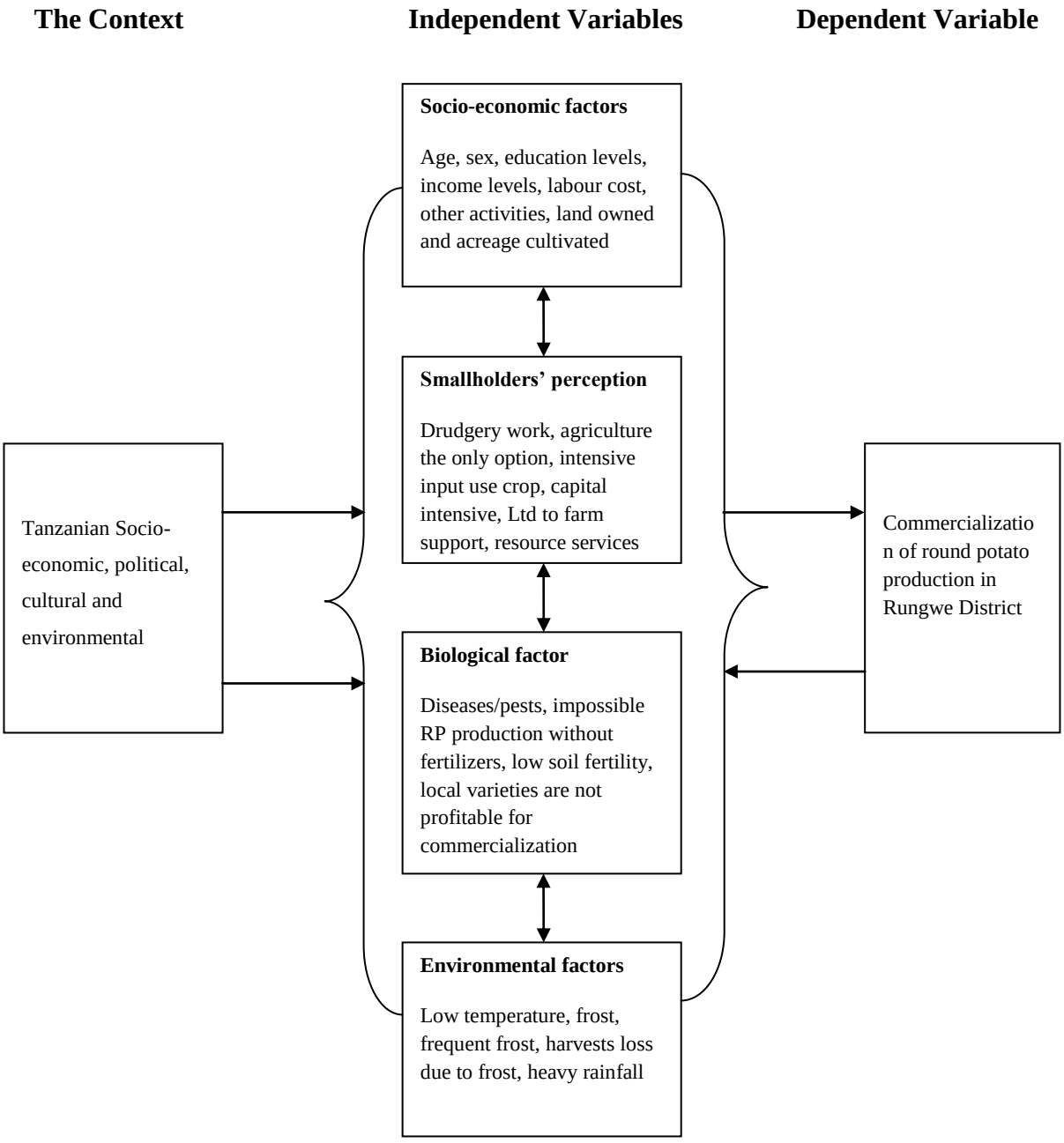

Figure 1: Conceptual framework of factors influencing commercialization of RP production in Rungwe District, Mbeya region

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Overview

This chapter presents materials and procedures of data collection and analysis. The first part presents the location and description of the study area, while part two explains the research designs and sampling procedures. This part is followed by data collection methods and finally data analysis procedures.

3.2 Location

Rungwe District is found in Mbeya region, South west Tanzania. The district is located at latitude 9^0 15’ 00’’ South of the Equator and longitude 33^0 40’ 00’’ E of Tanzania. Rungwe District is one of the 8 districts of Mbeya region in Tanzania. It shares borders with Mbeya Rural District to the North, Iringa Region to the East, Kyela District to the South, Ileje District to the Southeast and Mbeya Urban District to the West. Rungwe District covers a total area of 2211 km^2 of which 1 668 km^2 (75%) is arable land which is used for agriculture. The remaining land is covered by forest covering 44.5 km^2, and mountains and residential areas covering 498.3 km^2 (URT, 2010).

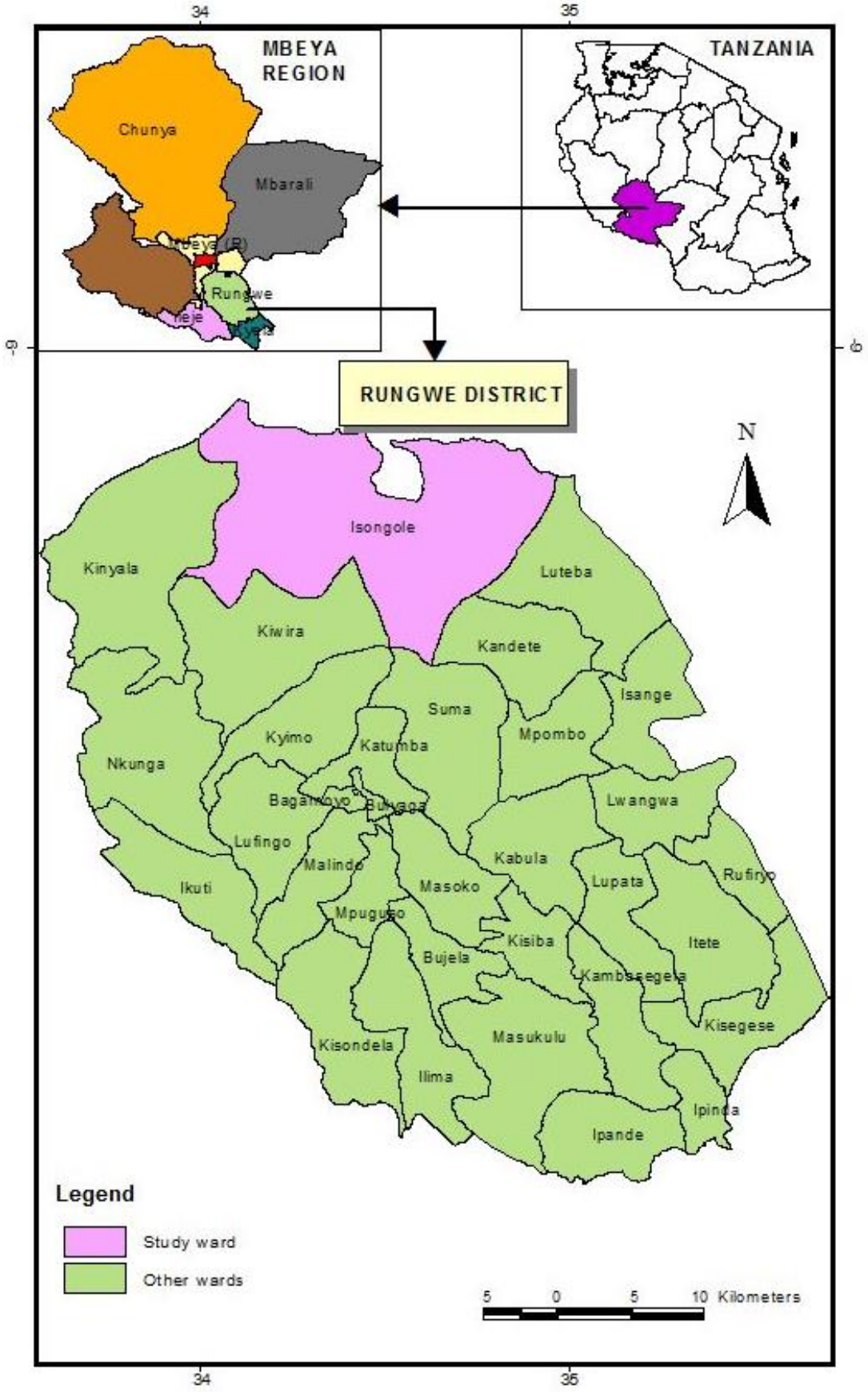

Figure 2: A map of Rungwe District showing Isongole Ward study area

The average rainfall ranges from approximately 980 mm in the low land to 3300 mm in the highland zone. Rungwe District is located between 770 and 2865 metres above the sea level. The District is divided into three agro-ecological zones namely, the upper, the middle, and the 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 meters above the sea level. Generally, the highlands zone is cold throughout the year with the average rainfall ranging from 1500 mm to 2700 mm per annum. The main crops grown include round potatoes, maize, and pyrethrum (URT, 2012).

Rungwe District is administratively divided into 4 divisions, 30 Wards and 162 villages. The District has a population of 339 157 (Mbeya Region Secretariat, 2013). Isongole/Ndanto ward has a population of 14 284 comprising mainly of two tribes namely Wanyakyusa who are at the Southern part and Wasafwa at the Northern part of the Ward, the rest of the population are immigrants from neighbouring regions of Njombe and Iringa (URT, 2012). Isongole is the ward that produces round potato crop in Rungwe, and the Ward was chosen in this study based on this unique characteristic of growing RP.

3.3 Research Design

A cross-sectional research design was used in this area. According to Babbie (2013), the design is suitable for determining the relationships between variables. It allows collecting data at a single point at a time; thus using minimum time and other resources (Kumar, 2011). Cross-sectional design constituted the collection of data from smallholder farmers dealing with RP production in Isongole Ward. Purposive sampling design was used to identify respondents at Isongole Ward, which is the area of study.

Simple random sampling was carried out to capture respondents for the interviews from all villages in Isongole Ward. Isongole Ward has four villages namely, Ntokela, Ndaga, Goye and Nzunda. All these villages deal with RP production and therefore, the simple random sampling was carried out to cover these villages.

3.4 Sampling Strategy and Sample Size

According to population census URT (2012), Isongole Ward had a population of 14 284 people and the average household (HH) size of 4.1. This population was a combination of aged people, babies, young people and handicapped men and women. People from these groups based on their physical status, were not capable of getting involved in RP production. To find out household heads that were responsible for RP production, the population of Isongole Ward, which is 14 284, had to be divided by the average HH size which is 4.1. Therefore: 14 284/4.1 equals to 3484.9, which is the number of HH heads of Isongole Ward.

To find the sample size, Yamane's (1967) formula was employed and the number of HH heads of the Ward was computed in the formula as follows: sample size $n = N/1+N (e^2)$ where N =All HH heads growing round potatoes, e = the level of precision (0.05) assuming 95% is the confidence level. Thus, the sample size was obtained as $n = 3484.9/1+3484.9 (0.05)^2 = 400$ HH heads. The study aimed at having 400 respondents as the sample size. Therefore, 400 HH heads were the selected sample for the interview.

3.5 Data Collection

Both quantitative and qualitative data were collected. The quantitative data were obtained through the main survey while the qualitative data were obtained through focus group discussion (FGDs), key informant interview and observation.

3.6 Primary Data Collection

3.6.1 Data collection instruments, validating and pre-testing of the semi-structured questionnaire

Primary data collection was achieved using researcher's checklists, which were used to collect data from focus group discussions (FGDs) and from key informants (KIs). Yet, a

diary was used to collect field notes, and semi-structured questionnaires were used to collect quantitative data collection from the respondents. Validity, which refers to how well an instrument measures what it is intended to measure, was achieved in two ways. First, the validity of the semi-structured questionnaire was achieved by first giving the prepared questionnaire to the two thesis supervisors. Second, the then ready questionnaire was given to experts in the Department of Agricultural Extension and Community Development at Sokoine University of Agriculture to read it and check the logical flow of the questions as per study objectives.

To test the reliability of the semi-structured questionnaire, 20 purposively selected smallholder farmers in two villages of Unyamwanga and Uporoto (ten respondents from each village) were involved of which ten were females and ten were males. Reliability is the degree to which an assessment tool produces stable and consistent results. In this study, this was done to ascertain the semi-structured questionnaire's stability and consistency. The collected data from this exercise was coded and entered in the SPSS and using the spilt-half reliability analysis the Spearman-Brown formula yields the reliability coefficient, which are expressed as Cronbach alpha correlation coefficients. In this case, pre-testing produced a reliability coefficient Cronbach alpha of 0.78, which according to Radhakrishna *et al.* (2013), a semi-structure questionnaire with a correlation coefficient of Cronbach alpha 0.7 and above is considered ideal and reliable.

3.6.2 Quantitative data collection

Data collection through survey

The researcher collected data from the smallholder farmers in the study area using structured questionnaires. The questionnaires were appropriate because they were cost-

effective, less time consuming and collected much information in a relatively short period of time.

3.6.3 Qualitative data collection

The study employed multiple qualitative methods of data collection. The methods included participant observation, key informants interviews, and focus group discussions using checklists.

3.6.3.1 Key informants interview (KIs)

The key informants involved in this study were 12 namely, District Agricultural Irrigation and Co-operative Officer (DAICO), District agricultural extension officer (DEO), one agricultural extension agent, four Village Executive Officers (VEO) from their respective villages, Ward Executive Officer (WEO) and four village chair persons. These KIs were purposively selected based on their status related to RP production in the study area. These KIs were interviewed using questions from a checklist; one KI at a time so as to collect useful information related to the real situation regarding RP production in the study area.

DAICO was selected based on his position in terms of supervising agricultural extension services in the district as he/she is well informed about agricultural production let alone RP production and their challenges. DEO is responsible for agricultural extension services in the District and was selected based on his duties. Agricultural extension agent was selected based on his duty performed in that ward; in that he is the responsible officer for technical knowhow of agricultural activities taking place in the RP growing areas. WEO is the government Administrative Officer of the Ward who supervises the economic development activities which are the sources of income of smallholders in the study area.

Village chair persons were selected based on their status as political leaders who help in sensitizing smallholder farmers into participating in RP production for economic growth.

3.6.3.2 Direct observation

According to Chaleunvong (2009), observation is a technique that involves a systematic selecting, watching, and recording behaviour and characteristics of living things, objects and phenomena for complementing respondents' responses. In this study, the researcher took the role of being a participant observer who observed various activities undertaken in the study area. A good thing about using participant observation method is that the information obtained under this method relates to what is currently happening.

3.6.3.3 Focus group discussions (FGDs)

In this study, 24 participants were involved in the focus group discussion and a special meeting for discussion was organized at the Ward office. The respondents were influential farmers. The selection was done purposively with the assistance from Ward Executive Officer (WEO). These respondents were asked to provide details regarding RP production. Influential farmers were selected based on their experiences regarding RP production in the study area. Therefore, with these qualifications, people who were selected were expected to provide useful information for the study purposes.

3.7 Secondary Data Collection

Secondary data were gathered from the District office and the data involved RP yield per hectare, availability of market for RP, access of inputs, extension services and acreage of RP farms. Other sources of secondary data included published and none-published studies and web surfing which were mainly done at Sokoine National Agricultural Library to provide information regarding commercialization of RP production.

3.8 Data Analysis

3.8.1 Qualitative data analysis

Based on Grounded theory as a general strategy of qualitative data analysis (Glaser and Strauss, 2010) the method was used in this study for the analysis of data from KIs, FGDs and direct observation.

On the case of direct observation, the observer was one namely, the researcher. The analysis was centred in finding out how respondents' socio-economic factors, respondents' perception, biological and environmental factors contributed to influencing commercialization. Discussions were sorted out, summarized and analysed based on the pre-determined themes, categories and patterns from where data have been originated.

3.8.2 Quantitative data analysis

The data collected in the household interviews were coded, entered, and cross-checked for accuracy, verified and analysed using Statistical Package for Social Sciences (SPSS) Computer programme (Field, 2000). This was used to yield descriptive statistics namely, frequencies and percentages for assessing farmers' perceptions about commercialization, assessing biological and determining environmental factors.

Chi-square statistical test was used to measure the strength of associations of smallholder farmers' perception; biological and environmental factors as well as testing hypothesis of variables formulated for the study and compared the influence on RP commercialization. Multiple Linear regression technique was employed to determine socio-economic factors influencing commercialization of RP production. Also, it measured the strength of associations of variables as well as testing hypothesis of variables and compared the influence on RP production.

The linear multiple regression model was preferred due to its nature of predictor (dependent or explanatory variables) to forecast effects or impacts of changes. That is to understand how much the commercialization of RP production (dependent variable) will change when we change one or more independent variables. The predictor variables were estimated using SPSS software and the dependent variable was the amount of kilograms of RP sold which was continuous.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Overview

This chapter presents and discusses study findings in four main sections which are also subdivided into subsections. The main sections are as follows: Respondents' socio-economic factors influencing commercialization of RP production; respondents' perception about commercialization of RP production; biological factors influencing commercialization of RP production; and environmental factors influencing commercialization of RP production.

4.1.1 Socio-economic factors influencing commercialization of RP production

Respondents' characteristics

The age of a farmer is an important characteristic in agricultural production because it involves physical strength in doing field operations. Moreover, the performance of economic activities such as commercialization of RP production in the study villages was carried out by most of the respondents who were old (40 to 52). For example, of all the respondents, 35.8% were aged from 40 years and above implying that these individuals could not effectively spearhead commercialization of RP production in the District (Table 8). One FGD participant reported that:

> *RP production activities are labour intensive and do not match with our ages because most of us are old and we cannot carry out RP activities more effectively* (FGDs, Nzunda village, 10/5/2015).

Lupilya (2010) in Bukoba, Tanzania found that the middle aged (35-45 years) were still energetic and actively involved in farming activities. Hence, the study findings suggest that a large percentage of smallholders were old therefore not capable of copping with

commercialization of RP production in the District. Thus, the age of the respondents was statistically significant at $p \leq 0.04$.

Sex of the respondents was a demographic characteristic which played a big role in the commercialization of RP production. The study findings show most (60.5%) of the respondents who were engaged in RP production in the District were women and only 39.5% were men (Table 8). One KI participant reported that:

> *Since RP production activities are mostly done by women their participation is in jeopardy due to having other responsibilities that make them fail to devote more time to RP production activities* (DAICO, Rungwe District, 15/5/2015).

Another KI participant said that:

> *Women respondents take care of families, cook food, rear babies, among many other things (*VEO, Ntokela village, 16/5/2015).

FAO (2011) found that sex is one of the components of household composition that determines the nature of work carried out by farmers; this is because sex influences the social positioning of household within the society and hence their success. A study by Henry *et al.* (2010) in rural Ethiopia also, found that the rate of women's participation in business activities varied because of gender role expectations and family dynamics in various countries. Also, given the historical and cultural backgrounds, most of the female headed households have limited access to resources based on either inheritance or institutional framework that excludes them from development projects or decision making bodies (FAO, 2011). In another study, Kinabo (2014) at Sokoine University of Agriculture, Morogoro, Tanzania found that limited access and rights to land by women is a significant barrier to increasing agricultural growth and expanding the supply of staple food and crops of high market value for commercialization. However, women whose access to productive resources, such as land and capital is often constrained to make an

essential contribution to agricultural commercialization and rural livelihoods; (Ibnouf, 2011). In the current study, sex was not statistically significant at $p \leq 0.54$ (Table 8).

The study findings show that married couples accounted for 87.5%, and singles were 12.5% of all the respondents suggesting that the later influenced commercialization of RP production (Table 8). As Mende *et al.* (2014) in their study in Mbeya Rural and Makete Districts, Tanzania shows, married couples were more productive than single household heads due to labour supply in the farm activities and access to productive resources endowed with the former. In another study, Voh *et al*. (2010) in Ahmadu Bello University, Nigeria observed that a married farmer is more likely to adopt improved agricultural technologies as he/she needs to feed more mouths. However, this observation is in contrast with what Kilima *et al*. (2010) study in Central Regions of Tanzania found out that married household heads had significantly less area of cultivation under improved technologies than single household heads. In the same study Kilima *et al*. (2010) found out further that married household heads reduced the probability of adopting improved technologies.

Education in the study villages played insignificant role in the commercialization of RP production due to low participation of educated respondents about 35.5% of all the respondents reported to have had no any formal education while 47.5% indicated to have attended non-formal education classes. Others, 12.5% reported to have had attained primary education and few, 5.0% had completed secondary school. One KI participant reported that:

> *Respondents with formal education were few. This necessitated low RP production in the study areas* (DEO, Rungwe District, 15/5/2015).

Another KI participant had this to say:

RP production activities are carried out as a routine activity and not as a business venture meaning that most of the respondents do not consider applying improved knowledge and improving RP production(DAICO, Rungwe District, 11/5/2015).

Table 8: Characteristics of the respondents (n=400)

Variable	n = 400(100%)	p – value
Sex		0.54
Male	158(39.5%)	
Female	242(60.5%)	
Marital status		-
Single	50(12.5%)	
Married	350(87.5%)	
Age		0.04
18-28	85(21.3%)	
29-39	107(26.8%)	
40-52	143(35.8%)	
Above 52	65(16.3%)	
Education level		0.04
No education	142(35.5%)	
Non-formal education	168(47.0%)	
Primary education	50(12.5%)	
Secondary education and above	20(5.0%)	
Income level (TZS)		0.05
<5000/day	247(61.8%)	
5000/day and above	153(38.3%)	
Other activities		0.05
No	57(14.3%)	
Yes	343(85.8%)	
Markets		0.00
Transportation costs and price fluctuations	290(72.5%)	
Normal situations	110(27.5%)	
Labour cost		0.00
Labour cost high	237(59.7%)	
Labour cost is normal	163(40.3%)	
Land size		0.00
Less than 4 ha	327(81.8%)	
4 ha and above	73(18.2%)	
Household size		
HH size – 1	123(30.8%)	-
HH size– 2	267(66.8%)	
HH size –6	1(0.3%)	
HH size –7	3(0.8%)	
HH size – 8	1(0.3%)	
HH size – 9	4(1.0%)	
HH size -12	1(0.3%)	

This suggested that education influenced commercialization of RP production in the study areas. On the other hand, Enete and Igbokwe (2010) in Africa, Nigeria found that

education exerted positive effects on commercialization and was an important human capital that enabled farmers to participate in a range of activities. It is further urged that formal education endows households with better production and managerial skills, enable individuals to make independent choices, increase the tendency of co-operating and participating in group activities. Education often increased the chances of increasing incomes among household heads (Enete and Igbokwe, 2010). In the current study, education was statistically significant at $p \leq 0.04$ (Table 9).

The level of incomes of the respondents engaged in RP production in Rungwe District was low compared to the annual national average of TZS 90 000 (Mbeya region socio-economic profile, 2008). For instance, of all the 400 respondents, 61.8% indicated to be earning less than TZS 5000 per day, while only 38.3% earned TZS 5000 and above/day. This situation made most of the respondents in the District to fail to engage in RP production for profitable commercialization. The level of incomes in rural areas in the country is a big challenge as 34% of the population live below the basic needs poverty line of approximately USD 0.40 per day (i.e. TZS 36 482 per adult equivalent per month) and 17% live below the food poverty line of TZS 1000 per day (i.e. TZS 26 085 per adult equivalent per month). The daily cost of the food Poverty line is TZS 858 per adult equivalent (National Bureau of Statistics (NBS), (2013). Most of the respondents in the RP growing areas in the study areas earned less than TZS 5000 per day (Table 8). One FGD participant said that:

> *Our level of incomes to most of us is low as we earn less than TZS 000 per day. Hence, we do not afford to buy inputs for RP commercialization* (FGDs, Goye village, 10/5/2015).

In another study, Smale *et al.* (2010) in the Southern Guanajuato, Mexico found that the level of incomes of smallholder farmers determined the purchasing power and the ability

of smallholders to meet the costs of inputs required in the production and the kind of technology to be adopted. The level of farmers' incomes can also influence farmers' choice over certain crop varieties, and poor households are more likely to choose traditional crop varieties because of the associated costs of production (Smale *et al.*, 2010). Mpogole (2013), in a study in the Southern Highlands of Tanzania, noted that the choice of crop varieties for agricultural production can reflect the subsistence farming practices among smallholder farmers in many developing countries. In the current study, the income level was statistically significant at $p \leq 0.05$ (Table 9).

Land is an important capital for smallholder farmers in Rungwe District as it is a source of their incomes through agricultural production. Observation in the current study revealed that land scarcity was a challenge in the study area as many people compete for land in order to grow RP for commercialization. For instance, 81.8% of the respondents indicated to have owned less than 4 hectares of land, while 18.2% reported to have owned above 4 hectares. One FGD participant reported that:

> *Due to land scarcity, most of us own small sizes of land (0.2-5 acres) for agricultural production more specifically RP production* (FGDs, Ndaga village, 10/5/2015).

Another FGD participant said that:

> *Profitable RP production for commercialization is not realized from small size of land that gives low yields* (FGDs, Ntokela village, 10/5/2015).

In another study, Olwande (2010) at Tegemeo Institute, Kenya noted that at any given yield level, a household with lower land per capita devotes a higher proportion of their land to food production so as to achieve a given level of self-sufficiency and spare just a small land if any for the production of higher value crops for market; and this affects commercialization. Similarly, the poor generally lack land, capital, and education to

respond quickly to technological innovation and agricultural market opportunities (Rahut *et al.,* 2010). Farm size may also, have positive impacts on market participation by enabling farmers to generate surplus to overcome credit and thus reducing post-harvest losses and stimulating high levels of commercialization. In the current study, land ownership was statistically significant at $p \leq 0.00$ (Table 9).

Labour cost in the RP production activities in Rungwe District was a problem because of many of the field operations involved costs which contributed to delays in accomplishing several field operations; and these factors affected commercialization of RP production. For instance, 59.7% of all the respondents complained that labour cost was a limiting factor. On the problems of hired labour one FGD participant reported the following:

> *Hired labour facilitates field operations to match with our crop calendar and increases productivity of the crop* (FGDs, Ndaga village, 10/5/2015).

Another participant in a FGDs revealed that:

> *When we fail to get hired labour at the right time we fail to achieve the intended goals of commercializing of RP production in our District* (FGDs, Goye village, 10/5/2015).

Another participant in a FGDs reported that:

> *'The most critical field operations in RP production is land preparation which costs TZS 100 000/acre, sowing which costs TZS 80 000/acre and fertilizer application which costs TZS 7000 /acre. Harvesting cost is about TZS 2000 per bag of 100 kg. Yet, others are pesticides and fungicides spraying which cost TZS 6000/acre* (FGD, Nzunda village, 10/5/2015).

One participant in a KIs said that:

> *Spraying of fungicides and pesticides normally is done three times. However, Households with family labour have an advantage in cultivation of RP* (Agricultural extension agent, Isongole ward, 10/5/2017).

Mwakaje (2010) study in Rungwe District, Tanzania found that households with enough family members were considered to have assets, particularly in the provision of labour. However, the author insisted that this occurred when almost all of the households'

members took part in the production activities. In another study, Metzger and Diehl (2009) in Nyankpalla Agricultural Research Station, Ghana found that hired labour was paid in cash and sometimes in kind but did the most tedious tasks which included land tilling, weeding and harvesting. However, the quality of hired labour was lower than that of family labour; furthermore, hired labour requires supervision and monitoring both of which are costly (Renger-Metzger and Diehl, 2009). In the current study, labour cost was statistically significant at $p \leq 0.00$ (Table 9).

Household size in the study area was low which forced the respondents to hire labour to achieve their goals of RP production. For instance, 30.8% of the respondents complained that they had few household members (1 person), while 66.8% indicated having only two persons. This implied that most of the respondents depended on household heads and their spouses. One FGD participant reported that:

> *Most of us have households with few family members. Given that the work of RP activities is tiresome, one or two persons cannot effectively manage the activities. Hence, we are forced to hire labour* (FGDs, Goye village, 10/5/2015).

Another FGD participant said that:

> *Hired labour is required when we have money. However, based on economic level of our incomes which is low many of us fail to hire labour* (FGDs, Ntokela village, 10/5/2015).

According to URT (2012), Rungwe District had an average HH size 4.1 which was higher than that of RP growing areas. This situation suggested that the household size in the study area did not provide enough family labour for effective commercialization of RP production. Household composition is also one of the socio-economic factors which influenced livelihoods of smallholder farmers. A study in Turkey showed that household composition (size, age, gender) determined the nature of work carried out by farmers

(Aydin, 2010). The total number of adults in the household that assists in the farm serves as a family labour supply for the production activities impacts positively on market participation (Olwande, 2010). In intensive agricultural systems there is growing evidence that an increase in household sizes leads to an increase of land productivity that exceeds subsistence requirements and leading to the production of surplus for the market.

Based on other activities that are done in the study villages, of the 400 respondents, 85.8% reported to have grown such crops as maize, beans, sweat potatoes and vegetables. For instance, one KI participant revealed that:

> *Given that RP production is not enough to sustain farmers, other respondents apart from growing other crops, they do off-farm activities such as lumbering, selling local brews, transporting passengers on motorbikes digging and weeding in other farmers' fields* (WEO, Isongole Ward, 11/5/2015).

Mende *at el.* (2014) study noted that the main non-agricultural sources of income in RP growing areas in Mbeya rural and Makete District, Tanzania were casual labour, local brewing, petty business, remittances, lumbering and renting out houses. Also, Mnenwa and Malit (2010) study in Dar-es-Salaam, Tanzania found that off-farm incomes complimented incomes from agricultural activities. Other activities too were statistically significant at $p \leq 0.00$ (Table 9).

RP markets in the study areas were a challenge as one of the middlemen in KI participant put it:

> *Middlemen dominate buying of the crop as they collect, buy and bag them hence increasing their margins by lowering product prices* (WEO, Isongole Ward, 11/5/2015).

For instance, about 72.5% of all the respondents complained about transportation costs, low prices and price fluctuations of round potatoes. One participant in FGDs had this to say:

> *We have no power over the middlemen because we need money and we lack a farmers' association to arrange for crop sales and pricing. As a result we suffer from unstable and low prices of RP crop* (FGDs, Ndaga village, 10/5/2015).

Another FGD participant said that:

> *We are forced to sell our crop at farm gate price, and we make little profit* (FGD, Ntokela village, 10/5/2015).

A study by Kherallah *et al.* (2010) in Washington D.C., USA found that poor markets of round potatoes in many African countries were a result of poor transportation systems and limited market opportunities. In the current study, market was statistically significant at $p \leq 0.00$ (Table 9).

4.1.2 Respondents' socio-economic factors influencing commercialization of RP Production

To answer this objective, a multiple linear regression model was used to identify factors influencing commercialization of RP production in the study areas in Rungwe District. Commercialization of RP production was taken as a function of eight variables: respondents' age, the cost of labour, markets, education levels, income levels, acreage cultivated, land owned and other activities. The regression model of factors influencing commercialization of RP production was specified as follows:

$y = \alpha_0 + \alpha_1 x_1 + \alpha_2 x_2 + \alpha_3 x_3 + \alpha_4 x_4 + \alpha_5 x_5 + \alpha_6 x_6 + \alpha_7 x_7 + \alpha_8 x_{8+} \alpha$ where: y = commercialization of RP production, α_0 = the intercept of regression equation. $\alpha_{(1-8)}$ = coefficient of parameter estimates, x_1 = age, x_2 = education levels, x_3 = land owned, x_4 = markets, x_5 = income levels, x_6 = labour cost, x_7 = other activities, x_8 = acreage cultivated ε = error term. Socio-economic factors that influenced commercialization of RP production were entered both as categorical and continuous predictors. The regression model assumed

that there were independent variables and a dependent variable which were indicated by the standardized coefficients. The unit change of one independent variable was assumed to cause a change in a dependent variable. The standardized coefficient value that bore a negative sign implied that the unit increase in an independent variable caused a decrease in a dependent variable, and a positive regression value with a unit change from independent variable caused an increase in the dependent variable. The statistical test of the model showed that the explanatory power of the model was significant at $p \leq 0.00$, the adjusted R square was 0.62, R square 0.63 and the standard error of the estimate was 0.77 (Table 9).

Table 9: Selected factors that influenced commercialization of RP in the study villages in Rungwe District

Variables	Unstandardized Coefficients			Standardized Coefficients		Collinearity tolerance	Statistics VIF
	B	Std error	Beta	T	Sig.	-	-
Constant	8.8	.50	-	17.75	.00	-	-
Age	-.09	.04	-.24	-2.05	.04	.849	1.178
Education level	-.40	.20	-.24	-2.05	.04	.957	1.045
Income level	-.19	.10	-.08	-1.91	.05	.882	1.134
Land ownership	.35	.14	-.11	-2.51	.01	.850	1.077
Acreage cultivated	.-05	.00	-.24	-5.61	.00	.888	1.126
Other activities besides RP	-.26	.13	-.08	-1.95	.05	.904	1.107
Labour cost	-.58	.10	-.23	-5.55	.00	.888	1.126
Markets	.52	.11	-.24	5.55	.00	.885	1.130

Adjusted R squared 0.62; R squared 0.63. Standardized error of the estimate = 0.78.

4.1.3 Respondents' age

Respondents' age was an independent variable which showed a relationship with commercialization of RP production as a dependent variable. In the current study, the association of age and RP production was statistically significant at $p \leq 0.04$ (Table 9). The statistical model shows a standardized coefficient of -0.24 bearing a negative sign as an output of commercialization of RP production. This implies that one unit increase in the

age caused a unit decrease in the commercialization of RP production and vice versa. For instance, one participant in a FGDs reported:

> *RP production in our village is carried out by old farmers and most of whom are mostly women* (FGDs, Ndaga village, 10/5/2015).

In the current study 35.8% of the respondents were aged from 40 years and above years implying that they could not be actively and effectively carrying out RP activities to have a positive impact on commercialization. In another study Lupilya (2011) in Bukoba District, Tanzania found that the middle aged (35-45 years old) were more energetic and were actively involved in farming activities. Furthermore, a study by Haule (2009) in Ludewa District, Tanzania found that people's livelihoods were closely related to their age, which influenced the type of assets they owned; for example, younger people provided more labour, time, and were more likely to expand their fields. A study by Enete and Igbokwe (2010) in Nigeria, found that younger household heads were more dynamic in the adoption of innovations that enhanced their productivity and marketing of output at reduced costs. Furthermore, a study by Aina (2010) in Farmers Africa, Seoul found that young people were less conservative to changes than their older counterparts and therefore they were more likely to participate in agricultural production. However, the level of participation increases with certain categories after which it starts to decline with an increase in age. It is more likely, therefore, that age was one of the contributing factors that influenced commercialization of RP production in the study villages.

4.1.4 Education levels

Education levels had a statistical significant relationship with commercialization of RP production at $p \leq 0.04$ level of significance and a coefficient value of -0.24, indicating that one unit increase in education level caused a decrease in commercialization of RP production and vice versa (Table 9). This implies that one unit increase in smallholder

farmers' children for school enrolment, that is, joining primary school will cause a decrease in one unit of commercialization of RP production and vice versa. One KI participant reported that:

> *With the current government policy of encouraging the youth to join primary schools and further moving on to secondary schools, and further, commercialization of RP production decreases in the study areas and vice versa* (WEO, Isongole Ward, 11/52015).

The Tanzanian Primary Education Development Plan (PEDP) and the Secondary Education Development Plan (SEDP) of 2006 (Sumra and Rajani, 2006). brought about policy reforms in education whereby pupils' Net Enrolment Ratio (NER) in primary schools increased from 65.5% in 2001 to 96.1% in 2006 leading to a decrease of commercialization of RP production in the study areas. Another KI participant added that:

> *From 2006 up to date the youth in the study villages have joined primary schools leaving behind old people to work in RP fields* (VEO, Ndaga village, 11/5/2015).

Observation showed that primary school enrolment will continue and affect commercialization of RP production in the study areas. For instance, KIs had this to say:

> *Most of the smallholders who are engaged in commercialization of RP production are those who are uneducated* (WEO, Isongole ward, 11/5/2015).

The study findings show that, 35.5% of the respondents had no formal education and 5% had attained secondary level education, 47.5% had attended non-formal education classes, while 12.5% had completed primary school education. This implies that RP production was dominated by smallholder farmers with little education. It is more likely that these farmers carried out RP production with minimal improved knowledge and skills which led to negative impact on commercialization of RP production.

Enete and Egbokwe (2010) study in Nigeria, found that education raised awareness among smallholder farmers and developed their understanding on the value and potentials of

various technological options available; and this in turn, influenced productivity and market access. Astrat *et al*. (2009) study in Southern part of the Himalaya found that education level also influenced the cost of information seeking and negotiating. Education attainment enables smallholder farmers to adopt and use good agricultural production technologies from different sources such as agricultural extension agents, publications and mass media. Furthermore, educated smallholder farmers are more profit-oriented than those with no formal education as low formal education levels can lower farmers' efforts to improve productivity, and this increases their vulnerability to poverty (Enete and Igbokwe, 2010). Education levels of household heads are associated with high levels of crop sales as education is posited to influence the understanding of household head of market dynamics and therefore improve on decision making about inter alia the amount of output sold (Makhura *et al*., 2010). In another study Aikaeli (2010) in Dar-es-Salaam, Tanzania found that education led to proficient household management which crucially improves economic performance of the households. Hence, low levels of education negatively influenced commercialization of RP production in the study areas.

4.1.5 Income levels

Study findings in Table 9 show that income levels were an independent variable which was statistically significant at $p \leq 0.05$. The standardized coefficient value for this variable was -0.08, implying that one unit increase in income levels causes one unit decrease in commercialization, and thereby having a negative impact to commercialization of RP production and vice versa. This finding was in line with one KI participant' statement who reported that:

> *Low respondents' incomes cause them fail to buy fertilizers, fungicides, hire labour and insecticides, which negatively influence commercialization of RP production* (WEO, Isongole Ward, 11/5/2015).

For instance 61.8% of the respondents reported to be earning less than TZS 5000/day, and 38.3% reported to be earning TZS 5000 and above/day. This implies that about two thirds

of the respondents could not afford to purchase agricultural inputs for RP production. During a FGDs and KIs session, one FGD participant said:

> *We fail to buy the required inputs for boosting RP production because we do not have enough money. Also, we cannot get credit because we are considered unqualified* (FGDs, Ntokela village, 10/5/2015).

One KI participant reported that:

> *Financial institutions available in the District do not provide credits to smallholder farmers for RP production in the study areas due to risks and uncertainties in the agricultural production activities* (DAICO, Rungwe District, 11/5/2015).

Commercial banks and other microfinance institutions are reluctant to lend smallholder farmers because of associated risks (Olomi, 2007). A study by Smale *et al.* (2010) in Southern Guanajuato Mexico found that the level of income of smallholder farmers and income status determined the purchasing power, and the ability to meet the costs of inputs which are required in the production and the kind of technology to be adopted. Similarly, the respondents' low income was a constraint for purchasing inputs for RP production. One respondent in FGDs had this to say:

> *To get capital for RP production we borrow from friends and relatives and sometimes we even sell our assets* (FGDs, Nzunda village, 10/5/2015).

Another KI participant reported that:

> *Most of the respondents grew RP without using fertilizers and other agricultural inputs and some used small quantities of fertilizers* (Agricultural extension agent, Isongole Ward, 11/5/2015).

Observation in the current study revealed that this situation affected productivity and ultimately influenced commercialization of RP in the study villages. For instance, The World Bank (2010) study found that income levels influenced the ability of smallholder farmers to choose over certain crop varieties and to use the available resources. Poor households are more likely to choose traditional crop varieties because of the associated

costs of production (Mpogole, 2013). In this regard, a study by Smale *et al*. (2010) in Southern Guanajuato, Mexico found that families' consumption of maize rather than its suitability for the market was the most significant factor for farmers' choice of growing certain varieties. Hence, low levels of the respondents' income appeared to have hindered commercialization of RP production in the study villages.

4.1.6 Other activities

Other activities were treated as independent variables for commercialization of RP production which had statistical significance at $p \leq 0.05$ and a coefficient of-0.08 value. This implies that one unit increase in the respondents' involvement in other activities caused a one unit decrease on commercialization of RP production and vice versa. One FGD participant reported:

> *Some of our fellow farmers opt to do other businesses such as growing other crops and doing off-farm activities other than RP production activities to earn extra money* (FGDs, Ntokela village, 10/5/2015).

About 85.5% of the respondents reported to have been engaged in other activities apart from RP production as reported by one KI participant:

> *Other activities which are done by most smallholder farmers include casual labour like digging, weeding in other farmers' fields, lumbering, making local brews, transporting passengers on motorbikes (boda boda)* (Agricultural extension agent, Isongole Ward, 11/5/2015).

A study by Mnenwa and Maliti (2010) in Dar-es-Salaam, Tanzania found that the role played by off-farm income was important because agriculture and related activities were generally not as paying as off-farm activities. A study by Mwakaje and Nyunza (2012) in Isongole, Rungwe District, Tanzania, found that 49.5% of the smallholder farmers in Isongole ward in Rungwe District depended on RP production as their main source of income. Still, 33.3% and 10.5% of the smallholder farmers grew maize and cabbages,

while others did off-farm activities such as petty business, casual labour, local brewing, and selling forest products. Similar findings are reported in a study by Mende *et al.* (2014) in Makete and Mbeya Rural Districts in Tanzania. Livestock keeping was also another income source for most smallholder farmers. In this context, involvement of the respondents in other activities negatively affected commercialization of RP production in the study villages.

4.1.7 Markets

Markets for RP were statistically treated as an independent variable and were statistically significant at $p \leq 0.00$ (Table 9). The coefficient value was -0.24 indicating that markets caused a negative relationship with commercialization of RP production. This implies that one unit increase in markets, that is, buying RP in local markets decreased one unit of RP price and vice versa. One FGD participant said that:

> *Most of RP are bought by middle men and are the source for lowering RP price in our villages* (FGDs, Goye village, 10/5/2015).

Another KI participant reported that:

> *Middlemen dominate RP business as they collect, buy and package RP. In so doing, they lower RP prices. The respondents have no power to resist middlemen because they need money* (WEO, Isongole Ward, 11/5/2015).

Seventy two (72.5%) percent of the respondents, complained that RP business was exploitative. The study findings showed that the respondents had no farmers' associations and co-operatives. This implies that RP market situation was not a friendly one and did not encourage the respondents into producing more for commercial purposes. For instance, one FGD participant revealed that:

> *Because of distances to Dar-es-Salaam we are forced to sell our RP in the villages which gives us little profit* (FGDs, Ndaga village, 10/5/2015).

Selling RP in the villages had a negative influence to the respondents and to the commercialization of RP production in the District. Kherallah *et al.* (2010) study in

Washington D.C. USA found that poor markets of round potatoes in many African countries are caused by several constraints such as poor transportation and limited market opportunities. Mitiku (2014) study in Regional State, Ethiopia revealed that distance from settlement centre to the next market place was positively and significantly related to the probability of being poor. The positive relationship is explained by the fact that households that are in close proximity to the market and other public infrastructure are likely to enjoy opportunities of creating more income through potential engagement in off/non-farm employment, access to transportation facilities and market information (Mitiku, 2014). In a study by Muthomi *et al*. (2013) on Small scale RP producers in Kenya also, price fluctuation was found to be the most important among the RP marketing constraints, due to seasonality of RP production.

Moreover, in a study by OECD (2010) it was observed that often farmers start planting crops without knowing the market. Producing without knowing the market is contrary to the demand driven production which requires farmers to produce for the market. It is said that the supply-driven production creates a mismatch between supply and demand. Alternatively, an additional increase in the price of the crop can increase the amount of crops sold (OECD, 2010).

The findings confirm the assertion from economic theory that output price is an incentive for farming households to produce more products for sale. Also, Olwande *et al.* (2010) at Tegemeo Institute, Kenya and Omit *et al.* (2009) in Rural and Peri-urban, Kenya found that output price was an incentive for sellers to supply more produce to the market. Usually, traders and exporting firms facilitate the financing of crops such as rice, but their investment in food crops, such as round potato was low (Kherallah *et al.,* 2010). Hence,

this study found that RP marketing had a negative impact on commercialization of RP in the study villages.

4.1.8 Land ownership

Land ownership was an independent variable, which was statistically significant at $p \leq 0.01$ with a coefficient of -0.11. This implies that one unit increase in land that a respondent owned caused one unit decrease in the commercialization of RP production and vice versa. During FGDs and KIs interviews, one of the KI participants reported:

> *There is an increase of people from within and outside the District who want land to buy. Here, availability of land is a problem as most farmers cultivate fields that range from 0.2 to 5 acres, mostly obtained through renting, inherit and buying* (WEO, Isongole Ward, 11/5/2015).

This observation indicates that because of land scarcity, family members competed for land, most of which was used to grow RP. About 81.8% of the 400 respondents indicated to have owned less than 4 ha, while 18.2% owned 4 ha and above (Table 8). This implies that most of the smallholder farmers owned small pieces of land, most of which could not produce profitable output for RP commercialization. One FGD participant had this to report:

> *The problem of land has become more acute following the 2009 migration of farmers from Kikondo village in Makete, District Njombe region who were evacuated after their lands were declared a National Reserve by the Government of Tanzania* (FGDs, Goye village, 10/5/2015).

Another KI participant added that:

> *The tendency of farmers from other areas to demand for land in this District is serious in Uporoto highlands, which is suitable for RP commercialization but also attractive for rich farmers to buy land. The prospects for RP commercialization are hampered because of lack of absolute landownership by most of the respondents* (DAICO, Rungwe District, 11/5/2015).

In another study Kinabo (2014) Sokoine University of Agriculture, Morogoro, Tanzania found that land scarcity led to conflicts and unrest which sometimes led to deaths.

Generally, households with larger farm sizes are able to sell larger shares of their production compared to households with small farm sizes (Martey *et al*., 2012). By implication, farm size influenced the level of RP commercialization in the study villages.

4.1.9 Labour cost

Labour cost was an independent variable and was highly statistically significant at $p \leq 0.00$ (Table 9), with a coefficient of -0.23 (Table 9). This implies that one unit increase in labour cost causes a unit decrease in RP commercialization and vice versa. In this regard, one FGD participant said the following:

> *Some field operations need hired labour. We farmers can barely pay for labour hence leave some fields unattended due to increased labour cost* (FGDs, Nzunda village, 10/5/2015).

Yet, another participant had this to say:

> *There are different types of farm operations for RP production that involve costs that contribute to delays to farm operations on time. To finish all farm operations on time we need enough money in advance something which is difficult to achieve because of low incomes* (FGDs, Ntokela village, 10/5/2015).

Observation revealed that most of the respondents could not hire, which affected RP production and commercialization. Yet another FGD participant had this to say:

> *Land preparation costs about TZS 100 000 per acre, sowing about TZS 80 000 per acre, fertilizer application about TZS 7000 per acre, pesticides and fungicides applications about TZS 6000. Harvesting cost about TZS 2000 to fill a bag of 100 kg* (FGDs, Ndaga village, 10/5/2015).

One KI participant added that:

> *There are operations of pesticide and fungicide applications that are carried out almost three times depending on severity of infestation* (Agricultural extension agent, Isongole ward, 11/5/2015).

A study by Doss (2009) in Washington D.C., USA found that the bottlenecks of labour cost were frequent during planting and harvesting seasons. Observation revealed that

households with access to large amounts of household labour or with the ability of mobilizing non-family labour had an advantage during these times. Hired labour typically performs the most tedious tasks including soil tilling, weeding and harvesting and were the most easily supervised. Thus, smallholders spend relatively large amounts in cash or in kind, for hiring labourers (Renger-Metzger and Diehl, 2009).

However, the quality of hired labour is lower than that of family labour and therefore, hired labour requires supervision and monitoring both of which are costly (Renger-Metzger and Diehl, 2009). In Zimbabwe, only few smallholders appeared to have used hired labour due to associated costs (Rohrbach, 2009). Mpogole (2010) in Southern Highlands, Tanzania found that smallholder farmers produced low quantities of round potatoes as they lacked the bargaining power which could offset the costs of labour. Lack of bargaining power not only raises the cost of labour but also inflates transaction costs and lowers farm gate prices which are likely to be less than half the ultimate retail prices. This trend inflates the labour cost to considerably higher levels thus negatively influencing commercialization of RP production. Martey *et al*. (2012) study in the University of Ghana, Legon-Accra Ghana found that family labour costs rose because of an increase in off-farm employment opportunities while urbanization and/or trade liberalization triggered positive shifts in market demand. For this study too, labour cost influenced commercialization of RP production in the study areas.

4.2 Acreage Cultivated

Acreage cultivated was another independent variable, which had a relationship with commercialization of RP production and was highly statistically significant at $p \leq 0.00$, with a Beta coefficient of -0.24 (Table 9). This implies that one unit increase in the acreage planted with RP caused one unit decrease in the commercialization of RP production and vice versa. In this regard, one participant during FGDs said the following:

> *When we increase acreage under RP production we face problems with managing them: We need to apply more fertilizers, apply fungicides and pesticides most of which we cannot buy in adequate quantities* (FGDs, Nzunda village, 10/5/2015).

Therefore, the possibility of applying recommended rates of fertilizers and fungicides varied from one season to another depending on the respondents' financial ability. Such fluctuations had a negative impact on the commercialization of RP production in the study areas. One KI participant reported that:

> *'Fluctuations of RP production are common in this Ward because of low income levels of our smallholder farmers that compel them to use low quantities of agricultural inputs such as fertilizers, fungicides and seeds* (Agricultural extension agent, Isongole ward, 11/5/2015).

In another study, Aune and Bationo (2010) in Tigray Region, Northern Ethiopia found that the entry point for crop intensification was the use of organic and inorganic fertilizers; this is because if soil fertility is not improved, the use of other technologies such as high yielding varieties will not have a significant impact on the crop.

Hence:

Hypothesis testing of $HO_{1:}$ *There is no statistical significant relationship between smallholder farmers' socio-economic factors that influence RP production for commercialization.* The results from linear multiple regression showed that the following socio-economic factors were statistically significant with their level of significance in brackets; age ($p \leq 0.04$), education level ($p \leq 0.04$), income level ($p \leq 0.05$), other activities ($p \leq 0.05$), markets ($p \leq 0.00$), land ownership ($p \leq 0.01$), acreage cultivated ($p \leq 0.00$), and labour costs ($p \leq 0.00$). Following these study findings socio-economic factors statistically had a relationship with commercialization of RP production in the study villages and hence the null hypothesis is rejected. Therefore, based on the study findings, socio-economic factors of smallholder farmers were found to affect commercialization of RP production in the study areas in Rungwe District.

4.3 Smallholder Farmers' Perception about Commercialization of RP production

This section examined the perception of respondents in relation to commercialization of RP production. Rao and Narayana (1998) define perception as the process whereby people select, organize, and interpret sensory stimulations into meaningful information that works into their environment. They argue that perception is the single most important determinant of human behaviour. Similarly, social perception refers to the construction of an understanding of the social world from the data we get through our senses (Michener *et al.*, 2004).

For this objective, the respondents' perception towards commercialization of RP production was measured by adopting a five level Likert-scale namely: Strongly agree, agree, undecided, disagree, and strongly disagree. These levels were framed based on five statements regarding the perception towards commercialization of RP production as shown in Table 10. The study findings (Table 10) show that commercialization of RP production as a drudgery work was statistically significant with commercialization of RP production at $p \leq 0.00$ and most (354 or 88.5%) of the 400 respondents agree that commercialization of RP production was a drudgery work, which required intensive agricultural inputs and capital.

This implies despite all the efforts and investment made by smallholder farmers in the RP production, they still could not get high yields per acre. During the FGDs session, one FGD participant had this to report:

> *We are doing a hard work involving different field operations about RP production, which are manually done using a hand hoe. This work is not proportional to the yields we get. Some of the farming operations that we do involve tilling the soil, sowing, fertilizer application, pesticides and fungicides spraying, weeding and harvesting* (FGDs, Nzunda village, 10/5/2015).

Another KI participant reported that:

> *Other activities that smallholder farmers do are to prepare the soil for RP growing in the study area to avoid bacterial soil-borne disease. Smallholder farmers are forced to prepare seed tubers in a free soil borne disease area far from the RP field. This is an extra work for RP production as they have to transport seed tubers from such areas to the fields* (DAICO, Isongole Ward, 11/5/2015).

Another FGD participant revealed that:

> *Considering the nature of RP growing area in the District, which is wet all the year around, storage of seed tubers is also a problem due to moist soils. This situation necessitates most of us to purchase the seed tubers from some distant villages. This impedes commercialization of RP production* (FGDs, Goye village, 10/5/2015).

Study results show further that despite all these operations, RP production did not show any good harvests worth commercializing. Similar findings are reported by Namwata (2010) in Mbeya Rural District, Tanzania that RP yield per acre was 8.25 tons instead of 25 tons. In this regards, one FGD participant observed:

> *Good productivity of RP cannot be achieved by using simple farming implements such as hand hoes and most of us are aged above40 years old, and we cannot effectively participate in RP production* (FGDs, Ntokela village, 10/5/2015).

Another KI participant revealed further that:

> *Smallholder farmers consider RP production as a routine activity that have no positive impact to them and is not taken as a business venture* (VEO, Ndaga village, 10/5/2015).

In another study, Jamali (2009) on rural women, in Pakistan found that agriculture in developing countries heavily depended on manual labour with major contribution coming from women. Similarly, observation in the study areas showed that women carried out many of the farm operations such as pre-sowing, post-sowing, harvesting, and post-harvesting. It was on the basis of these attributes that most respondents felt that commercialization of RP production was perceived a drudgery work.

Table 10 shows that RP production as the only option was statistically significant with commercialization at p≤ 0.00 and most, 352 (88%) of the 400 respondents agreed that RP production was the only option for them. Smallholder farmers in the District produce 25% of the total production of RP in the country for both food and a source of income for sustaining their livelihoods URT (2010).

Table 10: Perception of the respondents on commercialization of RP production (n = 400)

Variables	Strongly disagree n(%)	Disagree n(%)	Undecided n(%)	Agree n(%)	Strongly agree n(%)	Chi-square	p-value
RP considered drudgery work	16(4.0)	11(2.8)	19(4.8)	114(28.5)	240(60.0)	1184.738	0.00
RP production is considered the only option	14(3.5)	8(2.0)	26(6.5)	107(26.8)	245(61.3)	1184.738	0.00
RP production is an intensive input use crop	10(2.5)	7(1.8)	17(4.3)	109(27.3)	257(63.5)	1184.738	0.00
RP production capital intensive activity	14(3.5)	7(1.8)	12(3.0)	113(28.3)	254(63.5)	1184.738	0.00
RP production is limited to other support services	13(3.3)	8(2.0)	17(4.3)	111(27.8)	251(62.8)	1134.738	0.00

Likelihood ratio 619.893, linear by linear association 360.132

However, one FGD participant said that:

> *Commercialization of RP production in the areas is unprofitable: we continue to do it because we have no other reliable occupations* (FGDs, Goye village, 10/5/2015).

Another FGD participant revealed that:

> *Farming is our traditional life style because most of us found it and is a source of our living* (FGDs, Nzunda village, 10/5/2015).

Another FGD participant added that:

> *RP is our routine activity regardless its labour intensive and time consuming with poor income returns. Although we sometimes do off-farm activities, our main occupation remains RP production* (FGDs, Ntokela village, 10/5/2015).

One KI respondent reported that:

> *The smallholder farmers' mind sets are tuned to thinking that there are no any other areas of activities unless one is a government employee. They also think that agriculture does not need formal education as opposed to other occupations* (DAICO, Rungwe District, 11/5/2015).

Most respondents perceived that for most smallholder farmers agriculture was the only option because it did not require high educational attainments. In a study by FAO (2012), agriculture was perceived as a low-level occupation that could not make anyone progress in other carriers. In another study, Mpogole (2012) in Southern Highlands of Tanzania found that traditional farming practices where farmers practised farming as a routine activity rather than as a business, was one of the major challenges in rural potato production areas. Observation in the study areas showed that little or no efforts were made towards improving both production practices and yields resulting in low profits.

However, a study by Hemachandra and Kodithuwakku (2010) in poor dry zone of Sri Lanca showed that production oriented decision making that is not economically viable was a prominent reason for socio-economic failures among smallholder farmers. Here too, it was observed that majority of rural farmers followed well established routine traditional decision paths, which impacted negatively on commercialization of RP production.

RP production needs high quantities of inputs and most smallholder farmers considered it as an intensive input use. For instance, results in Table 10 indicate that 90% of the respondents agreed that commercialization of RP production was an intensive input use crop. Moreover, intensive input use as an independent variable was statistically significant with commercialization of RP production as a dependent variable at $p \leq 0.00$. This implies that production of RP was hardly attained without input use such as fertilizers, pesticides, fungicides, and improved seeds which were expensive. One FGD participant revealed that:

> *In order for the crop to yield better, we need to apply seven to eight bags of 50 kg of fertilizers per acre which is expensive as each bag costs up to TZS 80 000* (FGDs, Ntokela village, 10/5/2015).

One KI participant explained that:

> *Pesticides and fungicides are chemicals mostly required to protect the crop from insect pests and diseases. These have to be bought several times and are expensive because the crop is prone to diseases and insect pests, hence needs frequent spraying to be protected. For instanc*e, one *litre/kilogram of pesticide or fungicide costs about TZS.10 000 to 20 000* (Agricultural extension agent, Isongole Ward, 11/5/2015).

Another KI participant reported that:

> *Successful production of RP is based on use of improved varieties/seeds. To grow one acre of RP requires five bags (of 100 kg each). TZS 50 000 to 60 000 per bag of 100 kg of tuber seeds and the capital to achieve all these has to be prepared in advance something which is an obstacle to most of the smallholder famers* (DEO, Rungwe District, 10/5/2015).

One FGD participant reported that:

> *The little capital we manage to earn for instance, less than TZS 5000 per day is not enough to buy the required quantities of inputs which negatively affects commercialization of RP production* (FGDs, Nzunda village, 10/5/2015).

Furthermore, one KI participant commented that:

> *Because of low levels of incomes many smallholder farmers cannot buy inputs of high quantities required for RP production such as fertilizers, pesticides, fungicides, and improved seeds* (DEO, Rungwe District, 10/5/2015).

In another perspective, the study found that most of the respondents earned less than TZS 5000 per day. This amount is equivalent to approximately USD 0.40 per day, which is the basic needs of poverty line in the rural areas (NBS, 2013). Therefore, this low level of income negatively influenced commercialization of RP production in the study areas. A study by FAO (2010) in Asia found that due to the physiological nature of round potato tubers, and its relatively poorly developed and shallow rooted system, the potato demanded a high level of nutrients. Without balanced fertilization management, growth and development of the crop become poor; and both yields and the quality of tubers diminish. The type and the extent of nutrient management depend on the production

potential of the area in which potatoes are cultivated and on farmers' productivity objectives. Good quality seeds are essential for high yields and usually the most costly input to potato cultivation, accounting for 30 to 50 percent of the production cost (FAO, 2010).

Furthermore, results in Table 10 show that, RP production was capital intensive as independent variable and commercialization as dependent variable were statistically significant related at $p \leq 0.00$ and most 91.8% of the 400 respondents agreed that commercialization of RP production was a capital intensive. This implies that costs were involved in buying of fertilizers, pesticides, fungicides tuber seeds, labour, transport facilities, and packaging materials. Hence, commercialization of RP production in the study villages was difficult. One FGD participant reported that:

> *Cost of inputs is expensive. For instance, a bag of fertilizer of 50 kilogram costs TZS 70 000 to 80 000 and in order to apply one acre of RP with a fertilizer let alone other inputs such as fungicides and pesticides, it needs seven to eight bags of fertilizers which is expensive to most of us* (FGDs, Ntokela village, 10/5/2015).

Another FGD participant added that:

> *Similarly, an acre requires five bags of tuber seeds to plant and one bag of tuber seeds costs TZS 50 000 to 60 000. All these costs to most of us are a challenge, which we cannot address as a result we end up growing unimproved varieties/seeds which are not potentially productive* (FGD, Ndaga village, 10/5/2015).

Another FGD participant revealed that:

> *There is an issue of transport and labour charges that we need to incur when transporting fertilizers and tuber seeds from one place to the farm. Charges are not fixed, but roughly we pay from TZS 20 000 and above per trip* (FGDs, Nzunda village, *105/2015).*

Yet, one KI participant commented that:

> *This situation of capital intensity influences commercialization of RP production because the soil productivity in the District does not do well without applying fertilizers and productivity of RP depends on improved tuber*

> *seeds which are expensive for successful commercialization of RP production* (DEO, Rungwe District, 11/5/2015).

A study by FAO (2010) in Asia found that, compared to other food crops, the production of potatoes was capital intensive, requiring the purchase of large quantities of bulky seeds and the application of high-cost inputs such as fertilizers and pesticides. Similarly, observation in the current study showed that respondents had limited access to credit and most found it difficult to compete in the potato production and therefore they could not commercialize.

Table 10 shows that 90% of the respondents agreed that commercialization of RP production was constrained with other support resource services. Study observation revealed that support resource services such as institutional framework or incentives such as farmers' associations and co-operatives, technical support, credit facilities, and improved seeds in improving commercialization of RP production were lacking in the study villages. However, support resource services as independent variable and commercialization of RP production as dependent variable were statistically significant related at $p \leq 0.00$. One FGD participant complained that:

> *Our failures to access important support resource services for RP production like extension services and lacking farmers' associations and co-operatives usually make it difficult for most of us as to get updated technology about RP production as well as market information* (FGDs, Ntokela village, 10/5/2015).

This situation led to a challenge which compelled the respondents to consider commercialization of RP production as unprofitable. For instance, one KI participant revealed that:

> *Financial institutions such as credit facilities in this District do not provide credits to smallholder farmers as they think that agricultural production activities have many risks. It is difficult for smallholder farmers to get enough*

> *fertilizers to use for RP production as their level of incomes are low* (DAICO, Rungwe District, 11/5/2015).

Another FGD participant reported that:

> *What we do to get money for fertilizers, pesticides and fungicides, is to use off-farm earnings from such activities as casual labours, lumbering, masonry etc. and to borrow money from relatives or sell some of our assets to buy agricultural inputs* (FGDs, Goye village, 10/5/2015).

Another FGD participant added that:

> *Due to high input prices it is not possible to meet the required quantities with the little capital we get and this makes us use lower quantities of purchased agricultural inputs in our farms* (FGDs, Ndaga village, 10/5/2015).

A study by Jaln (2014) in India, reported that agriculture has always been a risky business unlike the industrial sector. Uncertainty of crop yields is thus one of the basic risks, which every farmer has to face in developing countries. In most of the developing countries, majority of farmers are poor and have limited means and resources to enable them to bear the risks of crop failure (Jaln, 2014). In this regard, one KI participant reported that:

> *Research and seed certification technology are also lacking in the District. These could enable the smallholder farmers have better clean and improved tuber seeds for a positive RP production. Lack of all these services cause a negative impact to commercialization of RP production in the District.* (DAICO, Rungwe District, 11/5/2015).

A study by IFAD (2011) in Kwa Zulu-Natal Province, South Africa found that majority of smallholder African farmers (most of them women) farms below two hectares, produce a significant amount of basic food crops with virtually no or little use of fertilizers and improved seeds. In another study by FAO (2010) in India revealed that, causal factors of this trend included the limited technical capacity of human resources, lack of managerial expertise and inadequate resource allocations to seed systems. The study observation in the study areas revealed that with potato increasingly becoming a cash crop, small scale potato growers are vulnerable to abrupt changes in input and output prices. The observation revealed further that smallholder farmers in the study villages complained

about poor agricultural extension delivery services that were expected to provide the best farming practices including RP production. One FGD participant reported that:

> *Poor agricultural extension services in the District, especially in the round potato growing areas has made us more often to rely on our neighbours and relatives for technological ideas about RP production* (FGDs, Ntokela village, 10/5/2015).

A study by Namwata *et al*. (2010) in Mbeya Rural District in Tanzania found that contacts with extension services were a major factor that led to the variations in crop production among farmers. Similarly, Asrat *et al.* (2010) study in Himalaya, India found the level of success to agricultural extension services affecting farmers' private variations of crop variety traits. A study by Martey *et al.* (2012) in Ghana, Legon-Accra, reported that, poor crop sales by smallholders with lower or little access to extension services was a result of ineffective monitoring in the utilization of improved technologies.

In another study of Farmers in Africa, Aina (2010) noted that because of low number of agricultural extension workers, farmers hardly obtained new agricultural technologies. This is because the ratio of agricultural extension workers to farmers is low. Similarly, a study by Bilonkwamanagaza (2010) in Njombe, Tanzania found that, agricultural extension workers did not reach every farmer and that only a few farmers did receive agricultural extension services. Although extension agents can be available in most of the round potato growing areas, the proportions of farmers who rely on recommendations given by extension agents are generally negligible. This raises questions on the role and effectiveness of the extension agents (Mpogole, 2013).

Also, Mntambo (2010) in Korogwe District, Tanzania noted a limited flow of information about the latest agricultural technologies and that both men and women were equally denied access to extension services. On the same token, Holmen and Hyden (2011) in

Florida, Gainesville, USA, found that agricultural extension services throughout Africa were even weaker today than they were in the past when agricultural extension services were supply-driven using a top down fashion. Under this situation it was difficult to have a breakthrough in the commercialization of RP production due to limited farm support resource services in the study areas. However, the hypothesis was tested to measure the relationship between respondents' perception and commercialization of RP production as follows:

Hence:

Hypothesis testing of HO_2: *There is no statistical significant relationship between respondents' perception and commercialization of RP production*. Chi-square test was used to ascertain the statistical relationship between respondents' perception as an independent variable and commercialization of RP production as a dependent variable. The results from chi-square test showed that the following statements of perception about commercialization of RP production were statistically significant with their levels of significance in brackets, smallholder farmers perceived that commercialization of RP production was a drudgery work ($p \leq 0.00$), commercialization of RP production was the only option ($p \leq 0.00$), commercialization of RP production was intensive input use ($p \leq 0.00$), commercialization of RP production was capital intensive ($p \leq 0.00$), commercialization of RP production was limited to farm resource support services ($p \leq 0.00$) (Table 10) and the null hypothesis is rejected. Therefore, based on the study findings, it was found that the respondents had a negative perception towards commercialization of RP production in the study areas in Rungwe District.

4.4 Biological Factors Influencing Commercialization of RP Production

Among biological factors that influence agricultural production include soil microbes, agricultural cultivars, and domesticated animals. Some of the biological resources (biotic

factors) have a less direct effect on agriculture. For instance, noxious weed density and diseases/insect pests can decrease farm's profitability on the surrounding lands because subsequent weed diseases and insect pests control measures increase the costs to the farmers. Similarly, non-agricultural lands can harbour diseases and both insect and animal pests which can cause losses to the farmer (Starling, 2008). This section assessed biological factors that influence commercialization of RP production in the study areas in Rungwe District.

The objective was measured by using descriptive statistics adopting likert scale with five levels namely, strongly agree, agree, undecided, strongly disagree and disagree. To measure the strength of association between biological factors and commercialization of RP production, the chi-square test was employed. However, based on the results Table 11, showed that, diseases/insect pests and commercialization of RP production were statistically significant related at $p \leq 0.001$. In this case the biological factors were independent variables and dependent variable was commercialization of RP production. Similarly, the study results indicate that 69.4% of the respondents agreed that diseases and insect pests caused low yield of RP in the study areas in the District. As one FGD participant revealed:

> *There is a problem of diseases and insect pests in our area which threaten the crop. The common diseases are Bacterial wilt, and RP blight, which affect the vegetative part of the plant causing crop dormancy that ends up causing poor tuber formation* (FGDs, Ntokela village, 10/5/2015).

Another KI participant reported that:

> *Bacterial wilt usually causes a serious damage to the extent of losing the whole crop. In the case of insect pests, there are aphids, mites, beetles and white flies which attack the vegetative part of the plant and cause crop failure and consequently producing poor quality tubers. Other insect pests are cutworms, which cut the crop during the early growing stages thus reducing the number of plants in the field leading to low yields* (DEO, Rungwe District, 11/5/2015).

A study by CIP and FAOSTAT (2010) revealed that viral and bacterial diseases contribute to the reduction of round potato yields in developed and developing countries. For instance, in China, seasonal aphids are high and potato virus and late blight (*Phytophtora infenstans*) are the major factors limiting yields of RP (CIP and FAOSTAT, 2010). In the USA potato crop was reported to face a problem of late blight diseases caused by fungus such as *Oomycete phytophtora infenstans* and *Rhyzoctonia selerotinia* and others such as black leg, powdery mildew, powdery scab and leaf roll virus (CIP and FAOSTAT, 2010). Insect pests included potato tuber moths and the green peach aphids (*Mycus persicae*). Moreover in Russia Federation and Ukraine, insects' pests and diseases were a major problem causing the loss of as much as four million tons annually mainly attributed to late blight and viral diseases as well as Colorado beetle (CIP and FAOSTAT, 2010).

Also in Africa particularly in Egypt, viruses and soil-borne diseases for instance, bacterial wilt were the major constraints against potato production (Hegazy, 2009). In Kenya, a study by FAOSTAT (2013) reported that RP production was constrained by a disease such as bacterial wilt, and insect pest known as potato cyst nematode (*Globodera restochiensis*). Also, Kamau (2010) study in National Resource, Kenya found that many round potato farmers were unable to control bacterial wilt and other related diseases such as tuber and late blight. In another study, Gildemachar *et al.* (2009) in Kenya, Uganda, and Ethiopia found that diseases and insect pests played a significant role in contributing to poor RP production.

Results from the study indicate that 76% of the respondents agreed that it was not possible to grow RP without fertilizers and statistical significant relationship between RP production is not possible without fertilizer and commercialization of RP production was at $p \leq 0.006$ (Table 11). In this case, not possible without fertilizers was independent

variable while commercialization of RP production was dependent variable. One FGD participant revealed that:

> *In order to get high production of RP we need to have seven to eight bags of fertilizers of 50 kg per acre to apply otherwise we get poor performance of the crop* (FGDs, Ndaga village, 10/5/2015).

Table 11: Respondents' opinions on biological factors influencing commercialization of RP production

Variables	Strongly agree n(%)	Agree n(%)	Undecided n(%)	Disagree n(%)	Strongly disagree n(%)	Chi-square	p-value
Diseases/pests caused low yield	125(31.1)	153(38.3)	7(1.8)	55(13.8)	60(15.0)	102.152	0.001
Soil fertility status was low	90(22.5)	120(32.0)	20(5.0)	80(20.0)	80(20.0)	119.246	0.000
Not possible to grow without fertilizers	199(49)	108(27.0)	20(5.0)	50(12.8)	23(5.8)	100.710	0.006
Local varieties are not profitable for commercialization	7(1.8)	232(58.0)	78(19.5)	33(8.2)	50(12.5)	147.737	0.002

A study by Kamnizzaman and Takeya (2008) in Bangladesh, Dhaka reported that agricultural production technologies, specifically chemical fertilizers, selected seeds or high yielding varieties, irrigation and soil quality enhance crop production and productivity of the land. In another study, Aune and Bationo (2010) in Tigray Region, Northern Ethiopia reported further that the entry point for crop intensification was the use of organic and inorganic fertilizers for soil fertility improvement as the use of other technologies such as high yielding varieties would not have a significant impact. Since soil fertility in the study areas was poor, it is possible that RP production was affected due to the failure of using the right quantities of fertilizers; and this may have influenced commercialization of RP production.

Study results in Table 11 indicate that local varieties and commercialization were statistically significant related at $p \leq 0.002$. Local varieties were independent variable and

commercialization of RP production was dependent variable. However, 59.8% of the respondents agreed that local varieties were not profitable for the commercialization of RP production. As one KI participant revealed:

> *Local varieties are not profitable as compared to improved ones because they produce poor quality and low yield per unit area even under good management. But smallholder farmers are forced to grow them because of their low prices, availability, and easier to prepare* (DEO, Rungwe District, 10/5/2015).

A study by Mekomen *et al*. (2011) in Southern Ethiopia, Khartoum did three trials with different levels of late blight resistance found that improved varieties showed higher yields without spraying fungicides. Also, a study by FAO (2010) noted that, improved varieties without spraying yielded 10 ton/ha compared to the local varieties that were sprayed in 5 times. A study by FAO (2010) reported further that the use of local varieties with poor quality and low adaptability to marginal environments reduced production. Hence, the use of local varieties in the study areas negatively influenced commercialization of RP production.

Study results in Table 11 indicate the statistical significant relationship between status of soil fertility and commercialization of RP production was at $p \leq 0.00$ where status of soil fertility was independent variable and commercialization was dependent variable. However, 54.5% of the respondents agreed that the status of soil fertility was low. During FGDs and KIs interviews, one KI participant reported that:

> *Prolonged periods of farming, has caused decreased yield of RP year after year and finally the soil fertility has deteriorated. To improve the soil status different inorganic fertilizers are needed to be applied during RP production* (DAICO, Rungwe District, 11/5/2015).

One FGD participant reported that:

> *The common fertilizers we use to improve soil fertility are UREA, DAP, CAN, NPK and TSP. For the crop to yield better we apply seven to eight bags of*

> *50kg of fertilizers per acre and each bag of fertilizer costs from TZS 70 000 and above. However, due to high cost of these inputs most of us fail to apply the recommended quantities of fertilizers* (FGDs, Nzunda village, 10/5/2015).

Similarly, EEA (2010) study in Ethiopia, Khartoum reported that the productive capacity of soils depended on the content of mineral nutrients, organic carbon, soil structure and texture. Erosion affects soil properties, soil biodiversity and consequently the deterioration of soil fertility are often driven by unsustainable agricultural practices such as shallow ploughing (EEA, 2010), Ulen and Kalisky (2010) in Copenhagen, Denmark demonstrated that treatments with less frequent tillage or treatments without tillage similarly reduced erosion and phosphorus losses by increasing soil stability and fertility.

Hence:

Hypothesis testing of $HO_{3:}$ *There is no statistical significant relationship between biological factors and commercialization of RP production*. Chi-square test was used to measure the relationship between biological factors and commercialization and the results showed that biological factors had a statistically significant relationship with their level of significance in brackets, diseases/ insect pests caused low yield ($p\leq 0.001$), soil fertility status was low ($p\leq 0.00$), not possible without fertilizers ($p\leq 0.006$), local varieties were not profitable ($p\leq 0.002$) (Table 11). This implies that there was a statistical relationship between biological factors and commercialization of RP production and the null hypothesis is rejected. Therefore, based on the study findings, it was concluded that biological factors negatively influenced commercialization of RP production in the study areas.

4.5 Environmental Factors Influencing Commercialization of RP Production

Environmental factors influence Round potato commercialization invariably by affecting the level of smallholder farmers' incomes. There are different environmental factors that

affect crop production across the globe, and these include edaphic and climatic factors. Among the edaphic factors include abiotic factors that are non-living components of the environment that determine the extent to which the genetic factors are expressed in plants (Starling, 2008). One of the most crucial abiotic factors that affect crop production is temperature**,** which is the degree of coldness and hotness in a given place (Starling, 2008). Temperature determines the growth and distribution of plants and if temperature is extremely high or too low plants will not grow well.

Also, rainfall affects crop production as plants need water to grow and absorb essential nutrients. Excessive rainfall, on the other hand, causes soil erosion, diseases and other disasters. This often leads to poor crop harvests and low quality of crop production (Starling, 2008). For RP production, rainfall and temperature appear to affect its productivity. A study by Kintomo *et al*. (2008) in Ibadan, Lagos reported that low temperatures, frost, rainfall and the intensive land use of farms by smallholders were the causes of reduced agricultural productivity.

This study, therefore, assessed the environmental factors that influenced commercialization of RP production in Rungwe District. The environmental factors' objective was analysed using descriptive statistics model involving likert scale with five levels namely, strongly agree, agree, undecided, strongly disagree and disagree. However, chi-square test was used to measure strength of association between environmental factors and commercialization of RP production (Table 12). The environmental factors included, temperature, frost, and heavy rainfall affected RP production. In this case environmental factors were independent variables and commercialization of RP production was dependent variable. Frost caused withering of crop leaves to making them turning dark

green and fall off. This situation caused a reduction of yields of RP in the study areas. One participant in FGDs reported that:

> *Low temperatures cause damage to our crops especially during the critical period from April to July. This affects RP production which negatively influences commercialization of RP production* (FGDs, Goye village, 10/5/2015).

Also, one KI participant revealed that:

> *Smallholder farmers are advised to apply agro-chemicals such as fungicides on crops to prevent against effects of low temperatures. However, only a few of them are able to use fungicides to protect crops because they are expensive* (VEO, Nzunda village, 10/5/2015).

Furthermore, Table 12 indicates that 68.8% of the respondents agreed that temperature affected RP production implying that temperature negatively impacted the commercialization of RP production in the study areas. The statistical significant relationship between temperature affected RP production and commercialization of RP production were at $p \leq 0.002$. In this case temperature affected RP production was independent variable while commercialization of RP production was dependent variable.

Similar findings are reported by Armah *et al*. (2010) in Northern Ghana - Accra who found that rural economies remained part of the most vulnerable areas to climate change in Africa in terms of declines in agricultural production and uncertain climate that significantly affected food security. A study by Patsalos (2010) study in Nicosia, Cyprus found that potato plant and other related crops were sensitive to low temperature changes. Similarly, Mboya *et al.* (2011) study in Rungwe District, Tanzania revealed that low temperatures, which were accompanied by fog and mist, were a threat to RP production, especially during April and July. This situation caused a negative influence to the commercialization of RP production.

Table 12: Respondents' opinions on environmental factors

Variable	Strongly agree%	Agree %	Undecided %	Disagree%	Strongly disagree%	Chi-square	p-value
Temperature affects RP	134(35.5)	133(33.3)	10(2.5)	81(20.3)	42(10.4)	147.247	0.002
Frost affects RP product	116(29.0)	165(41.3)	14(3.5)	52(13.0)	53(13.2)	128.844	0.000
Frost occurred frequently	161(40)	118(29.8)	11(2.8)	54(13.4)	56(14.0)	82.594	0.010
Heavy rainfall affects RP production	100(25)	130(32.5)	4(1.0)	100(25)	66(16.5)	105.201	0.007

Another environmental factor was frost which indicated that 70.3% of the respondents agreed that frost affected commercialization of RP production in the study area and the statistical significant relationship between frost affected commercialization and commercialization of RP production was at $p \leq 0.00$ (Table 12). The independent variable was frost affected commercialization and dependent variable was commercialization of RP production. One FGD participant reported that:

> *In serious situations most of us lose the whole crop due to effects of frost that damage the crop* (FGDs, Goye village, 10/5/2015).

Another FGD participant added saying that:

> *Sometimes, our fellow farmers with loans kill themselves following disasters of frost as they lack money to recover the loans after the crop has been seriously affected* (FGDs, Ntokela village, 10/5/2015).

Furthermore, the study findings indicate that 69.8% of the respondents agreed that frost occurred frequently affecting RP production in the study areas (Table 12). The statistical significant relationship between frost occurred frequently and commercialization of RP production was at $p \leq 0.010$. According to Webb and Snyder (2016), frost is an event where temperature falls to the freezing point and ice forms inside the plant tissues and causes damage to the cells. Observation in the study areas showed that frost negatively impacted the RP production. In this regard, One FGD participant revealed that:

> *Frost occurs frequently in our areas although its effects on the crops vary from season to season* (FGDs, Ndaga village, 10/5/2015).

Moreover, the findings in Table 12 indicate that 69.8% of the respondents agreed that frost occurred frequently in the study areas as one KI put it:

> *Most of the smallholder farmers opt to grow RP in low temperature months from April to July because during this time RP diseases are not a serious problem as opposed to other months of August to January* (DAICO, Rungwe District, 11/5/2015).

IFAD (2011) study in Rome, Italy found that at least 70% of the people, in rural areas who depended on agriculture were at risk of being subjected to recurrent natural disasters with devastating impacts on food security and overall social and economic development. A study by Jaln (2010) in India revealed that agriculture has always been a risky business as it is subjected to the vagaries of the nature, unlike the case with the industrial sector.

For instance, one FGD participant reported that:

> *Commercialization of RP production is threatened by frost which scotches crop leaves causing the crops completely fail to grow. This situation is critical in the months of April to July; the period when temperatures are low* (FGDs, Ndaga village, 10/5/2015).

One KI participant had this to say:

> *Rungwe District has temperatures that sometimes drop up to a minimum range of 3^0C to 10^0C even to -2^0C, especially in RP growing areas in (Uporoto highlands): Low temperatures affect RP production and its commercialization.* (DAICO, Rungwe District, 11/5/2015).

An ADB (2013) study in Germany noted that weather extremes lead to loss of crop products due to increased difficult of growing conditions (cold and wet), which caused low supply of RP, high prices of RP forcing the country to import RP from other countries. For instance, a study by Nyunza and Mwakaje (2012) in Rungwe District, Tanzania found that smallholder farmers in RP growing areas sold their land and other farmers opted for off-farm activities due to losses of RP harvests caused by frost. In

another study, Patsalos (2010) in Nicosia, Cyprus found that at 3^0C crop foliage fell down and the plants froze and became entirely destroyed.

The study in Table 12 indicates that RP production was affected by heavy rainfall which lowered RP production and affected commercialization. The statistical significant relationship between heavy rainfall and commercialization of RP production was at p≤ 0.007. In this case heavy rainfall was independent variable while commercialization was dependent variable. One FGD participant revealed that the following:

> *Heavy rainfall affects RP production and in our areas they start from December to May. At this time diseases of RP are rampant and most of us fail to control them due to lack of money to buy fungicides and pesticides* (FGDs, Ntokela village. 10/5/2015).

These Findings show that 57.5% of the respondents agreed that heavy rainfall affected RP production in the study areas. In Rungwe District, the average rainfall ranges from 980 mm in low lands to 3300 mm in the highland zone (URT, 2010).

A study by William *et al.* (2013) at MSU, USA found that heavy rainfall caused a conducive environment for late blight disease that causes water mould (*Phytopthora infestans*) in RP plants. Hence, heavy rainfall negatively influenced commercialization of RP production in Rungwe District.

Hence:

Hypothesis testing of HO_4: *There is no a statistical significant relationship between environmental factors and commercialization of RP production*. Results from chi-square test indicated that there was a statistically significant relationship between environmental factors and commercialization of RP production in brackets; temperature affects RP production (p≤ 0.002), frost affected RP production (p≤ 0.000), frost occurred frequently (p≤ 0.010), heavy rainfall affected RP production (0.007) (Table 12). Hence, the null

hypothesis is rejected. Therefore, based on the study findings it was concluded that environmental factors had a negative influence on commercialization of RP production in Rungwe District.

4.6 Theoretical Implications on the Study

The study is guided by three theoretical perspectives; profit maximization theory; the new institutional economic theory and structural functionalism theory. These theories provide an understanding of aspects that smallholder farmers faced in trying to address production and productivity of RP in the study areas.

4.6.1 Profit maximization theory

Economic theory of profit maximization considers a firm as a transformation unit of inputs into output. According to Parkin (2010), the major objective of the firm is to maximize profit. The author argues that while individual firms and entrepreneurs have similar objectives which include improving quality of product, growth, market share, and employee job satisfaction, all such objectives are only a means to profit maximization. Furthermore, the theory emphasizes that the great concern should be to improve quality of agricultural products, expand the area of production, look for a better market and consider incentives for workers. However, Anderson and Ross (2009), argue that profit maximization is a rational behavior of equilibrium assumption where marginal revenue is equated to marginal cost. A firm which aims at maximizing profit will go on increasing its inputs till it reaches the maximum profit. Therefore, profit is maximized when there is maximum difference between total revenue and total cost (Penson *et al*., 2009). The bigger the difference between total revenue and total cost the bigger the profit. Therefore, profit is maximized when there is maximum difference between total revenue and total cost (Penson *et al.*, 2009).

The hypothesis test was done to know if there was any relationship between the commercialization of RP production and this theory. Hypothesis testing was done as follows:

$HO_{1:}$ stated that: *There is no statistical significant relationship between respondents' socio-economic factors and commercialization of RP production in the study areas*. A multiple linear regression model was used in which socio-economic factors namely: age, education levels, income levels, other activities, access to markets, land ownership, acreage cultivated and labour costs were entered as independent variables. The results from multiple linear regression showed that the following socio-economic factors were statistically significant with their level of significance in brackets; age ($p \leq 0.04$), education level ($p \leq 0.04$), income level ($p \leq 0.05$), other activities ($p \leq 0.05$), markets ($p \leq 0.00$), land ownership ($p \leq 0.01$), acreage cultivated ($p \leq 0.00$), and labour costs ($p \leq 0.00$). However, the study revealed that there was low RP production because most of respondents mostly used local varieties which are not productive. Also, most of the respondents produced RP from small plots because of land scarcity in the study areas leading to low incomes which affected commercialization of RP production. Because of all these conditions, respondents lacked motives for commercializing RP production. Hence the earlier stated hypothesis is rejected. Additionally, the profit maximization theory's tenets were not met by the respondents as most failed to attain major theory's objectives of maximizing profits through producing poor quality RP, not increasing production because they could not expand farms, and having little control of RP markets. Furthermore, there was poor perception of RP commercialization by respondents as they were not satisfied with quantities produced and their relationship between respondents' perception and commercialization was ascertained through doing the hypothesis test as follows:

HO_2: tested that: *There is no statistical significant relationship between respondents' perception and commercialization of RP production*. Chi-square test was used to ascertain

the statistical relationship between respondents' perception and commercialization of RP production and found that respondents' perception was statistically significant with commercialization of RP production in brackets; respondents perceived commercialization of RP production was drudgery work (p≤ 0.00); commercialization of RP production was the only option (p≤ 0.00); commercialization of RP production was intensive use of inputs (p≤ 0.00); commercialization of RP production was capital intensive (p≤ 0.00); commercialization of RP production was limited to farm support services (p≤ 0.00). This implied that there was low RP production in the study areas, which was not satisfactory for effecting commercialization of RP production. Hence, the earlier hypothesis is rejected.

Also, biological factors were treated as independent variables and the hypothesis tested stated as: $HO_{3:}$ *There is no statistical significant relationship between biological factors and commercialization of RP production*. Chi-square test was used to test the hypothesis and the results showed that it was statistically significant in brackets; diseases/insect pests affected RP production (p≤ 0.001), status of soil fertility was low (p≤ 0.00), It was impossible without fertilizer (p≤ 0.006), local varieties were not profitable (p≤ 0.002). This implies that these conditions caused the respondents to produce meager products. Hence, the earlier hypothesis tested is rejected. Similarly, environmental factors caused a negative impact on RP commercialization, which stated: $HO_{4:}$ *There is no statistical significant relationship between environmental factors and RP commercialization*. Chi-square test was used to ascertain the relationship and results indicated that it was statistically significant in brackets; temperature affected RP production (p≤ 0.002), frost affected RP production (p≤ 0.00), frost occurred frequently (p≤ 0.010), heavy rainfall affected RP production (p≤ 0.007). This implies that because of these impediments, the

respondents failed to maximize RP production to achieve commercialization and the theory's objectives for maximizing profits were not achieved.

4.6.2 The new institutional economic theory

The new institutional economic theory states that, smallholder farmers' associations are diverse types of groups who act actively in order to benefit either as individuals or as a group (Poole and de Freece, 2010). This kind of association may be formal shared ownership or an informal set of social and business connections between farmers and traders. The theory believes that farmers' organizations help to create sets of social and business connections between farmers and traders when they exist in agricultural production areas. The hypothesis to test this relationship was done using a chi-square test and the hypothesis stated as:

Ho_2: *There is no statistical significant relationship between the respondents' perception (to limited farm support services, market networks and outlets, presence of farmers' associations and co-operatives) and commercialization of RP production*. Results showed that there was a highly statistical significant difference in relationship at $p \leq 0.00$. The study findings showed that there were limited farm support services, farmers' association and co-operatives, which caused weak flow of RP information to the respondents as most accessed it either from relatives or neighbours. Also, there were poor RP market networks and outlets and village-based SACCOs. Hence, the above stated hypothesis is rejected because commercialization of RP production was affected by the respondents' perception (to limited farm support services, presence of farmers' associations and co-operatives) which caused the theory's objectives not to be achieved because respondents failed to meet major tenets for commercialization of RP production in the study areas.

4.6.3 The structural functionalism theory

The structural functionalism theorysees the family like a body that has different parts and each part has different functions (Talcott, 2013). The family is considered the backbone of

the society which if it fails to pass on certain values and attitudes to its members then the society will be affected. With the structural functionalism perspectives, if one part or person is not doing its or his/her part then the whole family is dysfunctional. The functionalists attempt to explain the nature of social order, the relationship between the various parts (structures) in society and their contribution to the stability of the society by examining the functionality of each and how each contributes to the stability of the society as a whole (Talcott, 2013).

The structural functionalism theory, exemplifies commercialization of RP production in the study areas for its stability based on different factors of production like markets, producer prices, labour availability, input costs, farming costs, land costs, transport facilities and the infrastructure. The theory's objectives reflect the major tenets for commercialization of RP production in the study areas. To explain the relationship between the theory and commercialization of RP production, a linear regression model was used. The independent variables included sex, age, access to markets, producer prices, land ownership, income levels of the respondents and labour availability. The dependent variable was commercialization of RP production and the hypothesis was tested as:

HO_1: *There is no statistical significant relationship between socio-economic factors and commercialization of RP production.* The regression results showed that the following socio-economic factors were statistically significant as: age ($p \leq 0.04$); education level ($p \leq 0.04$); income level ($p \leq 0.05$); other activities ($p \leq 0.05$); access to markets ($p \leq 0.00$); land ownership ($p \leq 0.01$); acreage cultivated ($p \leq 0.00$) and labour costs ($p \leq 0.00$). Furthermore, the study results revealed that socio-economic factors negatively affected commercialization of RP production in different ways. For instance, low commercialization of RP production was due to poor access to RP markets because they

were dominated by middlemen, and most of the respondents were aged, women dominated RP production, and there was land scarcity. Hence, the earlier tested hypothesis is rejected. The respondents could not attain the theory's objectives and tenets of spearheading commercialization of RP production in the study areas.

CHAPTER FIVE

5.0 OVERVIEW

This chapter presents conclusion and recommendations based on the main findings of this study. The general objective of this study was to investigate factors that influence commercialization of RP production in Rungwe District. More specifically, the study intended (i) to examine smallholders' socio-economic factors influencing commercialization of RP production in Rungwe District (ii) to identify smallholders' perception towards commercialization of RP production in Rungwe District (iii) to assess biological factors influencing commercialization of RP production in Rungwe District and, (iv) to determine environmental factors influencing commercialization in Rungwe District.

5.1 Conclusion

5.1.1Smallholder farmers' socio-economic factors influencing commercialization of RP production

Results from multiple linear regression model, revealed that socio-economic factors among smallholder farmers influenced commercialization in different ways. For instance, Farmers' age was found to be influencing commercialization of RP production because activities associated with its production were tiring in nature. Most of the smallholder farmers who are engaged with commercialization of RP production were aged and could not carry out farming activities more effectively. For instance, 38.5% of the respondents were aged 40 years and above, while 16.3% of the respondents were above 52 years. Others, 26.8% of the respondents were aged between 29-39 years old and 21.3% of the respondents were aged between 18-28 years old. This affected commercialization of RP production in the study villages.

The implementation of Education reform policy influenced commercialization of RP production because the Net Enrolment Ratio (NER) in primary schools increased from 65.5% to 96.1% of young people who decided to forgo commercialization so as to join secondary schools hence, leaving old people for carrying out RP production activities. It was found out further that only few smallholders with good education were engaged in RP production. This implies that commercialization of RP production activities were carried out by smallholder farmers who had minimal knowledge on improved technologies and skills which led to negative impact on RP production in the study areas. For instance, 35.5% of the respondents had no education while 47.5% had non-formal education. Others, 12.5% had primary education and few 5.0% completed secondary education. This situation had an effect on the commercialization of RP production in in Rungwe District.

Income levels of smallholder farmers in the District was found to be a limiting factor for commercialization of RP production in the study areas as most of them could not manage to buy inputs as per the recommendation. For instance, 61.8% of the respondents earned less than TZS 5000/day while 38.3% of the respondents earned from TZS 5000 and above per day. This influenced commercialization of RP production.

Land ownership was found to be challenging in the study villages as most of smallholder farmers had small land sizes to cultivate. For instance, the study findings found that 81.8% of the respondents owned less than four hectares while 18.2% of the respondents owned four hectares and above. The profitability of RP production for commercialization was not realized due to low harvests which were obtained from small land sizes. With this situation, land ownership in terms of land size influenced commercialization of RP production in the study areas.

Market in the District was also found to be a limiting factor because there was low price and high fluctuation of crop prices; and this had a negative impact on commercialization of RP production. This situation was attributed to middlemen who lowered the prices of the RP crop, since they had the dominating purchasing powers and were also responsible for collecting and packaging. For instance, 72% of the respondents complained that the prices were low and fluctuating. Based on this system, smallholder farmers got little profit from RP production, and therefore, the market influenced commercialization in the study areas.

The study results indicate that other activities such as casual labours, selling of forest products, petty business, lumbering, passengers' transportation (*boda boda*), and selling of local brews had a negative effect on commercialization of RP production as most of smallholder farmers opted for off-farm activities claiming that commercialization of RP production was not paying. For instance, 85.8% of the respondents opted for off-farm activities; and this implies that only a few of smallholder farmers were left for RP production activities which influenced commercialization of RP production in the study areas.

Labour cost of RP production was found to be associated with many field operations and which became limiting factors to commercialization of RP production, and especially because the increased cost for hired labour left many of the RP fields unattended. Lack of capital to most of smallholder farmers made most of their farms untimely attended and this affected RP yields. It was revealed further that 59.7% of the respondents claimed that labour cost was high this negatively influenced commercialization of RP production in the study villages.

An increase land of cultivation was a challenge to most of smallholder farmers on how to manage applying the right quantities of fertilizers and other agro-chemicals in their fields, because the more the acreage the higher the quantities of inputs and the higher the cost of purchasing them. Therefore, availability and affordability of inputs was a problem to most of smallholders. This situation influenced commercialization of RP production.

However, study results of this objective found further, that there was a statistically significant relationship between socio-economic factors of smallholder farmers and commercialization of RP production; thus, the null hypothesis was rejected. Therefore, it was concluded that socio-economic factors of smallholder farmers had a negative impact to commercialization of RP production in Rungwe District.

5.1.2 Small holder farmers' perception that influence commercialization of RP in Rungwe District

Using descriptive statistics the respondents were asked to indicate whether they strongly disagree, disagree, undecided, agree or strongly agree to the provided likert scale. The study results revealed that all the respondents agreed with an idea that commercialization of RP was not profitable implying that smallholders had negative perception towards commercialization of RP production.

For instance, it was found that commercialization of RP production was perceived as a drudgery work because of having many field operations which were carried out using simple tools such as a hand hoe but at the end of the day smallholder farmers were getting poor results. Some activities involved long processes of preparation. For instance, preparing seed tubers was a tiresome work because it had to be done far away from the field of operations to avoid infestation of crop caused by bacterial wilt disease which

lowered the crop yields. The bacterial wilt was endemic in the soils of RP growing areas in the District (Isongole Ward), and whose prevention required special treatments when preparing seed tubers. Sometimes smallholder farmers were forced to buy seed tubers from distant places because they were not readily available in their local areas. With all these operations, farmers' efforts were fruitless because of getting low RP yields. Because of all these operations, about 88.5% of the respondents thought that commercialization of RP production was a drudgery work which had a negative influence on the commercialization of RP production in the study areas.

Commercialization of RP production was also perceived by 88.1% of the respondents as the only option because most of the smallholder farmers thought that there was no progress in other areas of production because of being unskilled and having the assumption that agricultural production needed no formal education as opposed to other careers. In so doing, RP production activities were carried out with minimal improved knowledge and skills. Since profitability of these operations on commercialization of RP production was not realised then this situation influenced commercialization of RP production in the study areas.

Commercialization of RP production was perceived as an intensive input use crop because high productivity was hardly achieved without the use of such inputs as fertilizers, pesticides, fungicides and improved seeds which were costly. For instance, it was found that in order for the crop to produce better results a smallholder farmer was required to apply seven to eight bags of 50 kg of fertilizers per acre and each bag of fertilizer costs up to TZS 80 000. Pesticides and fungicides were also mostly required to protect the crop from infestation. A litre/kilogram of pesticide or fungicide costs about TZS 10 000 to 20 000 and this needs to be bought several times because the nature of the crop needed

frequent spraying to be protected. It was found further that successful productivity of RP was based on improved varieties/seeds which cost TZS 50 000 to 60 000 per bag but an acre required five bags (100 kg). In view of the foregoing observation, 90% of the respondents considered commercialization of RP production as an intensive input use crop. This influenced commercialization of RP production in the study villages.

Commercialization of RP production was found to be capital intensive operation following high costs of inputs and other related resources such as tuber seeds, labour cost, transport facilities, and packaging materials. For instance, study results indicated that a 50 kilogram bag of fertilizer costs TZS 70 000 to 80 000 and an acre of RP requires seven to eight bags of fertilizers which are very expensive to a smallholder farmer. Similarly, an acre of RP crop requires five bags of tuber seeds and one bag of tuber seeds costs TZS 50 000 to 60 000. Following these costs, 91.8% of the respondents considered commercialization of RP production as a capital intensive activity. This situation influenced commercialization of RP production in the study villages.

Commercialization of RP production was found to be constrained with farm resource support services because the services were not available when smallholder farmers needed them for RP production. Such services were financial institutions, technical services, farmers' associations and co-operatives, management expertise, and resource allocation to seed systems which could facilitate management of RP production and boost commercialization. As a result, 90% of the respondents considered commercialization of RP production as constrained with farm resource support services. This situation influenced commercialization of RP production in the study areas.

Furthermore, using a chi-square statistical test, the results of the study objective showed a strong statistical significant relationship between smallholder farmers' perception and

commercialization of RP production in the study areas; thus, the null hypothesis was rejected. Therefore, it can be concluded that smallholders' perception had a negative influence on commercialization of RP production in Rungwe District.

5.1.3 Biological factors influencing commercialization of RP production

Using a chi-square test and descriptive statistics, study results revealed that biological factors influenced commercialization. For instance, the effects of diseases/insect pests influenced commercialization of RP production as it caused low yield. Accordingly, 69.4% of the respondents agreed that the effects of diseases and insect pests had a negative influence on commercialization of RP production. Therefore, the low yield of RP was attributed to diseases and insect pests, and this influenced commercialization of RP production in the study areas.

The study results revealed further that it was impossible to produce RP without fertilizers in the study areas because the soil fertility status was low hence fertilizers was needed to improve it. The study results revealed further that chemical fertilizers and other inputs enhanced crop production and productivity of the land and that without fertilizer application it was impossible to get high yield. In this regard, 76.0% of the respondents agreed that growing RP crop was impossible without fertilizers. Since soil fertility was not improved, RP production could not yield good results. This influenced commercialization of RP production in the study villages.

The practice of using local varieties/seeds in growing RP was not found profitable for commercialization of RP production as was experienced by most of the smallholder farmers dealing with RP production in the study areas. In this respect, 76.0% of the respondents agreed that local varieties were not profitable to commercialization. Other

study findings found that improved varieties showed higher yields without spraying fungicides. It was also found that improved varieties could produce 10 ton/ha of yields without spraying, which is higher compared to the local varieties with 5 times of spraying. This indicates the economic opportunities of improved varieties as opposed to local varieties/seeds; thus, it can be concluded that local varieties were not profitable for commercialization hence influenced commercialization of RP production in the District.

The status of soil fertility was found to affect commercialization in the study villages. It was found further that the productive capacity of soils depended on the content of mineral nutrients, organic carbon, soil structure and texture. Most of the smallholder farmers in the area failed to improve soil fertility because of the high costs of fertilizers. Accordingly, 54.5% of the respondents agreed that the soil was poor in fertility content. Following this situation, soil status influenced commercialization of RP production in the study villages. Furthermore, the study findings of this objective showed that there was a statistically significant relationship between biological factors and commercialization of RP production, making the null hypothesis rejected. Therefore, it was concluded that biological factors negatively influenced commercialization of RP production in the study areas in Rungwe District.

5.1.4 Environmental factors influencing commercialization of RP production

The study findings from chi-square test and descriptive statistics model, revealed that environmental factors influenced commercialization of RP production. For instance, potato plant and other related crops were sensitive to low temperature changes which were accompanied by fog which affected RP production. Accordingly, the study results indicate that 68.8% of the respondents agreed that temperature affected RP production. This

situation caused a negative impact on commercialization of RP production in the study villages.

Also, frost affected RP production in the study areas. The study results indicated that 70.3% of the respondents agreed that frost hazards had the potential of causing crop damage and especially to RP production. Smallholder farmers in the study area face a challenge especially when temperatures lead to frost. This influenced commercialization of RP production in the study areas.

The frequent occurrence of frost was a threat to the commercialization of RP production. Accordingly, the study results indicate that 69.8% of the respondents reported that frost occurred frequently and caused damage to their crop. It can therefore be concluded that frequent frost influenced commercialization of RP production in the study areas. Frost affected leaves of the crop through scotching them which ultimately caused a failure for the RP crop to produce good harvests making of commercialization of RP production unprofitable. The situation was critical in the months of April to July the period when temperatures were low. The study findings showed that temperatures dropped to a minimum range of 3^0C to 10^0C and as low as to -2^0C especially in the RP growing areas (Uporoto highlands) during the cold season; and this affected RP production and influenced commercialization RP production in the study areas.

Rainfall created conducive environment to the spread of crop diseases that affected RP production in the study areas. The study results indicated that 57.5% of the respondents reported that rainfall affected RP production. Heavy rainfall was a threat to RP production due to favouring late blight disease which is caused by water mould (*Phytopthora infestants*), which infests RP plants. The pathogen of the disease was favoured by wet

weather. The situation becomes severe especially in the months of December through May. At this time, the diseases are serious throughout the study area affecting the crop. This influenced commercialization of RP production in the study areas.

Furthermore, using chi-square test and descriptive statistics, the study findings revealed a statistically significant relationship between environmental factors and commercialization of RP production; this led to the rejection of the null hypothesis. Therefore, it is concluded that environmental factors negatively influenced commercialization of RP production in the study areas in Rungwe District.

5.2 Recommendations

5.2.1Recommendations for socio-economic factors influencing commercialization of RP production

(i)Aged people

Aged people in the District constituted the majority who dealt with commercialization of RP production. It is advised that since opportunities which are available for smallholder farmers in engaging in various livelihoods varied due to the existing socio-economic factors, this group should not be treated as homogeneous with other groups. Households made of aged people have different opportunities and constraints compared to other groups. So it is recommended that the government of Rungwe District should make some efforts to support this group of smallholder farmers by providing them with loans from financial institutions which could be established for this purpose. This will relieve them from working in labour intensity operations as they would now be able to hire labourers to work in their fields and access inputs for effective RP production.

(ii) Farmers' sex

The study findings revealed that women were the dominant group in the agricultural production activities. This influenced commercialization of RP production as they were

not able to make any improvement in the RP production operations as women were faced with many challenges. For instance, they had many responsibilities that made them fail to devote more time to RP production activities. They took care of families, cooked food, reared babies among many other things. In this case, it is recommended that gender equality in the commercialization of RP production among smallholder farmers should be integrated into the market economy and let all stakeholders (District Council) support the groups in dealing with constraints against participation in the commercialization RP production. Regarding the underperformance problem, this can be addressed and corrected by specific support and advice from both stakeholders and policy makers in the District which in turn will equip women to emulate the performance standards set by male counterparts.

(iii) Education level

Education in agricultural production particularly in RP production in the District was found to play an important role in improving commercialization of RP production as it endowed households with better production and managerial skills. Since the number of smallholder farmers with good education was low and most of them were joining secondary schools then it is advised that the District council should make sure agricultural extension services are directed towards training of rural farmers on the use of appropriate farm inputs, agronomic practices and access to markets. The District council authority should put more efforts in promoting improved productivity in RP production through investing in infrastructure, adoption of technology packages and inputs, reduction of input prices, promotion of public and private partnerships, supporting farmer-farmer approaches and encouraging the formation of farmers groups as a way of helping to spill over the existing knowledge among other groups.

(iii) Levels of incomes

Study findings revealed that the levels of incomes among smallholder farmers in the District led to the failure of commercialization of RP production in the study area, because most of the smallholder farmers had low incomes due to poor crop harvests. Incomes were found to influence smallholders' ability of accessing and using the available resources. Incomes are recommended to be improved by the district council through allocating smallholders with adequate resources such as human technical capacity and financial resources to enable them engaged in the RP production. Financial resources could be accessed to credit facilities that would enable smallholder farmers buy inputs (planting materials, fertilizers, pesticides and fungicides), pay wages and purchase machinery. To achieve this, the District Council should regulate modality of accessing loans from credit facilities which would be used to increase agricultural productivity and thereby enhancing commercialization of RP production. The government should also ensure that farmers' bargaining powers are enhanced through the provision of indicative prices, encouraging farmers to form groups and reduce transport costs through improved roads. Agricultural extension services should operate in line with credit facilities to make sure that the right standard and quantities of inputs are bought and are adequately applied to meet the expected results.

(iv) Markets

Markets were observed as a challenge in the District due to low and fluctuation of prices that affected commercialization of RP production. To address these challenges the District council should help smallholder farmers to form cooperatives and farmers' associations that would operate on behalf of their interests in regard to commercialization of RP production in the District. These institutions would look for market information as well as setting market prices for the crop based on the principle of supply and demand.

Furthermore, the District council should make sure it simplifies transportation of goods through improving roads and rail infrastructures.

(v) Land ownership

There was a problem of land availability in terms of size which also contributed to low harvests which ultimately influenced commercialization of RP production. This aspect needs collective efforts of the District council and other stakeholders in the District in educating and mobilizing smallholders on how to increase RP production through the expansion of areas of cultivation where possible or improve productivity per unit area in terms of using appropriate agricultural technology. Since commercialization of agriculture directly generates incomes, creates employment and increases agricultural labour productivity, agricultural extension services should be directed towards training of rural farmers on the use of appropriate farm inputs, agronomic practices and access to markets. The District Council should be advised to intensify its efforts in promoting improved productivity in agriculture by investing in infrastructure, supporting adoption of technology packages and inputs, reducing input price, promoting public and private partnerships, supporting research and extension or farmer-farmer approaches, ensuring that inputs are available to the farmers through provision of indicative prices and encouraging farmers to work in groups.

(vi) Cost of labour

To alleviate the challenge of cost of labour the District council should equip smallholder farmers with adequate resources such as input resources, financial facilities, and human technical capacity which would enable them acquire the necessary agricultural inputs to boost commercialization of RP production and therefore improve their financial economic status in coping with labour costs. It is also suggested that smallholder farmers should

form groups through which they can decide and agree on their passed decisions based on their own modality of setting labour charges on standardized rates. This would not only improve smallholder farmers' bargaining power but it would also raise farm gate prices as well as reducing transaction costs.

(vii) Other activities

Smallholder farmers in the District were found opting for other activities because commercialization of RP production involved a lot of costs that were not affordable. As such, off-farm activities appeared profitable as compared to commercialization of RP production. However, to address this issue the District council should promote commercialization of RP production through providing smallholder farmers with the required resources such as proper agricultural extension delivery services. The District should be enhanced with credit facilities such as the banks and SACCOS through which fair and desired ways of executing loans would be established. The available input providers should be effectively supervised to make sure that they provide inputs which are standard during the onset of the farming season and sell them at indicative prices.

(viii) Acreage cultivated

The study found that acreage cultivated was a challenge to smallholder farmers although increasing acreage was a good thing in improving production of the crop. However, the more the acreage was the more the quantities of inputs which are required to be applied. Considering that most of the smallholder farmers in the RP growing area in the District had low incomes, the application of inputs regime by most of these smallholder farmers was a problem. In view of this circumstance, the District council should enable smallholder farmers to access credits so as to enable them purchase inputs. The District council should also establish a strong operating system of input providers to make sure

that they provide services at indicative prices and that inputs are available throughout the growing season. Moreover, the agricultural extension delivery services should be strengthened to make sure that it operates closely with smallholder farmers to enable them achieve the required impact.

5.2.2 Recommendations for farmers' perception about RP production of RP production

Smallholder farmers in the study villages perceived commercialization of RP production negatively as they considered RP production activities as drudgery work, and despite that RP production was an intensive input activity and capital intensive crop agriculture was the only option, Furthermore, RP production activities were perceived to be constrained with farming resource services. Following this situation, most of smallholder farmers failed to invest seriously in commercialization of RP production business because of low incomes and limited means and resources to enable them bear the risks of crop failure. It is therefore suggested that, agricultural stakeholders and policy makers in Rungwe District Council should facilitate smallholders with technical and financial resources through creating opportunities of delivering technical services and access points of financial resources from credit facilities to enable them improve RP production and engage in commercialization of RP production.

The District Council should also, ensure that financial institutions are established to offer credits under fair collateral terms and make sure that inputs providers are available to farmers bargaining power. Moreover, the District council should provide indicative prices for inputs to encourage smallholder farmers to produce more RP. Agricultural extension services should enhance farmers' effectiveness in adopting farmers' field school approach in areas where either extension staff or resources are limited. This would improve the

technological status of different smallholder farmers and encourage other local people to participate in rising their agricultural productivity hence participate in the commercialization of RP production in the District.

5.2.3 Recommendation for biological factors influencing commercialization of RP production

(i) Problem of diseases and insect pests

The study findings reveal that there was a problem of diseases and insect pests to in the RP production; however, smallholders failed to control them because inputs such as fungicides were costly. Most of smallholders just bought little quantities of fungicides which didn't provide the recommended rates that could protect the crop from diseases as well as controlling pests from damaging the crop. It is therefore recommended that the District council should provide smallholders with adequate resources such as human technical capacity (agricultural extension agents), financial resources (credit facilities) and agricultural inputs such as improved varieties that resist diseases and of high yield, fertilizers and fungicides and at affordable prices. These would enable smallholder farmers to fight against diseases and pests.

(ii) Smallholder farmers' use of local varieties/seeds

The findings reveal that most of smallholder farmers didn't use improved varieties/seeds in RP production. Since the crop served as food and income source; therefore, the District council is advised to assist smallholder farmers through providing them with subsidies that would enable them to produce enough improved varieties/seeds so as to overcome the shortage of improved and clean seeds. It is also recommended that the District Council should collaborate with the Ministry of Agriculture to establish and strengthen the existing agricultural research institutions which can develop, certify, and supply adequate amounts

of improved and clean seed tubers. This would help in reducing the dominance of middlemen who sell seeds at hiked prices, instead they would make improved varieties/seeds and other inputs available for improving RP production.

(iii) RP production without fertilizers is not possible

In the production of RP the study findings reveal that it was impossible to produce RP without applying fertilizers and get bumper harvest. This is because owing to its physiological nature RP plant demands a high level of nutrients as it is relatively poorly developed and has shallow rooted systems. Since smallholders had low income and could not be able to buy fertilizers as recommended they ended up getting low yield. Therefore, it is recommended that the District council should facilitate farmers with the necessary inputs such as technical human capacity (agricultural extension agents) and financial institutions (credit facilities) to provide loans through any forum which the council could use to ease the problem and make smallholder farmers benefit from commercialization of RP production.

(iv) Status of soil fertility

To improve the status of soil fertility it is suggested that agricultural extension agents should educate smallholder farmers on how to properly manage the soil by avoiding deep ploughing and sometimes practice farming with minimum tillage or completely no tillage. This would reduce loss of phosphorus and enhance soil stability and fertility. On the other hand, the District council should prepare a strategy of equipping farmers with important resources such as agricultural inputs that would be accessed by smallholder farmers in the form of loans from the financial facilities to enable farmers purchase fertilizers and improve soil fertility which would in turn increase yield of RP production and increase the chances of engaging in commercialization of RP production.

5.2.4 Recommendations for environmental factors influencing commercialization of RP production

(i) Low temperatures accompanied with frequent rainfall

Research findings reveal that low temperatures which were accompanied with heavy rainfall contributed much to the impediment of RP production in the study area. The situation was mainly attributed to smallholder farmers' failure of purchasing fungicides which are very important preventive measures against RP diseases. Fungicides are chemical inputs which are commonly used in RP production to protect the crop against fungal diseases namely, early and late blight diseases. However, this material was reported to be costly and that most of the smallholder farmers could not afford them for RP production. Following this situation it is therefore recommended that the District Council should enable smallholders acquire the necessary agricultural inputs to boost commercialization of RP production by allocating them with adequate resources such as human technical capacity and designing a suitable modality of issuing loans from credit facilities. On the other hand, the District council which has the mandate of facilitating all development projects in the district should ensure that these inputs are accessible to smallholders through providing them (farmers) with indicative prices.

(ii) Challenge of frost

As for the challenge of frost, it is suggested that the District Council and its technical agricultural extension officers should sensitize and encourage smallholder farmers into considering adopting RP production based on two growing seasons namely, December to March RP growing season (although it is a wet season but it is a free frost season) and April to July RP production season which is desired and convenient to smallholder farmers in the study area. This new system would enable smallholder farmers benefit from both seasons and the loss of RP in the cold season would be compensated in the two seasons

rather than losing the crop in a single RP production season; assuming that all the necessary inputs are readily available and at indicative prices.

5.2.5 Future study

The future study should be on factors influencing increased use of purchased agricultural inputs in RP production in Rungwe District, Mbeya region.

REFERENCES

Aikaeli, J. (2010). Determinants of Rural income in Tanzania: An Empirical approach Research Report 10/4, Dar-es-Salaam. *REPOA*. Published for Research on Poverty Alleviation (REPOA) Dar-es-Salaam, Tanzania. P. 21. [*www.repoa.org.tz/document/rr10_4pdf*] site visited on 25/08/2016.

Aina, L. O. (2010). *Information Provision to Farmers in Africa: The Library- Extension Services Linkage. World library and Information Congress: 72nd IFLA General Conference and council*. Seoul, Korea. Department of Library and Information Studies. University of Botswana, Gaborone, Botswana. 20-24 August 2010/ 7pp. [*www.academia.edu/21068405/Information_Permision_to_farmers_in_Africa*] site visited on 24/07/2017.

Alderman, H. (2009). Managing risks to increase efficiency and reduce poverty. Background paper for the World Development Report.2009. World Bank, Washington DC. P. 26. [*siteresources.worldbank.org/INTWDR2008/Resources/ 2795087_1191427986785/Alderman_managing risks.pdf*] sited on 24/08/2016.

Anderson, W. L. and Ross, L. (2009). The Methodology of Profit Maximization Austrian Alternative. *The Quarterly Journal of Austrian Economics* 8(4): 31-44.

Applied Plant Research part of Wageningen UR (Eds.) (2012). *Business unit Arable Farming, Methods and Procedures for building sustainable Farming Systems (Application in the European Context).* Centre of Applied Economics Studies of the Atlantic Agricultural Sciences Department. University of Azores. 270pp. [*https://www.wageningen ur.nl/upload.mm/5/b*/.] site visited on 5/6/2016.

Armah, F. A., Yawson, D. O., Yango, G. T., Odoi, J. O. and Africa, E. K. A. (2010). Impacts of floods on livelihoods and vulnerability of natural resource dependent Communities in Northern Ghana. Department of Environment Science, School of Biological Sciences, University of Cape Coast, Ghana. *Scientific Journal* 2(2): 120-139.

Asian Development Bank (ADB) (2013). *Commercialization and Poverty Reduction: ADB briefing No. 10. A summary from research work from making Markets work better for the poor (MMW4P) Project*, ADB, Viet Nam. 25pp. [*https://www.google.com/search?hl=en&source=hp&q=ADB+2013+commercialization+and+poverty+reduction&oq=ADB*] site visited on 25/08/2017.

Astrat, S., Yusuf, M., Gersson, F. and Wale, E. (2009). Lessons for on-farm conservation and technology adoption Farmers' preferences for crop Varieties Traits: Environment for Development, Discussion paper series, *Journal of Agrarian Change. Issues in the Political Economy of Agricultural Biotechnology* 10(3): 342-366.

Aydin, Z. (2010). The new Right, Structural Adjustment and Turkish Agriculture*:* Rural responses and Survival Strategies. *The European Journal of Development Research* 14(2): 183- 208.

Babbie, E. L. (Eds.) (2013). *The practice of Social Research six editions: The Basics of Social Research.* © 2014, 2011 Wadsworth, Cangage Leerning. United States Copyright act. The Publisher: Library of Congress, Davis Drive. Belmot, CA

94002-3098, USA. 503pp. [*https://books.goggle.co.tz/books?hl=end id=w*] site visited on 25/7/2016.

Bank of Tanzania (BoT) (2010). *Monthly Economic Review*. September, 2010. 27pp

Barret, C. (2008). *Smallholder Market Participation*: *Concepts and Evidence*. Eastern and Southern Africa. 317pp. [*https://entwicklungspolitik.uni-hohenheim.de/uploads/media/smallholder_market_participation.pdf*] site visited on 11/11/2016.

Bhajantri, S. (2011). Production processing and marketing of potato Kernetaka –an economic awards. 117p *[http://agriccansearch.Umn.edu/bitstream/113945/2/my%20Thesis.pdf*] site visited on 7/11/2018.

Bilonkwamagaza, M. F. (2010). Role of informal Agricultural Information Dissemination networks in Poverty Alleviation in Njombe District. Dissertation for Award of MSc Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 180pp.

Bishaw, S. and Van, G. (2012). *Farmer seed net-works make a limited contribution to Agriculture? Four common misconceptions*. Ethiopia, Addis Ababa. 50pp. [*journalhomepage:www.elsevier.com/locate/foodpolicy*] site visited on 25/7/2016.

Brickley, A. (2014). Tanzania: *Challenges and Opportunities for the Small Farmers.* Bricley Lewis Central High school, Tanzania. 7pp. [*www.worldfoodprize.org/documents/filelibrary/images/youth_programs/research_papers/LewisCentral_ABrickley_IA_I*] site visited on 24/08/2017.

Centro International de la Papa (CIP) (2012). 2012- The International Year of Potato. *Journal of Food Composition and Analysis* 22(6): 491-626.

Chaleunvong, K. (2009). Data collection techniques. Training Course in Reproductive Health Research Vientine. [https://www.gfmer.ch/.../ Data_collection_ tecniques _Chaleunvong_Laos_2009.htm] site visited on 24/08/2016.

Clair, S. B. and Lynch, J. P. (2010). The opening of Pandora's Box*:* Climate Change Impacts on soil fertility and Crop nutrition in Developing Countries. *International Weekly Journal of Science, Plant and Soil* 335(2): 101-115.

Creswell, J. W. (2010). *Research Design*: *Qualitative, Quantitative and Mixed Methods Approaches, 2nd edition.* Sage Publications, Thousand oaks, London and New Delhi. 246pp. [*www.ceil-conicet.gov.ar/wp-content/uploads/2015/10/creswell-Cap-10.pdf*] site visited on 11/11/2016.

Da Corta, L. and Higgins, K. (2010). Enhancing the qualitative dimension in mixed methods (Q2) research in chronic poverty: *Lessons learnt in establishing a qualitative basis for policy making in Tanzania draft for Chronic Poverty Research Centre- International Conference entitled Ten Years of War Against Poverty: What have we learnt since 2000 and what should we do 2010- 2020?* Books World Poverty Institute, at the University of Manchester 2010. August, 2010. 40pp. [*https:www.google.com/search?rlz=1C2AVING_enTW689& source =hp&q=da+corta%2CI.and+haggins%2C+K.2010*] site visited on 25/08/2017.

De Janvri, A. and Sadoulet, E. (2010). Subsistence farming as a safety net for food price shocks. Department of Agricultural and Resource Economics, University of Califonia, Berkeley. *Journal Development in Practice* 21(5): 480-492.

Dercon, S. (2010). Fate and fear*:* risks and consequences in Africa. *Journal of African Economics* 17(2): 97-127.

Diao, X. and Hazell, P. (2009). *Exploring Market Opportunities for African smallholders. 2020 Africa Conference Brief No. 6. IFPRI*: Washington, DC. 5pp. [*https://www.google.com/scholar?q=diao,+x.,+hazel,+p.+2004+exploring+market+opportunities+for+African..&hl=en*] site visited on 15/08/2016.

Diao, X. J., Tharlow, S. and Fan, S. (2012). Strategies and priorities for African agriculture: Economy perspectives from country studies. Washington, DC, International Food Policy Research Institute (IFPRI). 55pp. [*Edupot, wur,nl/278987*] site visited on 6/11/2018.

Doss, C. R. (2009). Effects of women's bargaining power on household health and education outcomes*: Evidence from Ghana*. *Paper read at Population Association of America meetings*, 27-29 March 1997, Washington, D.C. 59pp. [https://scholar.google.com/scholar?q=doss+c.+r.+1997+effects+of+women%27s+bargaining+power+on+households] site visited on 15/08/2016.

Enete, A. A. and Igbokwe, E. M. (2009). Cassava Market participation Decision of Household in Africa *Journal Tropiculture* 27 (3): 129-136.

European Environmental Agency (2010). *Europe's environment, the third assessment. State of Environment report No 1/2003*. Copenhagen. 10pp [*https://ec.europa.eu/research/agriculture/scar_forsight_environment_en.pdf*] site visited on 25/7/2016.

Evaluation of Ethiopian Agriculture (EEA) (2010). *EEA with particular emphasis on the Participatory Demonstration and Training Extension System (PADETES): Research report.* Ethiopian Economic Association/Economic Policy Research Insitute, Addis Ababa, Ethiopia. 63pp. [*https://scholar.google.com/scholar?q=eea+2010+eea+with+particular+emphasi.*] site visited on 16/08/2016.

FAO (2011). World Census of Agriculture: analysis and international comparison of the results (1996-2005). FAO Statistical Development Series No. 13. (Columns 3 and 4). Rome. [www.fao.org/3/a-i6618e.pdf] site visited on 24/08/2016.

FAOSTAT (2008). Potato World: Production and Consumption [*https://faostat.fao.org.default.aspx*] site visited on 1/5/2009.

FAOSTAT (2013). FAO Production Statistics. Rome, Food and Agriculture of the United Nations (FAO).

Field, A. (2000). *Discovering Statistics Using SPSS for windows*, SAGE: Publishing, London. 470pp. [sutlib2.sut.ac.th/Sut_Contents/H124897.pdf.] site visited on 11/11/2016.

Fisher, E. (Ed.) (2000). *Beekeeping, Livelihoods and Rural Development. In Bradbear, . Strengthening Livelihoods. Exploring the Role of Beekeeping in Development. Bees for Development*, Man mouth, U.K. 34pp. [*centaur.reading.ac.uk/32347/*] site visited on 11/11/2016.

Food and Agricultural Organization (FAO) (2010). *The state of Food and Agriculture 2010-2011, women in Agriculture: Closing the gender gap for development.* 23pp. [*www.fao.org/docrep/013/i2050e00.htm*] site visited on 18/08/2017.

Food and Agricultural Organization of United States (FAO) (2010). The state of Food insecurity in the World: Economic crisis-impacts and lessons learned. FAO. Rome. 55pp [*http://www.fao.org*] site visited on 25/10/2010.

Gabagambi, D. M. (Eds) (2007). Towards a paradigm shift in revolutionalising Tanzania's agriculture. In: Research initiatives for improvement of livelihoods: Contribution of SUA and her partners 2009. *In: Proceedings of the Fourth Annual PANTIL Scientific Conference*, Morogoro, Tanzania, 19-21 October 2009. 25-38pp. [*https://scholar.google.com/scholar?hl=en&_sdt=0%2C+d+m.2009+towards*] site visited on 11/11/2016.

Gabagambi, G. M. and Hella, J. P. (2014). Assessment of operational aspects of the input supply chain under national agricultural input voucher scheme (NAIVS) in Tanzania. Mikocheni Agricultural Research Institute Dar-es-Salaam, Tanzania. Department of Agricultural Economics and Agribusiness Sokoine University of Agriculture, Morogoro-Tanzania. *Journal of Development and Agricultural Economics* 6(3): 94-104.

Gebremedhin, B. and Jaleta, M. (2010).Commercialization of smallholders*: Does Market orientation translate into market participation.? Improving Productivity and Market Success (IPMS) of Ethiopian Farmer Project Working Paper* No. 22. International Livestock Resarch Institute, Addis Ababa, Ethiopia. 30pp.

Gildemacher, P. R., Demo, P., Barker, I., Kaguongo, W., Woldegiorgis, G., Wagire, W.W., Wakahiu, M., Leeuwis, C. and Struik, P. C. (2009). A description of Seed Potato Systems in Kenya, Uganda and Ethiopia. *American Journal of Potato Research (2009)* 86(5): 373-382.

Glaser, B. G. and Strauss, A. L. (2010). *The Discovery of Grounded Theory: Strategic for Quantitative Research.* Chicago, Aldine. 271pp. [*https://my.rcn.org.uk/_data/assets/pdf_file/0007/253249/2009_RCN_research_8.7.1.pdf*] site visited on 11/11/2016.

Gollin, D. (2010). *Agricultural Productivity and Economic Growth Handbook of Agricultural Economics.* Vol. 4. 3866pp. [*https://a4f8c630-a-62cb3ala-s-sites.googlegroups.com/site/douglasgollin/*] site visited on 11/11/2016.

Hamachandra, D. and Kodithuwakku, S. (2010). Business orientation among poor dry zonal farmers in *Srilancan Journal of Agricultural Economics* 8: 31-49.

Haule, C. B. M. (2009). Assessment of change in smallholder farmers' livelihoods due to land degradation in Ludewa District, Tanzania. Thesis for Award of PhD Degree of Doctorate at Sokoine University of Agriculture, Morogoro, Tanzania. 180pp.

Haule, M. E., Laswai, G. H., Mwaseba, D. L., Kimambo, A. E., Madsen, J., Mtenga, L. A., and Mwilawa, A. J. (2010). An assessment of attitude toward selling livestock among pastoralists in Ngorongoro District of Tanzania the 5th All Africa Conference on Animal Agricultural commercialization of Livestock. *Agriculture in Africa: Challenges and opportunities.* United Conference Centre, 25-28 October 2010. Addis Ababa, Ethiopia. 1-24pp. [*https://www.google.com /scholar?q=haule+et+al+2010+an+assessment+of+attitude+toward+selling=l ivestock&hl=e*] site visited on 10/07/2016.

Hegazy, S. (2009). *Seed potato Production in Egypt*. Agrofood co. Cairo-Egypt. 3pp. [*www.unece.org.net4all.ch/fileadmin/DAM/trade/meetings/ge.06/2009/Egypt_PP Ts/S4_Saleh Hagazy. Pdf*] site visited on 11/11/2016.

Hemachandra, D. and Kodithuwak, S. (2010). Business orientation among poor dry zone farmers in Sri Lanka. *Journal Agricultural Economics* 8(1): 31-49.

Henry, C., Foss, L. and Ahl, H. (2010). Parallel lines? A Thirty-Year review of Methodological Approaches in Gender and Entrepreneurship Research. Entrepreneurship Theory and Practice. *Journal of Business Venturing* 23(9): 1-21.

Holmem, H. and Hyden, G. (2011). *African Agriculture: From crisis to Development:* Department of Geography, Linkoping University, Linkoping Sweeden: University of Florida, Guinesvvilla, USA. (Edited by Goran, D. *et al*.), 5 – 10 June 2016. UK. 354pp. [*https://www.google.com/search?rlz=1C2AVNG_ en*

TZ689TZ&source=hp&q=ho;e;+%2C+h.+and=hydn%2C+g+2011] site visited on 02/08/2017.

Hu Yu Huang, Z., Hendrikse, G. and Xu, X. (2010). Organisation and Strategy of Farmer, Specialized Cooperatives in China. ERIM Report Series. Research in Management Rotterdem. *Official Journal of the Interaction Food and Agribusiness Management Association* 14(4): 1-75.

Ian, C. (2012). *Food and Agriculture Organization, Office of Knowledge Exchange*. Research and Extension Global Forum for Rural Advisory Services 272pp. [*www.fao.org/research and extension/en/*] site visited on 15/07/2016.

Ibnouf, F. O. (2011). *Challenges and Possibilities for Achieving Household food Security in the Western Sudan region: The role of female farmers*. Sudan, Khartoum. 3(2): 231pp.

IFAD (2011). Rural Poverty report. New realities new challenges: New opportunities for tomorrow's generation. International Farm Management Association and Institute of Agricultural Management, Rome, Italy. *International Journal of Agricultural Management* 1(3): 4pp.

International Food Policy Research Institute (IFPRI) (2005). *The future of small farms:* Proceedings of a Research workshop, Wye, UK, 26-29 June 2005. Washington, DC. 1348pp. [*iri.columbia.edu/=jhansen/Sonja/10.1.1.139.3719pdf*] site visited on 10/07/2016.

International Monetory Fund (IMF) (2012). W*orld Economic Outlook, October, 2012: Coping with High Debit and Sluggish Growth.* Washington DC. 255pp.

Jaln, R. C. A. (2014). *Challenges in Implementing Agriculture Insurance and Re-insurance in Developing Countries.* Kigali Ruanda. 65pp.

Jamali, K. (2009). The role of Rural women in Agriculture and its allied Fields: a case study of Pakstan. *European Journal of Social Sciences* 7(3): 71pp.

Jayne, T. S., Hagblade, S., Minot, N. and Rchard, S. (2011). *Agricultural Commercialization, Rural Transformation and Poverty Reduction; what we have learned about How to achieve this? Synthesis Report prepared for the African Agricultural Markets Programme Policy Symposium.* Alliance for Commodity Trade in Eastern and Southern Africa. 20-22 April 2011, Kigali, Ruanda. 25pp [*https://agriknowledge.org/downloads/wd.375w335*] site visited on 10/06/2016.

Kabungo, C. V. (2008). Evaluation of Irish Potato Production and Marketing performance: A case study of Mbeya Rural District. Unpublished Dissertation for Award of MSc Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 89pp.

Kamau, P. (2010). Farmers are now producing potato seeds. The news paper for sustainable agriculture in Kenya. National Resource (NR) 3 June. [*www.infonet-biovision.org/sites/default/files/470.org_farmer2_reduced.pdf*] site visited on 15/06/2016.

Kammizzaman, M. and Takeya, H. (2008). Importance of Structural change and Factors affecting Production of Vegetables in Bangladesh. *International Journal of Agricultural Research* 3(6): 397-406.

Kenwar, A. A. (2010). Risk management for bank in Pakistan, Karachi. *Market Forces* 1(1): 7pp.

Kherallah, M. and Kirsten, J. F. (2010). *'The New Institutional Economics are the blue collar guys with a hearty appetite for reality.' Washington DC.* Vol. 41 (2): 50PP. [*www.tendfontline.com/doi/abs/10.1080/03031853*…] site visited on 10/6/2016.

Kilima, F. T. M., Mbiha, E. R., Erbaugh, J. M. and Larson, D. W. (2010). Adoption of improved agricultural technologies by smallholder maize and sorghum farmers in Central Tanzania. *Eastern and Southern African Journal of Agricultural Economic Development* 1(7): 24-54.

Kinabo, J. (2014). *The Policy Environment for linking Agriculture and Nutrition in Tanzania*. Agri Diet working paper 1 65pp. [*http://agridiet.ucc.ie/wp-content/uploads/sites/2/2014/11/Joyce-WP2-FinalDraft-update-31-oct-2.pdf*]. site visited on 15/01/2017.

Kintomo, O., Connaughton, M., Obajida, A., Taiwo, L. and Afoloyani, S. (2008). *Assessment of irrigation Systems for Dry season Vegetable Production in Urban and Peri-urban Zones of Ibadan and Lagos South western Nigeria* 6(2): 236-243.

Kirsten, J., Mapila, M., Okello, J. and De, S. (2012). Managing agricultural commercialization for inclusive growth in Sub-Saharan Africa: *Policy research paper 1, The global Development Network*. 33pp. [*www..gdn.int/admin/uploads/ editor/files/SSA_1_ResarchPaper_Agricultural commercialization.pdf*] site visited on 15/012016.

Koizuni, M. (2007). Comparative study of farming systems in South-Western Tanzania: Agrarian adaptation in a socio-historical perspective. *African Study Monograph* 34: 1-20.

Kumar, R. (2011). *Research Methodology, 3rd edition. Sage*, Los Angeles, London, New Delhi, Singapore and Washington DC. 415pp.

Leeuwis, C. and Struik, P. C. (2013). A description of Seeds Potato Systems in Kenya, Uganda and Ethiopia. Publisher: Springer, New York. *American Journal of Potato Research (2009)* 86(5): 373-382.

Li,Y., Liu, J. and Deng, R. (2010). *New and Future Development in Catalysis: Catalysis for Remediation and Environmental concerns.* Department of Chemistry and Chemical Engineering and Institute of Material Science. The University of Connecticut. 399pp. [https://books.google.co.tz/books?id=2KEZL6i32MAC &pg..] site visited on 10/10/2016.

Lupilya, G. S. (2010). Assessment of Social Support Projects for vulnerable groups towards Poverty Reduction in Bukoba district. Dissertation for Award of MA Degree at Sokoine University of Agriculture, Morogoro Tanzania. 112 pp.

Mac Nicol, R., Ortman, G. F. and Ferrer, S. R. D. (2011). *Perceptions of Key Business and Financial Risks by Large Scale Sugarcane Farmers.* Kwa Zulu Natal in a dynamic socio-political environment Agrekon. Vol. 42(2): 145-151.

Makhurah, M., Kirsten, J. and Delgado, C. (2010). *Transaction Costs and Smallholder Participation in the Maize Market in the Northern Province of South Africa.* South Eastern and Southern Africa regional Conference, 5-11 February 2010. 467pp.

Martey, E., Ramatu, M. A. and Kuwornur, J. K. M. (2012). Commercialization of Smallholder agriculture in Ghana: A Tobit regression analysis. Department of Agricultural Economics and Agribusiness Legon-Accra Ghana. *African Journal of Agricultural Research* 7(14): 2131 – 2141.

Mashindano, O. and Maro, F. (2011). *Growth without Poverty reduction in Tanzania;* Reasons for mismatch working paper, July 2011 No 207. 25 pp. [*https://r4d.dfid.gov.uk/PDF/output/chronic_RC/WP207-mashindanoandmaropdf*] site visited on 12/08/2015.

Maswaga, K. A. S. (2013). Potential and limitations of resettling pastoralists in agricultural areas in Songea District, Tanzania. Thesis for Award of PhD degree at Sokoine University of Agriculture, Morogoro, Tanzania. 153pp.

Mbeya Regional Secretariat (2013). Searches related to Mbeya Regional Secretariat. 22pp. [https://www.goggle.com/#q=Rungwe+district+villages] site visited on 31/5/2016.

Mboya, R., Tongoona, P., Yobo, K. S., Derera, J., Madhera, M. and Langyintuo, A. (2011). The quality of maize stored using roof and sack stored methods in Katumba Ward, Rungwe District, Tanzania: Implication on household food security. *Journal of stored Products and Postharvest Research* 2(9): 189-199.

Mekomen, S., Alemu, T. Kassa, B. and Forbes, G. (2011). *Evaluation of contact fungicides spray regimes for control of late blight* (*Phytopthora infestans*) *in Southern Ethiopia using potato cultivars with different levels of host resistance*. Tropical Plant Pathology, 3b. 27pp. [https://www.wageningenur.nl/upload_mm /5/b/a/44-] site visited on 31/5/2016.

Mende, D. H., Mwatawala, M. W. and Kayunze, K. A. (2014). Contribution of Round Potato Production to Household income in Mbeya and Makete Districts, Tanzania. *Journal of Biology, Agriculture and Healthcare* 4(18): 1 – 4.

Michener, H. A., Delamater, J. D. and Myers, D. J. (2004). *Social Psychology* (*Fifth Edition*). Thompson Wadsworth, Australia. 106pp.

Ministry of Agriculture and Animal Resources of Ruanda (MINAGRI) (2013). COUNTRYSTAT Rwanda. 241pp. [www.minagri.gov.rw/fileadmin/user_ upload/documents/AnnualReports/AnnualReport_RportFY_2010_2011pdf] site visited on 20/06/2017.

Mitiku, A. (2014). Impact of smallholder farmers Agricultural Commercialization in Rural households' Poverty. Department of Agricultural Economics and Extension, Jimma University, Jimma Oramia Regional State Ethiopia. *The International Journal of Applied Economics and Finance* 8(2): 5-61.

Mnenwa, R. and Maliti, E. (2010). *Comparative analysis of Poverty Incidence in Farming system in Tanzania.* special paper published for Research and Poverty Alleviation (REPOA) Dar-es-Salaam, Tanzania. 37pp. [www.repoa.or.tz/ documents/10-4_web_1.pdf] site visited on 16/08/2017.

Mntambo, B. D. (2010). Social Economic Institutional and Behavioural of Determinant of Accessibility and Utilisation of Agricultural Information by women Farmers in Korogwe District, Tanzania. Dissertation for Award of MA Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 150pp. [www.is.cityu.ed.hk/ staff/is.robert/ejisdc/51-6pdf] site visited on 10/07/2016.

Moskin, J. (2009). Outbreak of Fungus Theratens Tomato crop. The New York times, [https://en.wikipedia.org/wiki/phytopthora_infenstans] site visited on 31/5/2016.

Mpogole, H. (2012). Round Potato Profitability and implications for Variety Selections. *Journal of Development and Agricultural Economics* 4(9): 258 – 267.

Mpogole, H., Malchior, E., Mlambiti, R. and Kadigi, M. J. (2013). Round potato production in Southern Highlands of Tanzania: Are Smallholder Farmers Becoming Commercial? *Journal of Agricultural Extension and Rural Development* 4(14): 385 – 391.

Muthomi, J., Shimelis, H. and Melis, R. (2013). Potato production in Kenya: Systems and Production Constraints. *Journal of Agricultural Science* 5(5): 1-182.

Mwakaje, A. (2010). Information and communication Technology for Rural farmers. *Journal of Information Technology Impact* 10(2): 111-128.

Namwata, B. M. L., Lwelamira, J. and Mzirai, O. B. (2010). Adoption of improved agricultural technologies for Irish potatoes (*Solunum tuberosum*) among farmers in Mbeya Rural District, Tanzania. Dissertation for Award of MA Degree at Sokoine University of Agriculture, Morogoro, Tanzania. *Journal Animal Plant Sciences* 8(1): 927-935.

National Adaptation Programme of Action (NAPA) (2012). Update of Projects and Profiles. 12-58pp. [*www.nec.gov.bt/nec l/wp-content/uplods/2013/04/nepa.pdf*] site visited on 7/11/20/2018.

National Bureau of Statistics (2013). Ministry of Finance June, 2013. 16pp. [www.nbs.go.tz/nbs/takwimu/references/Tanzania_in_figures2012.Pdf] site visited on 24/07/2017.

Nicole, M., Mason, T. S., Jayne, C. D. and Chapoto, A. (2011). *Are staple foods becoming More Expensive for Urban Consumers in Eastern and Southern Africa?* Trends in Food prices Marketing Margins and Wage Rates in Kenya, Malawi, Mozambique and Zambia. Development of Agricultural, Food and Resource Economics, Paper presented at the Institute for African Development Conference, 1-2 May 2011. Cornwell University, New York. 32p. [www.ifpri.org/publication/food-and-financial-crises-sub-saharan-african] site visited on 10/06/2016.

Njuki, J., Kaaria, S., Chamunorwa, A. and Chiuri, W. (2011). Linking smallholder farmers to markets, gender and intra-household dynamics; does the choice of commodity matter? *European Journal of Development Research* 23(3): 426-443.

Nkumba, J. M. (2007). Assessing adoption and economic impacts of new banana varieties on livelihoods of farmers in Kagera region in Tanzania. Thesis for Award of PhD Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 200pp.

Nyunza, G. and Mwakaje, A. (2010). Analysis of Round potato marketing in Tanzania: The case of Rungwe District, Tanzania. Institute of Resource Assessment University of Dar-es-Salaam. *International Journal of Business and Social Science* 3(23): 86 – 96.

Olomi, D. R. (2007). *Unleashing Entrepreneurial potentials of the poor in Tanzania prospects, Challenges and way forward*. Working paper for presentation to the High level Commission on the Legal Experiment of the poor. 27pp.

Olwande, J. and Mathenge, M. (2010). *Market Participation among the poor Rural households in Kenya Tegemeo Institute of Agricultural Policy and Development.* Selected paper prepared for Presentation at the International Association of Agricultural Economics (IAAE) Treennial Conference, Foz do Iguaacu, Brazil, 18-24 August 2012. 29pp. [*ageconsearch.umn.edu/bitstream/126711/1/olwande.pdf*] site visited on 10/06/2016.

Omiti, J. M., Otieno, D. J., Nyanamba, T. O. and Mccullocegh, E. (2009). Factors influencing the intensity of Market Participation by Smallholder Farmers: A case

study of Rural and Peri-urban areas of Kenya. *African Journal Agricultural Resource Economics* 3(1): 57-82.

Organization for Economic Cooperation and Development (OECD) (2010). *Turning African Agriculture into a business: The end of African Peasants: From Investment Funds and Finance Value-chains to Peasants related questions.* Paper presented at the International Conference on Global Land Grabbing 6-8 April, 2011 organized by the Land Deals Politics Initiative (LPD) in collaboration with the Journal of Peasant Studies at the Institute of Development Studies of University of Sussex. 16pp. [www.oecd.org/dataoecd/58/56/4222987772.pdf.] site visited on 12/8/2015.

Parkin, M. (2010). *Microeconomics*, 9th ed., Boston: Addison-Wesley. pp274-275.

Patsalos, K. (2005). The cultivation of potatoes. Department of Agriculture, Edition 9/2005. The Scientific Reports 3-Potatoes Gregorious. Nicosia Cyprus. 7pp. [http://www.cyi.ac.cy/images/AGWATA_scientific-Reports3-Potatoes_ Gregorious.pdf] site visited on 12/8/2015.

Pender, J. and Alemu, D. (2007). *Determinants of Smallholder Commercialization of Food crops:* Theory and evidence from Ethiopia. IFPRI discussion papers No. 00745. December, 2007. International Food Policy Research Institute (IFPRI), Washington, DC. 74pp. [ageconsearch.umn.edu/bitstream/42354/2/IFPRIDP00745.pdf] site visited on 12/08/2015.

Penson, J. B., Capps, O., Rosson, C. P. and Woodward, R. T. (2010). *Introduction to Agricultural Economics,* 4th *edition*. Pearson education, Upper Saddle River, New Jessey, Columbus and Ohio. 494pp.

Pingali, P. L. (2008). *Agricultural Renaissance: Making 'Agriculture for Development*'. Work in the 21st Century. *Hand Book Agric. Econ*. 4: 3867-3894.

Poole, N. and de Frece, A. (2010). *A Review of Existing Organizational Forms of Smallholder Farmers Associations and Their Contractual Relationships with Other Market Participants in the East and Southern Africa ACP Region.* AAACP Paper series, No. 11 Food and Agriculture Organisation (FAO). 106 pp.

Poulton, C., Tyler, G., Hazell, P., Donard, A., Kydd, J. and Stakbridge, M. (2008). Commercial Agriculture in Africa: Lessons from success and failure. Background paper for competitive agriculture in Sub Saharan Africa study.World Bank: Washington, DC. 9-10pp. [*www.academic Journals.org/app/web root/article/article 1380881227_Zhou%20 el.pdf*.] site visited on 7/11/2018.

Radhakrishna, R. B., Fransisco, C. L. and Bagget, C. D. (2013). *Analysis of Research Designs Used in Agricultural and Extension education*: Proceedings of the 30th National Agricultural Education Research Conference. 541pp. [*https://scholar. google.com/scolar?lookup=&q=radhakrishna.*.] site visited on 04/9/2017.

Rahut, D. B. Sehoo, P. and Castellanos, I. V. (2010). *Commercialization of Agriculture in the Himalayas:* Institute of Developing Economics. IDE Discussion Paper No.

265. 24p. [*https://ir.ide.go.jp/dspacebitstream/2344/931/1/APRIDE_Discussion _N0.265_rahut.pd*f] site visited on 12/05/2015.

Rao, S. and Narayan, J. (1998). Define perception as the process whereby people select, organise and interpret sensory stimulations into meaningful information. 1-17pp. [*http://www.google.com/search?r/z=/c2AUNG_en TZ*] site visited on 7/11/2018.

Renger-Metzger, A. and Diehl, L. (2009). *From Household Systems in Northern Ghana. Agricultural Research Report 9*. Nyankpela Agricultural Research Station. Tamale, Ghana. 249pp. [*https://www.ajol.info/index.php/just/article/viewfile/ 32916/63391*] site visited on 12/05/2015.

Rohrboch, D. D. (2009). *The Economics of Smallholder Maize Production in Zimbabwe: Implications for Food Security.* East Lansing, Michigan State University, Michigan.100pp. [https://searchworks.stanford.edu/view/242805] site visited on 12/05/2015.

Rudmann, C. (Ed.) (2008). *Entrepreneurial Skills and their role in Enhancing The Relative Independence of Farmers.* Results and Recommendations from the Research Project Developing Entrepreneurial Skills of Farmers. Research Institute of Organic Agriculture, Frick, Switzerland. 559pp. [orgprints.org/ 18064/1/rudmann-etal-2008-esof.pdf] site visited on 12/05/2015.

Sabatier, P. A. and Mazmanian, D. A. (1986). The Implementation of the Public Policy: Aframework of Analysis. *Policy Studies Journal* 8: 538-560.

Scott, G. J., Laborta, R. and Suauzi, V. (2013). Booms bursts and emerging markets for potatoes in East and Central Africa 1960-1020. Potatoe Research. 1-32pp.

Shiferaw, B., Hellin, J. and Muricho, G. (2011). Improving market access and agricultural productivity growth in Africa: *What role for producer organizations and collective action institutions? Food Security* 3(4): 475-489pp. [repository. cimmyt.org/xmlui/handle/10883/2219] site visited on 16/04/2017.

Smale, M., Bellon, M. R. and Gomez, J. A. (2010). Maize diversity, Variety attributes and Farmers choices in Southern Guanajuato, Mexico. *Economic Development and Cultural Change Journal* 50(1): 201-225.

Sokoni, C. H. (2008). Commercialization of Smallholder Production in Tanzania: Implications to sustainable resource management. *The Geographical Journal* 174(2): 158 – 161.

Starling, G. R. (2008). Biological control of Plant parasitic Nematodes 2nd Edition, *July, 2008 Journal Books, Biological Control* 46(1): 15-23.

Stein, P. (2010). *The Economics of Burundi, Kenya, Ruanda, Tanzania and Uganda*. Report prepared for Swedfund International AB. April, 2008. 57pp. [*http://www.swedfund.se*] site visited on 30/02/2015.

Sumra, S. and Rajani, P. (2006). *Secondary Education in Tanzania*: Key Policy Challenges. Working paper No. 4. 8p. [hakielimu.org/files/publications/

document34secondary_ed_tz_policy_challenges en.pdf] site visited on 16/04/2017.

Talcott, P. (2013). *Structural-functional theory in sociology. Causation and Functionalism in Sociology*. Published in 1998 by Routeledge. Reprinted in 2000, 2002. by Routeledge. First issued in 2010. 44pp. [*faculty.lahoreschool.edu.pk/Academics/ lectures/anis/Functionalism.pdf*] site visited on 15/04/2016.

Tanzania Economic Outlook, (2017). *Contribution of agriculture to the economy of Tanzania.* pp11-17. [tz-budget-economic-outlook-2017.pdf] site visited on 25/10/2018.

Ulen, B. M. and Kalisky, T. (2005). Water erosion and phosphorus problems in an agricultural Catchment-Need for natural research for implementation of the EU Water Frame-work. Directive. *Journal of environmental Science and Policy* 8(5): 477-484.

URT (2007). *Iringa Region Socio-Economic Profile.* National Bureau of Statistics (NBS) and Iringa Regioners' office. 274pp.

URT (2009). Investment Potential and Opportunities in Agriculture (crop subsector). Ministry of Agriculture, Food Security and Co-operatives. 36pp. [www.usa-journals.com/wp-content/uploads/2015/06/chongela/vol37.pdf] site visited on 22/09/2015.

URT (2010). Rungwe Socio-economic profile. *Journal of Information Technology Impact* 10(2): 111-128.

URT (2010). Tanzania Development Vision 2025 (MKUKUTA) Statement of Tanzania (NSGRP). The National Strategy for Growth and Reduction of Poverty (NSGRP or MKUKUTA in Kiswahili). 170pp. [*www.international.gc.ca/development-development/assets/pdfs/countries-pays/National-Strategies-for-Growth.*.] site visited on 15/4/2016.

URT (2011). Review of the Tanzania Development Vision 2025. Vol. 1 Main Report, Presidents' Office Planning Commission (POPC, Dar-es-Salaam TZ). 118pp. [*https://www.oecd/org/daf/inv/investment-policy/FPR-Tanzania-2013-overview. Progress-Policy-Challenges.pdf*] site visited on 15/04/2016.

URT (2012). Agricultural Public Expenditure Review (PER) for input Support Programme for FY 2012/13. 79pp. [*www.tzdpg.or.tz/fileadmin/documents/external/public_expenditure_review/Reports/PER_NAIVS_Tanzania_FinalReport-March.*.] site visited on 15/04/2016.

Valentinovo, V. and Baum, S. (2011). The Institutional economics of rural development: Beyond market failure. *Journal of Central Eropean Agriculture* 9(3): 457- 462.

Vein, A. and Botiono, S. (2008). Factors affecting Agricultural Production in Tigray Region, Northern Ethiopia. Thesis for Award of PhD Degree at the University of South Africa. 140pp. [uir.unisa.ac.za/bitstream/handle/10500/19072/thesis_ bihon_ kassa_abrha.pdf?sequence] site visited on 12/05/2016.

Vijay, J. K. (2009). Commercialing new knowledgies. Getting from mind to market: Harvard Business School Press. New edition early 2009. 29p. [*http://en.wikipedia.org/wiki/commercialization*] site visited on 6/11/2018.

Voh, J. P., Ahmed, B., Olufajo, S., Dike, M. and Ishaku, F. (2010). Adoption of improved cowpeas technologies in the savannah ecology of Nigeria. A report of survey conducted on PEDUNE/PRONAF project in Nigeria by Institute for Agricultural Research, Ahmadu Bello University Samaru-Zaria, Nigeria. 29pp. [*www. fidefrique.net/IMG/pdf/technology_adoption_Pronaf-Nigeria.pdf*] site visited on 12/05/2016.

Webb, L. and Snyder, R. L. (2016). *Frost Hazards Encyclopedia of Natural Hazards part of the series*. Encyclopedia of Earth Sciences Series. 366pp. [*https://www. sringer.com/cda/content/document/cda_download/document…*] site visited on 12/5/2016.

William, K., Phillip, W., Ray, H. and Dave, D. (2013). Michigan Potato diseases. Department of Plant Pathology, Michigan State University. 4pp. [www. potatodiseases.org/lateblight.html] site visited on 20/05/2016.

Williford, J. and Zimba, P. (2008). *Renewable Agriculture and Food Systems/ Vol.23/Special issue 04/December 2008*, Cambridge University Press 295pp. [https://scholar.google.com/scholar?q=williford+j.+r.+and+zimba+p.+ v.+ 2008+..] site visited on 20/5/2016.

Wolter, D. (2008). *Tanzania- Why a Potential Food Exporter is still Importing Food* OECD Development Centre, Paris. 5pp [*www.oecd.org*.] site visited on 29/9/2016.

World Bank, (2009). Gender in agriculture source book. The International Bank for Reconstruction and Development/the World Bank, Washington DC, USA. 30pp.

[*siteresources.worldbank.org/Intgenagrlivsoubook/Rsources/CompleteBook.pdf*] site visited on 29/09/2016.

World Bank, ADB and JICA (2010). *Mainstreaming Climate Change adaptation into development planning*. *Adaptation knowledge platform.* 15pp. [*www.india environmental portal.org.in/file/mainstreaming climate change_2.pdf*.] site visited on 15/06/2016.

Yamane, T. (1967). *Statistics: An Introduction Analysis, Second Edition*, New York: Harper and Row, 1967. 886pp. [*www.sciepub.com/reference/180098*] site visited on 15/8/2015.

APPENDICES

Appendix 1: Research questionnaire

Factors influencing commercialization of round potato production in Rungwe District – Mbeya region

General information:

Questionnaire number ……Date of interview……..

Village……..

Ward……..

Division……..

Socio-economic factors

1. Gender (Tick) 1 = male, 2 = female
2. What is your age..... years?
3. Marital status: 1 = married, 2 = single, 3 = widowed, 4 = divorced
4. Educational level of respondents: 1= Non-formal education, 2 = attended primary education, 3 = achieved secondary education and above
5. Income levels of respondents: 1 = >TZS.5 000/day, 2 = TZS.5 000/day, 3 = TZS. 10 000/day, 4 = TZS. 20 000 and above/day
5. Household size: How many people live in your household?

Age group	Male	Female
Children < 5 years		
Children 6 – 18 years		
Adult 19 – 30 years		
Adult 31 – 50 years and above		

6. Main occupation: 1 = self-employed 2 = Farming 3 = un employed 4 = employed 5 = do business 6 = keep house
7. What is your main source of income? 1= Round potato production 2 = livestock production 3 = other food crops, specify……. 4 = doing business (specify)……..
8. Who in the household is primarily responsible for round potato production? 1 = male 2 = female 3 = labourer 4 = people staying with mother/father
9. Do you own land? 1 =Yes, 2 = No
10. If yes what is the way of ownership? 1 = purchased, 2 = rented, 3 = inherited
11. Who purchase lands in your area of round potato production? 1 = rich people 2 = ordinary people 3 = Young people
12. Where are people purchasing land come from? 1 = from towns 2 = within the local area 3 = from neighbouring villages
13. Why do you sell land to other people? 1 = Household cash needs 2 = Capital for another business 3 = Price offered by the buyer
14. How big is the land you own? 1 = Less than 3ha (small land size) 2 = less than 6ha (medium land size), 3 = above 6ha (large land size)

15. Do you have any problem regarding the size of the land you are having? 1 = Yes 2 = No
16. If Yes state the problem ……..
17. What percentage of your land is used for round potato production? 1 = 25 percent 2 = 50 percent 3 = 75 percent 4 = 100 percent
18. If rented how much do you pay per month during the production season?
19. How does land affect round potato production in your area in terms of size?
20. What is the contribution of food crops that are found in the areas in terms of percentage?

Crop	%
……	……..
…….	……
…….	……

21. How long have you been producing round potato in that area?
22. For what purpose?

Round potato	Purpose of growing			How much do you get from selling RP/season(TZS)
	Food	Cash	Both	

23. How many months do you grow round potato in a year?
    1 = three months (one season) 2 = six months (two seasons)
24. Estimate how much money you get per season from round potato production

Month	Area cultivated (ha)	Yield kg/ha	Amount sold/bag	Price/bag	Income TZS
1……					
2……					
3…….					
4…….					
5…….					
6…….					

25. Mention amount of round potato consumed and stored at home in the previous season

Round potato production harvested (kg/ha)	Amount consumed (kg)	Amount stored (kg)	Cost (TZS)

26. What is the total amount of money spent on buying food /month of the growing season?
27. What is the total amount of money spent on other issues/month of the growing season?
28. How much do you serve per month of the growing season by growing round potatoes?

29. Do you have any other activities besides round potato production that contribute to your incomes? 1 = Yes 2 = No
30. If yes what are the activities? Mention them……
31. What is the income of such activities?

Activities	Income
1…….	
2……..	

32. Estimate the seasonal income that you earn from growing round potato versus other income generating activities

Activity	TZS/season	Total annual income	Percentage of total household income
Round potato production			
Other activities (specify)			

33. Do you hire any labourers to assist you in round potato production? 1 = Yes 2 = No
34. What is your main source of labour?

Source/relationship	Number	Type of work done	Cost/plot (TZS)
Family			
Relatives			
Neighbours			
Hired labour			
Others (specify)			

Marketing of round potato

35. Where do you sell your round potatoes? 1 = production site 2 = market place 3 = hawking 4 = tender 5 = others (specify)……..
36. How do you measure quantity of round potato for sale? 1 = in kg 2 = in bags 3 = in special local baskets
37. What is the standard kilogram weight of one bag full of round potato?
38. What is a normal price of a bag of such kilogram in question number 37?
39. Where do you sell your round potato crop? 1 = middle man 2 = local consumers 3 = traders 4 = neighbors 5 = at local market 6 = to other places (specify)……..
40. Do you have other places for marketing your round potato crop outside Rungwe District? 1 = Yes 2 = No
41. If yes what are those places, name them……

42. Do you find difficulties in selling round potato crop? 1 = Yes 2 = No
43. If Yes why? 1 = market place is very far from home 2 = lack of transport facilities 3 = few customers 4 = low demand 5 = low farm gate price 6 = others (specify)……
44. What factors do you consider when deciding to sell round potato crop 1 = price offered 2 = household cash needs 3 = personal ties with middle man 4 = others (specify)…….
45. How do you determine the price? 1 = quality 2 = preferences 3 = income of buyers 4 = demand 5 = season
46. Who mainly sells round potato crop from the fields? 1 = farther 2 = mother 3 = children 4 = labourer 5 = others (specify)…….
47. Do you organize marketing of round potatoes with other producers? 1 = Yes 2 = No
48. What transport do you use to carry round potato crop to the market? 1 = own car 2 = hired truck public transport 4 = own cart 5 = hired cart 6 = hired labourers 7 = others means (specify)…….
49. What marketing cost do you incur when marketing round potato crop? 1 = storage costs 2 = packaging costs 3 = transportation costs 4 = No cost
50. What challenges do you face in marketing round potato crop? Please rank them in the scale of (high cost of inputs, low farm gate price, RP diseases and pests, frost, land scarcity, and fake inputs)

1 ……. 2 …… 3 …… 4 …….. 5 ……..

51. What are costs of round potato crop versus income/growing season?

Round potato production	SEASON 1			SEASON II		
	1st month	2nd month	3rd month	1st month	2nd month	3rd month
Cost of land preparation						
Renting						
Organic fertilizers						
seeds						
Fertilizer application						
Spraying activities						
Use of fungicides						
weeding						
harvesting						
Bags for filling round potato						
transportation						

52. What are incomes obtained from round potato crop based on two production seasons?

Round potato production	SEASON 1			SEASON II		
	1st month	2rd month	3rd month	1st month	2nd month	3rd month
Total hactarage harvested	Total bags of RP harvested x the present price/bag	To use the same formula	Same formula	Same formula	Same formula	Same formula
Total TZS						

53. What is the gross margin obtained from round potato based on two production seasons? (Gross margin = Revenue (incomes) – Cost of production

Months	Revenue – Cost of production		Gross margin
SEASON 1	Revenue	Cost of production	
1…….	TZS……..	TZS…….	TZS……..
2…….	TZS……..	TZS……	TZS……
3…….	TZS……..	TZS……..	TZS……..
SEASON II			
1……..	TZS……..	TZS……..	TZS……..
2……..	TZS……..	TZS……	TZS……..
3……..	TZS……..	TZS…….	TZS…….
Grand total	TZS…….	TZS……..	TZS……

Supporting services:

54. Where do you get information about round potato production 1 = Radio 2 = News paper 3 = neighbours 4 = Relatives 5 = Friends 6 = leaflets 7 = personal experience 8 = Agricultural extension agents
55. Do agricultural agents visit you to give advice on growing round potato crop? 1 = Yes 2 = No
56. If yes what is the frequency of contact with extension agents 1 = once per week 2 = 2 times/wk 3 = 4 times/wk 4 = more than 5 times/wk 5 = No extension agent
57. If No state the problem of extension agents
58. Have you attended any training in growing round potato crop? 1 = Yes 2 = No
59. How much does it cost transporting a bag of round potato to the market?
60. How many bags of round potato do you get per acre (0.4ha) per growing season?
61. How many growing seasons do you involve into producing round potato? 1 = two growing seasons 2 = one growing season
65. How many bags of round potato in kilograms do you harvest annually?
66. How many bags of kilograms do you sell out annually? 1 = 50% of the harvest, 2 = above 50% of the harvest, 3 = below 50% of the harvest

67. How many types of inputs do you use in round potato production? 1 = local seeds and inorganic fertilizers (low inputs user) 2 = local seeds, agro-chemicals and inorganic fertilizers (medium inputs user) 3 = improved seeds, agro-chemicals and inorganic fertilizers (high inputs users)
68. Are these inputs readily available? 1 = Yes 2 = No
69. If No, why? State the problem……
70. Are these inputs affordable? 1 = Yes 2 = No
71. If No, Why? State the problem……..
72. Do you use improved varieties only? 1 = Yes 2 = No
73. If No, Why? State the problem……..
75. If you use both of them mention them: Improved……..local……..
74. If yes what are those? Mention them……

Farmer's perception towards commercialization of round potato production

75. Agricultural commercialization is perceived as drudgery work.
    Strongly agree, agree, undecided, strongly disagree, disagree
76. Agricultural commercialization is perceived as the only option.
    Strongly agree, agree, undecided, strongly disagree, disagree
77. Agricultural commercialization is perceived an intensive input use crop.
    Strongly agree, agree, undecided, strongly disagree, disagree
78. Agricultural commercialization is perceived as a capital intensive activity.
    Strongly agree, agree, undecided, strongly disagree
79. Agricultural commercialization is perceived as a limited to farm support resources.
    Strongly agree, agree, undecided, strongly disagree, disagree

Environmental factors

80. Temperature contributes to affect round potato production in your area.
    Strongly agree, agree, undecided, disagree, and strongly disagree
81. Frost causes serious effect to round potato production when it strikes.
    Strongly agree, agree, undecided, disagree, strongly agree
82. Frequent occurrence of frost has a negative effect to round potato.
    Strongly agree, agree, undecided, disagree, strongly disagree
83. Many bags per 0.4ha (acre) are lost when the frost strikes.
    Strongly agree, agree, undecided, disagree, strongly disagree
84. Heavy rainfall negatively affects round potato production in the study area.
    Strongly agree, agree, undecided, disagree, strongly disagree

Biological factors

85. There are diseases/insect pests affecting round potato production in your area.
    Strongly agree, agree, undecided, disagree, strongly disagree
86. Diseases/insect pests cause significant negative effect to the round potato production.
    Strongly agree, agree, undecided, disagree, strongly disagree
87. Low number of bags of round potato per hectare are a result of diseases/insect pests.
    Strongly agree, agree, undecided, disagree, strongly disagree

88. The status of soil fertility in your area of round potato production is not fertile.
    Strongly agree, agree, undecided, disagree, strongly disagree
89. It is not possible to produce round potato in your area without applying fertilizers.
    Strongly agree, agree, undecided, disagree, strongly disagree
90. Few bags of round potato are harvested without using fertilizers.
    Strongly agree, agree, undecided, disagree, strongly disagree
91. Quality of round potato harvested without using fertilizers is low.
    Strongly agree, agree, undecided, disagree, strongly disagree
92. Most of smallholder farmers grow local varieties in a study area.
    Strongly agree, agree, undecided, disagree, strongly disagree
93. Local varieties are not profitable for round potato production as a business venture.
    Strongly agree, agree, undecided, disagree, strongly disagree

Appendix 2: Focus Group Discussion (FGD) Done At Isongole/Ndanto Ward

Questions asked.

1. What is the problem regarding ownership of land in your area?
2. Under which period in months do you grow RP per year?
3. How much do you serve after selling the crop?
4. How do you manage to sell your crop (RP) after harvest?
5. How do you rank the challenges which face you in RP production?
6. Can you tell me types of inputs that you use them for RP production?
7. Why do you grow different varieties in the area?
8. Why some varieties are most preferred than others in the area?
9. Why local varieties are mostly preferred as compared to improved ones?
10. How do you control diseases and pests that affect RP production?
11. Can you explain about other activities which contribute to your income other than RP production?
12. How extension agents help you in maximizing your RP production in your area?
13. How commercialization helps you in improving your standard of living in terms of increasing your income through RP production?
14. How frost affects your RP production?
15. How frequently does frost occur to your area of RP production?
16. How fake inputs come into being one of the challenges in RP production in your area?
17. How farm gate price becomes a source of one of the challenges in RP production?
18. What challenges do you face concerning agro-chemicals in RP production area?

QUESTIONS TO KEY INFORMANTS (KIs)

1. What is a problem concerning land ownership of smallholder farmers in the study area?
2. Can you explain how smallholder farmers benefit from commercialization of RP production?
3. How can you make market of RP reliable in the study area?
4. How do you manage to sell the RP crop after harvest?
5. What are the technical recommendations to improve commercialization of RP production?
6. What are the main challenges of commercialization of RP production in the study area?
7. How smallholder farmers manage to control diseases/insect pests of RP?
8. Why smallholder farmers opt doing off-farm activities?
9. How agricultural extension services properly delivered in the study area?
10. How frost affect commercialization of RP production in the study area?
11. How serious is the problem of frost in the study area?
12. How do smallholder farmers solve the problem of frost?
13. How do smallholder farmers get inputs for RP production in the study area?
14. How many hectares of RP are cultivated in the study area?
15. What is the production of RP per unit area?
16. How smallholder farmers perceive about commercialization of RP production?
17. How farmers' associations and co-operatives contribute to improve commercialization of RP production?