DETERMINANTS OF CHOICE OF MARKETING CHANNELS AMONG POTATO FARMERS IN MUSANZE DISTRICT, RWANDA: EVIDENCE AFTER THE 2015 POTATO MARKET REFORMS

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A56/81985/2015

A thesis submitted in partial fulfillment of the requirements for the award of Master of Science in Agricultural and Applied Economics

University of Nairobi

November 2018

DECLARATION

This thesis is my original work and has not been presented for the award of a degree in any other University.

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I dedicate this thesis to my family.

ACKNOWLEDGEMENT

Firstly, I thank the Almighty God for His guidance and compassion. Secondly, I am grateful to the United States Government because this material is based upon work supported by the United States Agency for International Development, as part of the Feed the Future Initiative, under the CGIAR fund, award number BFS-G-11-00002, and the predecessor fund the Food Security and Crisis Mitigation II grant, award number EEM-G-00-04-00013. I also acknowledge Borlaug Higher Education for Agricultural Research and Development for coordinating this scholarship and facilitating the learning process.

Thirdly, my appreciation goes to the lecturers of the Department of Agricultural Economics at Nairobi University for the good learning environment. My special thanks to my supervisors Prof. John Mburu, Dr. John R. Busienei and Dr. Lucy Karega Njeru for their guidance and encouragement throughout the course of conducting this study. From the selection of the research topic up to the final thesis write up, they generously gave their time, solid advice, guidance and instruction, which ended up with the production of this thesis. I also thank my fellow classmates for their motivation and moral support; I really have learned a lot from each one of you.

Finally, I wish to extend my gratitude to enumerators for their assistance in data collection and to interviewed farmers for sharing their experiences and practices; your input into this study made it a success.

ABSTRACT

Marketing plays an important role in poverty alleviation through the generation of employment and improvement of household income. It connects input and output markets as demand for modern agricultural technologies accelerate their development. However, agricultural marketing in Rwanda is characterized by poor infrastructure such as roads and storage facilities which make it less efficient. Inefficiency is also a result of undeveloped marketing channels which consist of many players; thus increasing transaction costs for producers. To achieve the Malabo declaration target on harnessing markets and trade opportunities, the government of Rwanda has put much effort in developing value chains of priority crops such as potato for local and regional trade to increase farmers` income and achieve food security. The new trading system for potato involves using collection centers to harmonize supply through formal contracts as well as facilitate equitable income distribution among all the actors.

Previous studies on the choice of marketing channels found that socio-economic and institutional factors such as age, education and access to extension services influenced farmer`s choice of marketing channels. However, the relevance of these factors after the 2015 marketing channel reforms has not been extensively investigated in Rwanda. Using 210 randomly selected farmers from Musanze District, the study aimed at analyzing the determinants of farmer`s choice of marketing channels. The Multinomial Logit Model was used to analyze the determinants of the choice of marketing channels among the potato farmers, whilst descriptive statistics were used to characterize different marketing channels in the study area. The results showed that three main marketing channels were used by potato farmers namely brokers, open-air market and collection centers. The study found that 48% of the respondents used potato collection centers while 38%

and 14% sold to brokers and open-air market respectively. The findings showed that brokers offered slightly high prices compared to collection centers; however, there was no significant difference between prices offered by collection centers and other marketing channels. The results from the Multinomial Logit Model revealed that age had a positive influence on the choice of brokers while group membership, land size under potato cultivation, the quantity produced and off-farm income negatively influenced the choice of brokers relative to collection centers. The study, therefore, recommended that farmers should organize themselves into groups and cooperatives to be able to bulk their production and benefit from economies of scale. Further, they should consider using their cooperatives as saving groups which will enable them to get off-farm income to look for better markets.

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LIST OF ACRONYMS

ACIAR	Australian Centre for International Agriculture Research
AGRA	Alliance for a Green Revolution in Africa
ANOVA	Analysis of Variance
EDPRS	Economic Development and Poverty Reduction Strategy
FAO	Food and Agriculture Organization
FRW	Rwandan Francs
GDP	Gross Domestic Product
GoR	Government of Rwanda
IIA	Independence from Irrelevant Alternatives
MINAGRI	Ministry of Agriculture and Animal Resources
MINICOM	Ministry of Trade and Industry
MLE	Maximum likelihood estimation
MNL	Multinomial Logit
NISR	National Institute of Statistics of Rwanda
PSDAG	Private Sector Driven Agricultural Growth
PSTA	Strategic Plan for Agriculture Transformation
RAB	Rwanda Agriculture Board
RDB	Rwanda Development Board
RUM	Random Utility Model
SDG	Sustainable Development Goals
SPSS	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa
USAID	United State Agency for International Development
VIF	Variance Inflation Factor

CHAPTER ONE: INTRODUCTION

1.1 Background

Agriculture plays an important role in the economies of developing countries through its contribution to the economic growth and achievement of food security. Agricultural growth is much more effective in poverty eradication than growth from other sectors because it employs more than a half of the population from Sub-Saharan Africa (SSA). Enhancing agricultural productivity can, therefore, improve incomes of millions of smallholder farmers (Schaffnit and Lanzeni, 2014). However, in SSA agriculture remains subsistence and is characterized by poor infrastructure, land fragmentation due to high population growth, limited access to modern agricultural technology, under-investment and weak policy environment (ACIAR, 2012). Thus, there is need for structural transformation of agriculture from subsistence to a market-oriented sector to move from economies that depend on primary sector to a diversified economic base (AGRA, 2016).

Agricultural marketing plays an important role in poverty alleviation through the improvement of household income. The use of new agricultural technologies improves productivity and increases marketable surplus; which increases farmer`s income (Makhura, 2001; Barrett and Mutambatsere, 2005; Jari and Fraser, 2009; Olwande and Mathenge, 2012). Moreover, marketing contributes to food security by facilitating access to food through its distribution from surplus to deficit areas (Poulton and Dorward, 2003). Well performing agricultural markets stimulate supply to meet demand through the transmission of price signals (Hebebrand and Wedding, 2010). According to the Sustainable Development Goal (SDG), poverty and all its

manifestation should be ended by 2030, therefore, improving market access by making marketing channels more efficient would improve household`s welfare in terms of increased income. Jagwe et al. (2010) stated that efficient marketing channels that reduce transaction costs and give higher prices for products increase farmer`s profitability.

Irish potatoes are among the most efficient crops in terms of transforming resources into high-quality food which makes them suitable for poverty reduction due to its high productivity and limited use of resources for its growth. Potatoes have a short growing season (3 to 4 months) which allows farmers to harvest up to three times per year depending on the region, therefore, leading to a stable supply of potatoes to the market. In addition, they can lead to rapid agricultural and economic growth because of their high demand (FAO, 2008).

Rwanda is among the top potato producers in Africa producing around 2 million tons per year (FAOSTAT, 2014). Different varieties of potatoes such as Kinigi, Kirundo, Mabondo, Cruza and Sangema are produced in Rwanda, however, Kinigi is prized for its taste and chipping characteristics. Potatoes are grown mostly in the western and northern provinces of the country in the districts of Musanze, Nyabihu, Rubavu, and Burera. The northern region is favorable for potato production because of its high altitude (above 1800 m) and high annual rainfall (between 1400 mm and 1800 mm) (GoR, 2013).

Potato production cycle is between 3 and 4 months and can yield up to 30 tons per hectare which makes it suitable for countries where arable land is limited like Rwanda (Birachi et al., 2013). Over 70,000 households produce potatoes for consumption and commercial purpose in Rwanda. Potatoes account for 7.6% of the total food purchased and the average per capita consumption is

96 kg per year in rural areas and an estimate of 150 kg per year in urban areas (USAID, 2015a). The high demand can be linked to urbanization and increase in population growth.

Although the production is high, the potato value chain is characterized by inefficiencies derived from premature and inadequate harvesting which reduce the quality of the potato thus resulting in low prices (MINICOM, 2014). Lack of improved seeds is also a problem facing the value chain as the number of certified seeds multipliers is low (MINAGRI, 2013; USAID, 2016). Farmers have weak bargaining power which affects prices at the market level. Moreover, the marketing channels are not developed as they consist of many players which increase transaction costs for farmers.

The main marketing channels that were used before market reforms are open-air market, brokers, hotels and restaurant. To achieve the Malabo declaration target on harnessing markets and trade opportunities, the government of Rwanda has put much effort in developing value chains of the priority crops destined for local and regional trade to facilitate farmer`s access to market and increase their income (GoR, 2013). As one of the priority crops, potato value chain has recently undergone through a period of organizational change and marketing innovation.

The new potato trading system was launched in 2015 and it involves using a network of registered collection centers in production areas to harmonize potato supply through formal contract. The potato marketing reform followed an outcry from farmers who complained about low farm-gate prices that were being offered by traders (USAID, 2015a). Potatoes are collected and taken to the collection centers which further supply to the wholesale market in Kigali and wholesalers in other districts. Potato collection centers are owned by farmer cooperatives and

private companies, however, farmers own the majority of the shares in collection centers (60%) (USAID, 2015b).

1.2 Statement of the Research Problem

Potato marketing is mostly done at the farm-gate and farmers usually complain about poor trading terms which sometimes lead to them being price takers. To solve this problem, the government of Rwanda launched a new system of using potato collection centers. The new trading system is meant to harmonize supply through formal contracts, to stabilize prices in the country and distribute income equitably among all actors of the value chain (USAID, 2015b). Collection centers are seen as important tools to increasing a farmer`s profitability because they protect them from being exploited by traders. They also offer other services such as short-term storage facility, assist in weighing and grading different varieties of potatoes to determine accurate prices for each grade. However, some farmers avoid the collection centers and meet traders at the farm-gate and consequently, they sell their produce at any price offered which at times does not cover the cost of production (USAID, 2015a).

The choice of marketing channels is among the most important marketing decisions that farmers have to make so as to maximize their profits. There is, therefore, need to identify factors that affect farmer`s choice of marketing channels to understand the reasons behind their choice of marketing channels and pinpoint areas that need more efforts to improve farmers income.

Previous studies on potato farmer`s choice of marketing channels found that factors such as age, distance to the tarmac road and access to market information affected farmer`s choice of marketing channel. Umberger et al. (2017) found that willingness to negotiate on price, timely

payment; off-farm income and access to certified seeds were positively related to the choice of marketing channels. Emana et al. (2015) found that value addition had a positive relationship with the choice of collectors and wholesalers and a negative relationship with the choice of retailer, while access to market information had a positive effect on the choice of the collectors. Emana et al. (2015) also noted that bargaining power, distance to the market and the quantity produced were negatively related to the choice of marketing channels. Amaya et al. (2009) revealed that age had a positive effect on the choice of close markets while ownership of a cell phone influenced farmers to sell at distant markets. Other factors that had a positive effect on the choice of marketing channels were the price of potatoes and the quantity produced while the distance to the tarmac road had a negative effect on the choice of marketing channels.

However, despite a wealth of literature on the choice of marketing channels among potato farmers, the relevance of these factors on marketing channel after the 2015 reforms has not been extensively investigated in Rwanda. Hence there is limited information and evidence on which to base viable policy interventions. The study, therefore, determined factors that affect a farmer`s choice of marketing channels after potato market reforms.

1.3 Objectives

The overall objective of the study is to analyze the factors that affect potato farmer`s choice of marketing channels after the marketing reforms

Specific objectives:

1. To characterize potato marketing channels after the marketing reforms
2. To analyze factors influencing potato farmer`s choice of marketing channels after the marketing reforms

1.4 Research questions

1. What are the characteristics of farmers participating in different potato marketing channels?
2. What are the socio-economic and institutional factors that influence potato farmer`s choice of marketing channels?

1.5 Justification of the Study

Agriculture sector has been viewed as an important sector that can lead to sustainable growth by the government of Rwanda. The Economic Development for Poverty Reduction Strategy phase 2 (EDPRS 2) highlights that sustainable poverty reduction requires the increase in farm productivity, thus, there is need to facilitate farmers to access modern agricultural technologies to increase marketable surplus thereby increasing farmer`s income (GoR, 2013a). According to the Sustainable Development Goal number one (SDG1), poverty and all its manifestation should be ended by 2030, therefore, improving market access by making marketing channels more efficient would improve household`s welfare in terms of increased income. Thus, the analysis of factors that affect potato farmer`s choice of marketing channels is of great importance because it will help in understanding challenges in potato marketing, therefore, providing the information which will help to come up with policies to achieve SDG1.

The importance of markets in transforming Rwanda's agriculture from subsistence to a competitive market-led sector has been emphasized on in the Strategic Plan for Agriculture Transformation phase 4(PSTA 4). The government of Rwanda has put much effort in improving market infrastructure such as storage facilities, drying grounds, cold room facilities and collection centers to improve the trading systems and to strengthen the role farmer cooperatives in aggregating and marketing agricultural commodities (MINAGRI, 2018). The findings of this study will, therefore, be a milestone in achieving this strategy because the study will provide information on socio-economic and institutional factors such as education, experience and market information that influence farmer`s decision to sell to collection centers, hence, providing information on areas that need more efforts to make the new trading system work effectively.

Further, the results of this study will provide information on factors that influence farmer`s choice of marketing channels and the characteristics of each channel. This information can be used by farmers to make informed decisions on the choice of marketing channels.

1.6 Organization of the Thesis

The rest of the thesis is organized as follows: chapter two presents an overview of the role of marketing in agricultural development in developing countries. Also, this chapter reviews the theoretical framework and empirical studies that have been done on the choice of marketing channels. Chapter three describes the sampling procedures, data collection, and analysis. Chapter four discusses the results of the study, both descriptive and econometric. Chapter five presents the conclusion and recommendations.

CHAPTER TWO: LITERATURE REVIEW

2.1 The Role of Marketing in Agricultural Development

According to FAO (2013), a marketing channel is an institutional arrangement through which goods and services are exchanged. Pinkerton (2002) has defined a marketing channel as the movement of a particular product from the production area to the consumption area including transportation, handling, storage, processing, and distribution. Kotler (2002) explained that marketing channels are different organizations that are involved in distributing products to the consumer. Further, Kotler (2002) acknowledged that most of the times consumers don't buy directly from producers because there are intermediate organizations that perform marketing functions to make the product available to consumers. Marketing channels are built in a way that products move from producers to consumers (Pelton et al., 2014).

Marketing gives consumers the opportunity to choose from available products in the market to satisfy their needs, thus contributing to their welfare (Bilaliib, 2015). Further, it summarizes demand and supply among all actors of the value chain. When the agricultural markets are performing well, they reinforce development opportunities such as the use of improved seeds and fertilizer to increase productivity, therefore increasing farmer`s income. Without these markets, an increase in productivity will reduce prices that farmers get due to oversupply (Barrett and Mutambatsere, 2005). Moreover, markets play an important role in the distribution of agricultural inputs such as fertilizers and improved seeds, thus facilitating efficient resource allocation to the best interest of all the actors of the value chain (Abera, 2015).

Efficient marketing is realized when goods move from producers to consumers at the lowest possible costs. Efficient marketing is influenced by factors such as market information, prices

and market structure, conduct and performance (Anrooy, 2003). According to Dastagiri et al. (2013), market efficiency can be increased by increasing production through the application of new technologies, improving infrastructure and enhancing access to market information. In most developing countries agricultural marketing is characterized by poor infrastructure and communication which make it less efficient. Marketing channels are also undeveloped as they consist of many players who increase transaction costs (Schalkwyk et al., 2012). Cooperatives have been the predominant marketing channels in developing countries whereby they are seen as tools that can increase farmer`s bargaining power. However, they face some problems such as mismanagement and free riding (Kindness and Gordon, 2001).

2.2 Overview of Potato Marketing Channels in Rwanda

Potato marketing in Rwanda is done by the private sector and the crop is mostly sold fresh (RDB, 2015). However, potato marketing channels are not developed as they consist of many players which increase transaction costs for producers. Further, Kigali markets are predominantly characterized by traders who collude to set low prices. The main marketing channels that were being used before potato market reforms were: brokers, open-air market, supermarkets and restaurants. Brokers or rural assemblers buy potatoes at the farm gate and the price depends on the farmer`s bargaining power. Wholesalers buy from brokers and supply to different markets in Kigali and other districts. Farmers also sell small quantities directly to their neighbors and other consumers at local markets (USAID, 2015a). Some farmers sell high quality potatoes to high-value markets such as supermarket and hotels (Wennink et al., 2014).

Recently, the government of Rwanda put in place a new trading system to aggregate and synchronize potato supply using the formal contract to distribute profit equitably (USAID,

2015b). The new potato trading system was launched in 2015 and it involves using a network of registered potato collection centers that have adequate storage facilities. This was meant to harmonize potato supply through formal contract and stabilize prices across the country, therefore distributing income equitably among all the actors of the value chain. The potato marketing reforms followed an outcry from farmers who complained about low farm-gate prices that were being offered by traders and a high difference between farm-gate prices and the final prices paid by consumers in Kigali. Collection centers are seen as important tools to protect farmers from being exploited by traders because they offer other services such as short-term storage facility, assist in weighing and grading different varieties of potatoes to determine accurate prices for each variety (USAID, 2015a).

The new trading system for potatoes is built in a way that potatoes are collected and taken to the collection centers which further supply to the wholesale market in Kigali and to wholesalers in other districts. Potato collection centers are owned by farmer cooperatives and private companies, however, farmer cooperatives own the majority shares in the collection centers (60%). Collection centers are managed by farmer cooperatives but due to limited marketing skills, they are being exploited by private companies. Thus, in partnership with the Private Sector Driven Agriculture Development Project (PSDAG), the government of Rwanda is piloting the use of the farm book suite, a set of integrated field-based data collection and reporting tools, to help farmers through field-based agribusiness training, business planning and market analysis. This strategy aims to improve farmers` marketing skills to enable them to manage collection centers effectively (USAID, 2015b).

2.3 Review of Empirical Studies on the Choice of Marketing Channels

The multinomial logit model (MNL) has been used in different studies on the choice of marketing channels. Train (2002) argued that MNL is applicable to various subject as it has been used in social studies, animal behavior, and in economic studies to analyze unordered multiple discrete choices. Staal et al. (2006) used a logit model to assess factors affecting small-scale dairy farmer choice of milk marketing channels in India. They found that access to extension services increased farmer`s probability of selling to private traders and cooperatives as opposed to individual buyers. Further, they noted that families with large farms were more likely to sell directly to clients rather than selling to private traders or processors. Households with large herd size preferred selling to private traders and processors. However, the study used marketing channel attributes only and omitted the characteristics of the individuals making the choice. The current study considers both the market attributes and farmer`s characteristics such as age, gender, education and experience to asses all the factors that may influence the choice of marketing channels.

Ogunleye and Oladeji (2007) analyzed the determinants of the choice of marketing channels among cocoa farmers in Nigeria. The results showed that the price was an important factor which was positively related to the choice of private channels. However, the study used descriptive analysis with more emphasis on the description of different marketing channels used by cocoa farmers in the study area. Even though descriptive analysis provides information on social trends, it doesn`t provide much information on the causal effect between variables. Therefore, the current study used both descriptive and quantitative analysis to fill this gap.

Chirwa (2009) used the multinomial logit model to determine factors affecting maize farmer`s choice of marketing channels in Malawi. The results showed that education was positively related to the choice of private traders as opposed to neighbors. The land portion under maize cultivation was negatively related to the choice of marketing channels. Transaction costs, maize prices and contractual arrangements were found to influence the choice of marketing channel among maize farmers. The findings also revealed that the distances to the tarmac road, to the market and other facilities such as phones and the post office had an influence on the choice of marketing channel. The study, however, used secondary data to analyze factors influencing farmers' choice of marketing channels. Although secondary data analysis can provide a larger database, it may give inaccurate results because the data may be outdated or collected for different purposes. The current study used primary data to capture the full information specific to the study objectives.

Martey et al. (2012) assessed the determinants of the choice of marketing channels among yam farmers in Nigeria using the multinomial logit model. They found that the age of the household head was positively associated with the choice of the rural market. Being male was negatively related to the choice of cooperative markets compared to the urban market. The choice of the cooperative market was positively influenced by the level of education of the household head and the distance to the tarmac road. However, ownership of a cell phone and farm size had a positive influence on the choice of rural markets. The study used possession of a cell phone as a proxy for market information. But, ownership of a phone may not necessarily mean that a farmer has access to market information. To bridge the gap, the current study used the real variable access to market information to give accurate results.

Xaba et al. (2013) used the multinomial logit model to study factors affecting vegetable farmer`s choice of marketing channels in Swaziland. They found that age, quantity and education affected farmer`s choice of the National Agriculture Marketing Board relative to wholesalers. The distance to the market and group membership were positively associated with the choice of wholesalers.

Edoge (2014) used a logit model to analyze the determinants of the choice of marketing channels among fish farmers in Nigeria. He found that the age of the household head, education, access to market information and farm size positively influenced the choice of distribution channel. In addition, the findings showed that the distance to the market was negatively associated with the choice of marketing channels. The difference between Edoge (2014) and the current study is that he collapsed all marketing channels into a binomial outcome while the current study used a multinomial logit model to capture the determinants of choice of each marketing channel independently.

Maina et al. (2015) assessed the effect of transaction costs on the choice of mango marketing channel in Kenya using the multinomial logit model. The findings showed that being male, age and experience had a positive effect on the choice of brokers. Education was found to be positively related to the choice of the marketing group and negatively related to the choice of the local traders. Access to extension services was negatively associated with the choice of the local traders. The study, however, focused on transaction cost as the most important variable that influences a farmer`s choice of marketing channels. Thus, it is not clear why transaction costs were isolated as key determinants of the choice of marketing channel. The current study included

other variables to determine all the variables that may influence the choice of marketing channels.

Abera (2015) analyzed the factors that affect coffee farmer`s choice of marketing channels in Ethiopia using the multinomial logit model. The findings showed that access to transportation facility, to price information and to credit were positively associated with the farmer`s choice to sell to the end consumer outlet. However, the quantity of coffee produced and extension services were negatively related to the farmer`s choice to sell to the end consumer outlet. Abera (2015) also found that the distance to the markets, ownership of a transportation facility, price information and training increased the probability of selling to cooperatives.

Soe et al. (2015) analyzed the factors influencing the choice of marketing channels among paddy rice in Myanmar using the multinomial logit model. The results showed that the distance to the market and timely payment positively influenced the choice of brokers while the quantity produced, possession of storage and transport facilities were negatively related to the choice of brokers. They also found that the road condition and access to market information had a negative effect on the choice of brokers.

Mutura et al. (2015) conducted a study to determine the factors influencing dairy farmer`s choice of marketing channel in Kenya using the multinomial logit model. The study found that farm size, farmer`s access to training and access to marketing information increased farmer`s probability of selling at the farm gate through middlemen or through cooperatives, while education level reduced their probability of selling at the farm gate. Nyaga et al. (2016) used the multinomial logit model to understand the factors that influence fish farmer`s choice of marketing channels in Kenya. The result revealed that being male was positively associated with

the choice of direct market as opposed to neighbors while the distance to the market was negatively related to the choice of direct market. The number of fish ponds, access to extension services and group membership had a positive effect on the choice of traders as opposed to neighbors.

The studies by Soe et al. (2015), Abera (2015), Mutura et al. (2015) and Nyaga et al. (2016) were helpful to the current study as they all used the multinomial logit model to determine the factors that affect farmer`s choice of marketing channels, though the studies analyzed different choices. A few studies such as Amaya et al. (2009), Emana et al. (2015) and Umberger et al. (2017) have been carried out on the choice of marketing channels among potato farmers. Despite a wealth of literature on the choice of marketing channels among potato farmers, the relevance of these factors on marketing channel reforms has not been extensively investigated in Rwanda; this literature gap is what this study sought to fill.

2.4 Theoretical Framework

The current study was anchored on the theory of collective action. Ostrom (2014) defined collective actions as activities done by a group of people so as to achieve members` shared interest. The collective action theory states that where there are common benefits, people will join together to accomplish a given outcome (Gillinson, 2004). Collective actions enable farmers to manage their resources and raise economies of scale of the members to reduce transaction costs. Also, they encourage knowledge gaining among members which allow them to achieve their common objectives. Collective actions contribute to the development of human resource because members can easily access different types of training on different topics such as entrepreneurship, cooperative management, and postharvest handling techniques.

In addition, farmers can have easy access to extension services. Tetsuya (2015) argued that collective actions facilitate social inclusion as all people are allowed to be members; therefore, they enable equitable distribution of benefits of development. Moreover, they facilitate access to market information and increase farmer`s bargaining power. Furthermore, collective action facilitates farmer`s access to markets because they act as marketing channels to make their products reach consumers.

The effectiveness of collective actions in Rwanda is however hampered by inactive membership which leads to the problem of free-riding whereby some members don`t participate in the group`s activities because they know that others will do. Also, collective actions are constrained by lack of leadership skills and lack of access to credit (Mukarugwiza, 2010).

Collective marketing among potato farmers in Rwanda has progressed due to dynamics in the population and government`s policies. Before the 2015 potato trade reforms, few cooperatives and associations were involved in the marketing of ware potatoes (Goossens, 2002). After potato market reforms, the new system of collective marketing involves the use of collection centers owned by farmer cooperatives and private companies to streamline potato supply through formal contracts. Collection centers provide services such as collection of potatoes from farmers and provision of temporary storage. They also enable farmers to weigh, sort and grade their produce in different varieties to be able to determine accurate prices for each grade (USAID, 2015b). However, these collection centers face some problems such as side marketing whereby farmers are not channeling their produce through collection centers (USAID, 2015a). There is need to evaluate among other factors, the importance of collective action in the choice of marketing channels among potato farmers in Musanze District.

CHAPTER THREE: METHODOLOGY

3.1 Conceptual Framework

The dependent variable is the choice of marketing channels and it is influenced by socio-economic, farm and institutional factors (Figure 1). Institutional factors include market information, transaction costs and extension services. Socio-economic factors include sex, age, education group membership and off-farm income. Farm factors include the distance to the paved road; the quantity produced and farm size. The distance to the paved road affects farmers` choice of marketing channel because farmers who are located farther from the road are more likely to sell at the farm gate to reduce transportation costs. Transaction costs also have an influence on the farmer`s decision to sell to a given marketing channel because high transaction costs restrain exchange and reduce farmer`s income. Education enables a farmer to select profitable marketing channels because educated farmers incur fewer transaction costs as they can easily access and understand market information.

Policy interventions that target socio-economic and institutional aspects in potato marketing are therefore needed to ensure that farmers have access to lucrative markets. There is a need for policy interventions to help farmers to come up with some measures such as collective action to gain from economies of scale and improve their bargaining power. Reviewing the market information dissemination ways such as the short message system would reduce transaction costs incurred during searching for market information and curtail exploitation due to information asymmetry between farmers and traders. With access to the right information, farmers are able to make the right decision about which marketing channel to use so as to increase their income.

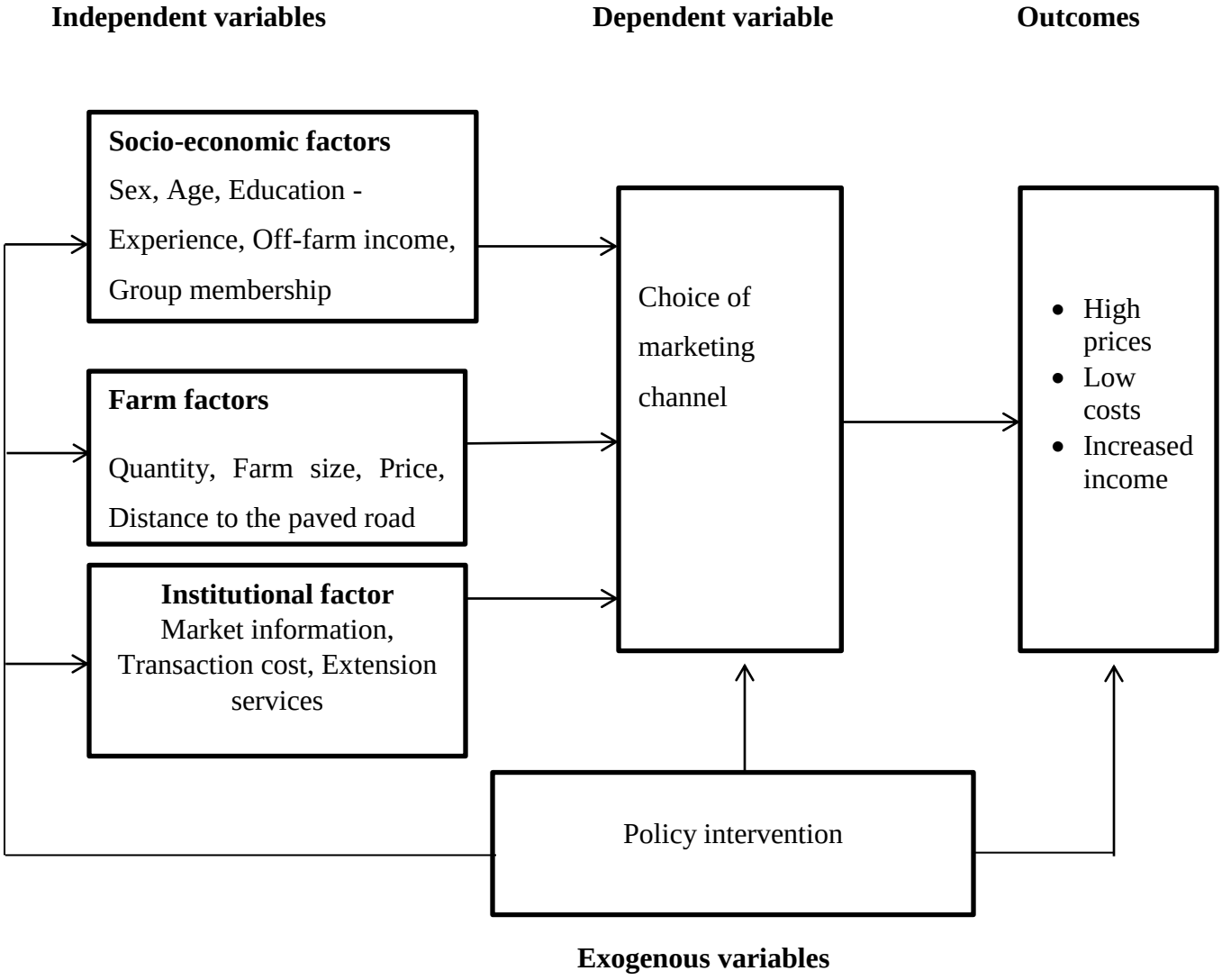

Figure 1: Conceptual Framework of the Determinants of the Choice of Marketing Channels

Source: Author

3.2 Study Area

The study area was Musanze District located in the Northern Province of Rwanda. It was chosen because it is among potato top producing districts in the country. Potatoes are mostly grown in Kinigi, Nyange, Shingiro, Musanze, Gataraga and Busogo sectors. The total area of Musanze District is 530.4 km^2 and it has a total population of 368,267. Musanze is divided into 15 sectors 68 cells and 432 villages (Wennink et al., 2014). In the North, the District is surrounded by Virunga National Park which goes up to Uganda and the Democratic Republic of Congo. Musanze borders Gakenke, Burera and Nyabihu Districts in the South, East and West respectively. It has a tropical climate and a high altitude with the average annual temperature estimated at 20ºC. Musanze is considered as the country`s granary because of its volcanic soils and high amount of annual rainfall ranging between 1400 mm and 1800 mm (GoR, 2013).

The majority of households (91%) participate in agriculture and the major crops grown are potatoes, coffee, tea, pyrethrum, wheat, banana, beans and sorghum. Livestock is also an important source of income as 62% of households keep animals. Trade is an important economic activity in the district with 8% of the population involved in it. Musanze district is also a popular tourist destination in the country because of the Virunga National Park (Rugazura, 2015). The district`s population is predominantly young with 63% under 25 years, and 25% of the population has no formal education while more than a half has attained primary school (NISR, 2012a).

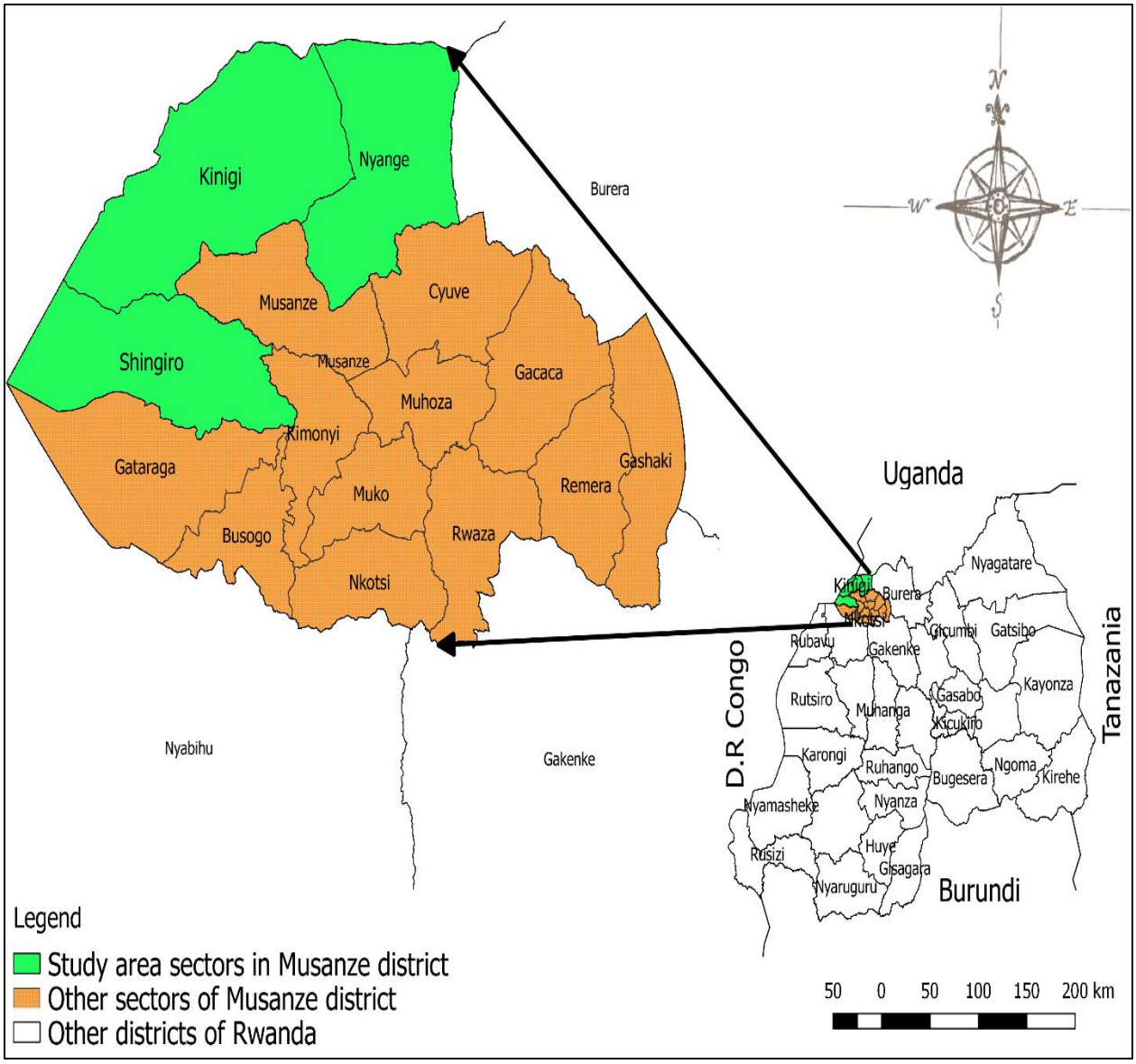

Figure 2: Map of Musanze District Showing the Study Sites

Source: GoR, 2013

3.3 Empirical Framework

A small-scale producer is assumed to choose the level of output for each distribution channel in a manner that maximizes profit (Mendola, 2005). This implies that farmers decide on which marketing channel to sell through after foreseeing that the option will increase their profit. The current study is based on the theory of random utility model (RUM). It assumes that decision-makers are rational which means that they will choose the alternative that provides higher utility (Wooldridge, 2012). In this study, it was assumed that farmers would choose the marketing channel that has higher utility. RUM theory states that decision-makers are guided by observable and random factors when making decisions. Normally, it is not possible to observe every characteristic of decision makers that affect their choice. However, if some information about the decision-maker can be observed, it can be used to predict their probability of choosing a given alternative. The utility for each farmer for choosing a particular channel is specified as a linear function of the vector of channel-specific parameters, and the attributes of that channel and the error term. The utility that farmers derive in choosing a marketing channel is expressed as shown in Equation 3.1:

$$U_{i(j=k)} = \beta_{j=k} X_{ij} + \varepsilon_{ij} \qquad \forall j \in N \qquad (3.1)$$

Farmers will choose to sell to a specific channel if the expected utility from this channel is greater than that of all the other channels. The probability of choosing a given marketing channel is equal to the probability that the utility of that particular channel is greater than the utilities of all other channels in the choice set (Greene, 2002). The household selects market channel j = k if:

$$U_{i(j=k)} > U_{i(j\neq k)} \text{ for all other } k \neq \mathbf{j} \qquad (3.2)$$

Where:

U_{ij} denotes a random utility associated with the market channel j = k

$\beta_{j=k} X_{ij}$ is an index function denoting the producer's average utility associated with this channel

ε_{ij} denotes the error term

The Multinomial Logit Model

Given that the dependent variable was a discrete outcome with more than two unordered channels, the multinomial logit model was used to assess the determinants of farmer`s choice of marketing channels. The multinomial logit model is used in studies involving the dependent variable with multiple choices (Gujarati, 2004). The probability that the i^{th} farmer chooses the j^{th} channel is P_{ij}. The probability that a farmer chooses channel j can be explained by a multinomial logit model as expressed in Equation 3.3

$$P_{ij} = \frac{e^{\beta_j' x_i}}{1+\sum_{j=1}^{3} e^{\beta_j' x_i}} \quad for\ j = 1,2\ and\ 3 \qquad (3.3)$$

Where

X_i is a vector of all the explanatory variables that influence farmer`s choice of marketing channel

ßj is a vector of parameter estimates associated with channel j and 3 is the number of marketing channels in the choice set

The coefficients of the independent variables in the base category are set to zero in order to make the conditional probabilities of the channel use sum one (Greene, 2002). The probability that the base category will be chosen is estimated as shown in Equation 3.4

$$P_{i(j=1|Xi)} = \frac{1}{1+\sum_{j=1}^{3} e^{\beta_j x_i}} \quad (3.4)$$

The probability of choosing the other channels is expressed as shown in Equation 3.5

$$P_{i(j=m|Xi)} = \frac{e^{\beta_j' x_i}}{1+\sum_{j=2}^{3} e^{\beta_j' x_i}} \quad \text{for j=2 or 3} \quad (3.5)$$

By differentiating Equation (3.3) with respect to the covariates, the marginal effects of the individual characteristics on the probabilities can be estimated as shown in Equation 3.6

$$\frac{\partial Pi}{\partial Xi} = Pj[\beta j - \sum_{j=1}^{3} Pj\beta j] = Pj[\beta j - \bar{\beta}] \quad (3.6)$$

Where

P_j is the probability of the farmer choosing market channel j

ßj is a vector of parameter estimates associated with channel j

By taking logs on Equation (3.3) given that farmer i's choice set of marketing channels is denoted by Y = 1, 2, 3 where 1= collection center, 2= broker and 3= open-air market. Then the log-likelihood function of the MNL is expressed as shown in Equation 3.7

$$\text{Prob } (Y_i = j) = \beta 0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \ldots\ldots + \beta_c X_{im} \quad (3.7)$$

Equation 3.7 was estimated using the maximum likelihood estimation (MLE) method (Wooldridge, 2012).

After fitting in the variables the model was specified as:

$$M\_Channel = \beta_0 + \beta_1 Sex + \beta_2 Age + \beta_3 Year\_In\_School + \beta_4 Experience + \beta_5 Off\_Farm\_Inc + \beta_6 Price + \beta_7 Quantity + \beta_8 Dist\_To\_Road + \beta_9 Own\_Transport + \beta_{10} Trans\_Cost + \beta_{11} Extension + \beta_{12} Market\_Info + \beta_{13} Group\_Member + \beta_{14} Land\_Size + \varepsilon_{ij}$$

Where β_s are the coefficients to be estimated

3.4 Justification of Variables included in the Model

Being a male was expected to increase the likelihood of selling to open-air market relative to collection centers (Table 1). The reason is that males are more likely to have access to market information through their frequent interaction with many people, unlike women who spend most of their time doing households chores; therefore, males can easily access market information which enables them to look for alternative markets. Similarly, Girma and Abebaw (2012) found that the choice of marketing channels is positively influenced by the sex of the household head.

The age of the household head was expected to reduce the likelihood of selling to brokers relative to collection centers. The older the household head, the more information he/she has about profitable marketing channels as they have network with many actors of the value chain. Ayieko et al. (2014) underscored the fact that age had a positive effect on market efficiency as older farmers have more knowledge which helps them in identifying profitable markets.

The household head's years of schooling (Year_In_school) was expected to increase the likelihood of selling to open-air market relative to collection centers. Farmers with more years of schooling could easily access and understand market information which would enable them to choose profitable markets. Also, farmers with more years of formal education are less likely to join agricultural cooperatives as they are busy with other occupation. Thus, they prefer selling

individually at open-air markets rather than selling through collective marketing. The finding by Contò et al. (2001) revealed that education had an effect on a farmer`s marketing decision because it enabled them to make an informed decision about profitable markets.

Experience was expected to increase the likelihood of selling to open-air market or collection centers because experienced farmers have been in potato marketing for a long time; therefore, they know which marketing channels are more profitable than others.

Off-farm income (Off_Farm_Inc) was expected to reduce a farmer`s likelihood of selling to brokers relative to collection centers because wealthier farmers are not constrained to sell at the farm gate as they have means to look for other markets. Shiferaw et al. (2006) argued that wealthier farmers were less likely to be affected by the delay of payment and therefore, they would choose the channel that provided high prices.

Potato price was assumed to positively affect the choice of marketing channel. The price motivates farmers to produce more; therefore, they have an incentive to look for profitable marketing channels. Mburu et al. (2007) found that farmers were more likely to choose the channel that offered higher prices.

The quantity of potato produced was expected to reduce a farmer`s likelihood of selling to brokers relative to collection centers because high volume motivates farmers to look for better markets. Similarly, Kadigi (2013) found that the quantity produced significantly affected the choice of marketing channels among dairy farmers in Tanzania.

The distance to the paved road (Dist_To_Road) was hypothesized to increase the likelihood of selling to brokers relative to collection centers because farmers who are located far from the

paved road are more likely going to sell at the farm gate to reduce travel time and transportation costs.

Transaction costs (Trans_Cost) were expected to increase farmer`s probability of selling to brokers relative to collection centers because brokers buy at the farm gate which reduces costs of searching for market information.

Ownership of a transport facility (Own_Transport) was expected to reduce the likelihood of selling to brokers relative to collection centers because, with own transport facility, farmers are willing to look for better markets as they are not constrained by high transport costs.

Being a group member (Group_Member) was hypothesized to reduce a farmer`s likelihood of selling to brokers relative to collection centers. This is because groups facilitate farmers to bulk their production and sell collectively to gain from economies of scale. Groups also enable farmers to easily access market information and look for profitable markets.

Access to extension services was hypothesized to have a positive effect on the choice of open-air market or collection centers because farmers who have access to extension services are more likely to improve their knowledge about good farming practices which would enable them to increase their productivity thereby looking for a channel which can accommodate their high volumes. Kihoro (2016) found that farmers who had access to extension services got access to market information easily, therefore, they could sell to the channel which benefits them more.

Table 1: Description of Variables Hypothesized to Affect the Choice of Marketing Channels

Dependent Variable			
Variable	**Measurement**	**Description**	
Categorical showing the alternative marketing channels	1= Collection center, 2= Broker, 3= Open-air market	Collection center is taken as the base category	
Independent variables			
Variables	**Measurement**	**Expected sign**	
		Broker	**Open-air Market**
Sex	1=Male, 0 =Female	-	+
Age	Years	-	+
Year_In_School	Years	-	+
Experience	Years	-	+
Off_Farm_Inc	Frw/ Month	-	+
Land_Size	Acre	-	+
Price	Frw/Season	-	+
Quantity	Tons/Year	-	+
Distan_To_Road	Km	+	-
Own_Transport	1= yes, 0 =No	-	+
Trans_Costs	Frw/Year	+	_
Extension	Number of visits	-	+
Market_Info	1=Yes, 0=No	-	+
Group_Member	1=yes, 0=No	-	+

Source: Survey Data (2017)

3.5 Sampling Procedure and Data Collection

3.5.1 Data Source and Types

Qualitative and quantitative data were used in this study. Qualitative data was collected from key informants through the focus group discussions using a checklist (Appendix 2), while the quantitative data was collected from the sampled household using a structured questionnaire (Appendix 1). Primary data was collected on production, marketing, institutional and household`s demographic and socio-economic information. Secondary data was collected from government`s institutions like the Bureau of Statistics, the Ministry of Agriculture and the Ministry of Trade and Industry.

3.5.2 Sampling Procedures

Purposive sampling was used to select three sectors (Kinigi, Nyange, and Shingiro) on the basis that they produce the high quantities of potato in Musanze. Later, a random sampling was used to select respondents from those sectors. The random sampling reduces bias in sample selection and ensures that the population is well represented (Wackerly et al., 2008).

3.5.3 Sample Size

According to Glenn (2013), a good sample size should be between 200 and 500 respondents. The current study used, therefore, a sample size of 210 farmers which was selected based on the budget and time constraints. The sample size was also determined by considering what similar studies on the choice of marketing channel have used. For instance, Ndoro et al. (2015) used a sample size of 230 farmers in their study on determinants of farmer`s choice of cattle marketing channels in South Africa. Soe et al. (2015) used a sample of 196 respondents in their study to

analyze the determinants of the choice of marketing channels by paddy rice in Myanmar. Kadigi (2013) used a sample of 222 respondents in his study on the determinants of milk outlets in Tanzania.

3.5.4 Data Collection

Eight enumerators from Musanze district helped in data collection at the household level. They all had a background in agriculture and were briefed about the study to ensure that they understood its objectives. Further, they were trained on how to conduct the survey and all the questions from the questionnaire were clearly explained to them. A semi-structured questionnaire was used to collect primary data at the household level and it was pre-tested to check whether there is any problem associated with it. Data collection was done from the 14th – 23rd August 2017.

3.6 Data Analysis

SPSS version 22 was used for data entry while STATA version 14 was used for the analysis. The specific objectives of the study were achieved as shown in 3.6.1 and 3.6.2

3.6.1 Characterization of Potato Marketing Channels after the Marketing Reforms

To achieve the first objective, descriptive statistics such as mean and percentages were used. A t-test was also used to determine the difference between farmers who sold to collection centers and those who sold to brokers and open-air market.

3.6.2 Analysis of Factors Influencing Farmers' Choice of Marketing Channels after the Marketing Reforms

To achieve the second objective, the Multinomial Logit Model was used. The model was chosen because it allows the analysis of discrete choice where the outcome variable has more than two unordered categories; unlike the binary probit or logit models which are limited to a maximum of two choice categories (Greene, 2002). The Multinomial Logit Model is efficient because of its closed form of underlying choice probabilities which simplify the computation of situations where there are more than two alternatives (Cosslett, 1981). In the current study, farmers are faced with three choices on the marketing channel, which are: collection centers, brokers and selling directly to consumers at the open-air markets. Collection center was taken as the base outcome to analyze the determinants of farmers` choice of marketing channels.

3.7 Model Diagnostic

Prior to the Multinomial Logit Model, some diagnostic tests were done to assess if the independent variables were suitable for inclusion in the model.

3.7.1 Tests for Multicollinearity

Multicollinearity occurs when independent variables have a linear relationship with each other. The presence of multicollinearity has consequences such as inflated variance, standard errors and coefficients which lead to unreliable inferences as there is high probability of committing type I error; meaning rejecting the null hypothesis when it is true (Wooldridge, 2012). Variance inflation factor (VIF) was used to test for multicollinearity.

3.7.2 Test for Heteroskedasticity

Heteroskedasticity occurs when the regression disturbance has variances which are not constant across observations, thus the variance of the population varies with the increase in the number of independent variables. With the presence of heteroskedasticity, estimates are inefficient and standard errors are biased and incorrect; thus the hypothesis may be misleading (Greene, 2002). Breusch-Pagan/Cook-Weisberg test was used to test for Heteroskedasticity.

3.7.3 Test for Independence from Irrelevant Alternatives (IIA)

The Multinomial Logit Model has a closed form which makes the computation of choices with many alternatives more convenient. However, it has some drawbacks such as the Independence from Irrelevant Alternatives (IIA). This means that by adding a new alternative the probabilities for prior choices must adjust to retain the original odds ratio (Mc Fadden and Train, 1977). The violation of the IIA assumption lead to invalid estimates (Cheng and Long, 2007). Hausman specification test was used to test whether the IIA assumption was violated or not.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Characterization of Potato Farmers

To characterize potato farmers in the study area, data on the socio-economic, farm and institutional characteristics were collected and analyzed using descriptive statistics such as means and percentages.

Table 2: Frequencies of Socio-Economic Characteristics of Respondents (n=210)

Variables	Frequency	Percentage
Sex of the household head:		
Male	174	82.86
Female	36	17.14
Education:		
No education	30	14.29
Primary	119	56.67
Secondary	58	27.62
University degree	3	1.43
Occupation:		
Farming	195	92.86
Business	6	2.86
Salaried employee	6	2.86
Casual laborer	3	1.43

Source: Survey Data (2017)

Table 2 shows that 82% of the households were male headed and this is close to the findings from the third integrated household living conditions survey where more than 76% of households in the country are headed by males (NISR, 2011a; NISR, 2012). The household head is a family member who is responsible for the economic welfare of the household. The predominance of

male-headed household in the study area is explained by the fact that in Rwandan culture men are considered as household heads, thus women are less likely to declare themselves as the household head if there is an adult male in the household.

The results showed that 56.6% of the household heads had attained primary school education. These findings reflect the national figures whereby more than a half of the population had attained primary school education (NISR, 2012a). The results also showed that 27% of the households head have attained secondary school education while only 1% had a university degree.

The majority of household heads` main occupation was farming (92%) and only less than 10% were engaged in other activities such as businesses and salaried employment. Similarly, the results from the fourth population and housing census showed that in rural areas more than 80% of the population are mainly employed in agriculture (NISR, 2012).

Table 3: Mean of Socio-Economic and Farm Characteristics of Respondents (n=210)

Variables	Units	Mean	Standard deviation	Min	Max
Age	Years	44.5	11.1	25	75
Years in school	Years	5.5	3.9	0	16
Household Size	Number of household members	5	1.6	1	9
Experience	Years	18.3	10.6	1	60
Off-farm Income	Frw/Month	25474.29	54097.26	0	450000
Total land size	Acre	2.1	1.6	0.24	12.35
Land portion under potatoes	Acre	1.5	1.1	0.12	6.17
Quantity produced	Tons/year	12.7	18.5	0.2	90
Distance to paved road	Km	3.2	4.3	0.01	17

Source: Survey Data (2017)

The results in Table 3 showed that the average age of the household head was 44 which imply that potato farming in the study area is mostly done by old people. According to Etfo and Lufumpa (2014), 33% of the Rwandan population is between the age of 15 and 34 years and very few within this age bracket were engaged in agriculture. Etfo and Lufumpa (2014) attributed this to the lack of access to resources as well as the fact that youth don't like agriculture because they perceive it as a non-profitable activity compared to white collar jobs.

The mean number of years in school was 5 which imply that farmers in the study area had not attained secondary education. This can be attributed to the lack of financial means to pursue their studies as well as families that encourage their children to drop-out from school and do household activities. Obura (2005) found that the drop-out at the primary level was 15% in Rwanda and this was attributed to poverty and difficult home environment which force children to leave home to look for jobs.

The mean household size was 5 with total members ranging from 1 to 9. The family size in the study area was slightly above the average household size at the national level which is 4 members (NISR, 2009).

The mean number of years of experience in potato farming was 17 and this shows that potato farming in the study area is mostly done by farmers with a lot of experience. This is likely because potato requires high management practices to get high yield and farmers with a lot of experience have acquired managerial skills over time which enables them to efficiently manage potato farming.

Although farming was the main activity for almost all respondents, the average monthly off-farm income was 25,474 Frw which is equivalent to 30 USD per month. This shows that farmers had other sources of income other than potato farming which includes small businesses, salaried employment, and casual labor.

The average total land size was 2 acres with the minimum and maximum ranging from 0.02 to 12 acres respectively. The mean land size in the study area was slightly above the national average (1.2 acres) (NISR, 2011).

4.2 Characterization of Potato Marketing Channels

Potato farmers in the study area used mainly three marketing channels: collection centers, brokers and open-air market. The findings of the study showed that most farmers sold to potato collection centers as they account for almost a half of respondents (48%). Farmers reported that they preferred collection centers because they were reliable and could buy large quantities. The results also showed that 38 % of respondents chose brokers because they bought at the farm gate, therefore reducing transportation costs. Only 14 % of the respondents sold to open-air market (Figure 3).

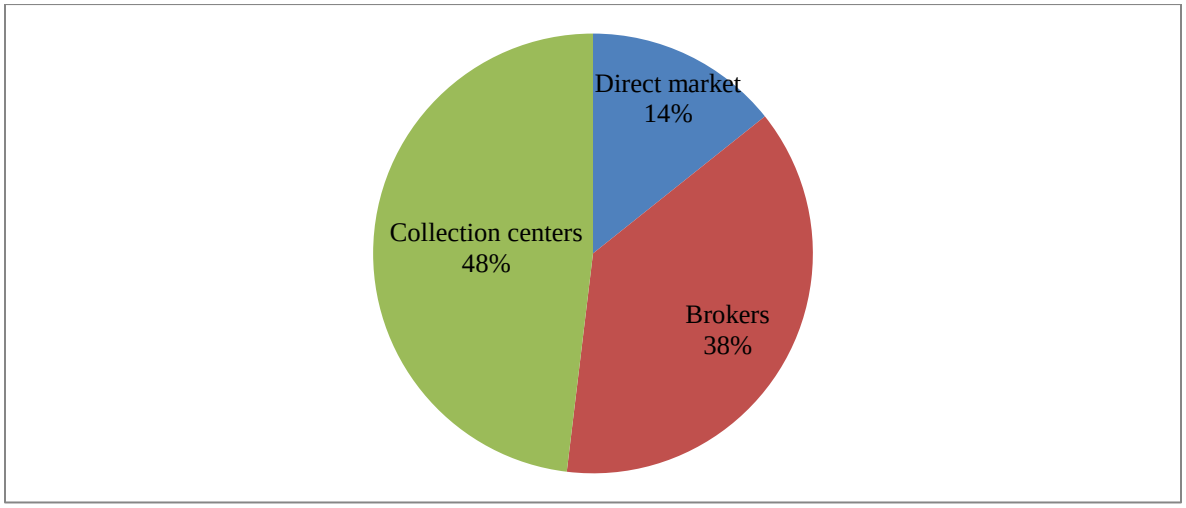

Figure 3: Distribution of Farmers by Marketing Channels

Source: Survey Data (2017)

The results in Table 4 showed that farmer`s participation in collection center was higher in Kinigi (54.46%) and lower in Nyange Sector (12.87%). Wennink et al. (2014) revealed that Kinigi is the top producer of potatoes in Musanze District with the mean yield of 35 tons per

hectare per year while it is estimated at 3 tons per year in Nyange. Thus, farmers with high yield chose collection centers likely because they could buy large quantities of potatoes.

Table 4: Farmer`s Participation in Different Marketing Channels by Sector

Marketing channels	**Sectors (%)**		
	Kinigi	**Nyange**	**Shingiro**
Collection center	54.46	12.87	32.67
Broker	3.80	87.34	8.86
Open air market	10.00	56.67	33.33

Source: Survey Data (2017)

Collection centers collect potatoes from farmers and supply them to the wholesale market in Kigali, which further supply to other wholesalers. Collection centers are reliable markets which offer fair prices to farmers as their prices are set through group discussions. However, they face some challenges such as lack of enough capital, lack of marketing records and lack of appropriate infrastructure such as storage (USAID, 2015a). Brokers buy from farmers at the farm gate and supply to collection centers, wholesalers and retailers in Kigali and other districts (Figure 4). Brokers reduce transportation costs and costs of searching for markets for the farmers as they move from farm to farm. However, farmers have reported that they are exploited by brokers through weighing because their scales are not accurate. Prices offered by brokers depend on farmers` bargaining power, thus making them price takers. Farmers also sell directly to open-air markets whereby they get immediate payment. Rwanda Agriculture Board is the main institution in charge of the early generation of seed and organization of seed distribution to

farmers. Farmers can access seeds from the agro-vet store or retain some potatoes for use as seeds in the following season.

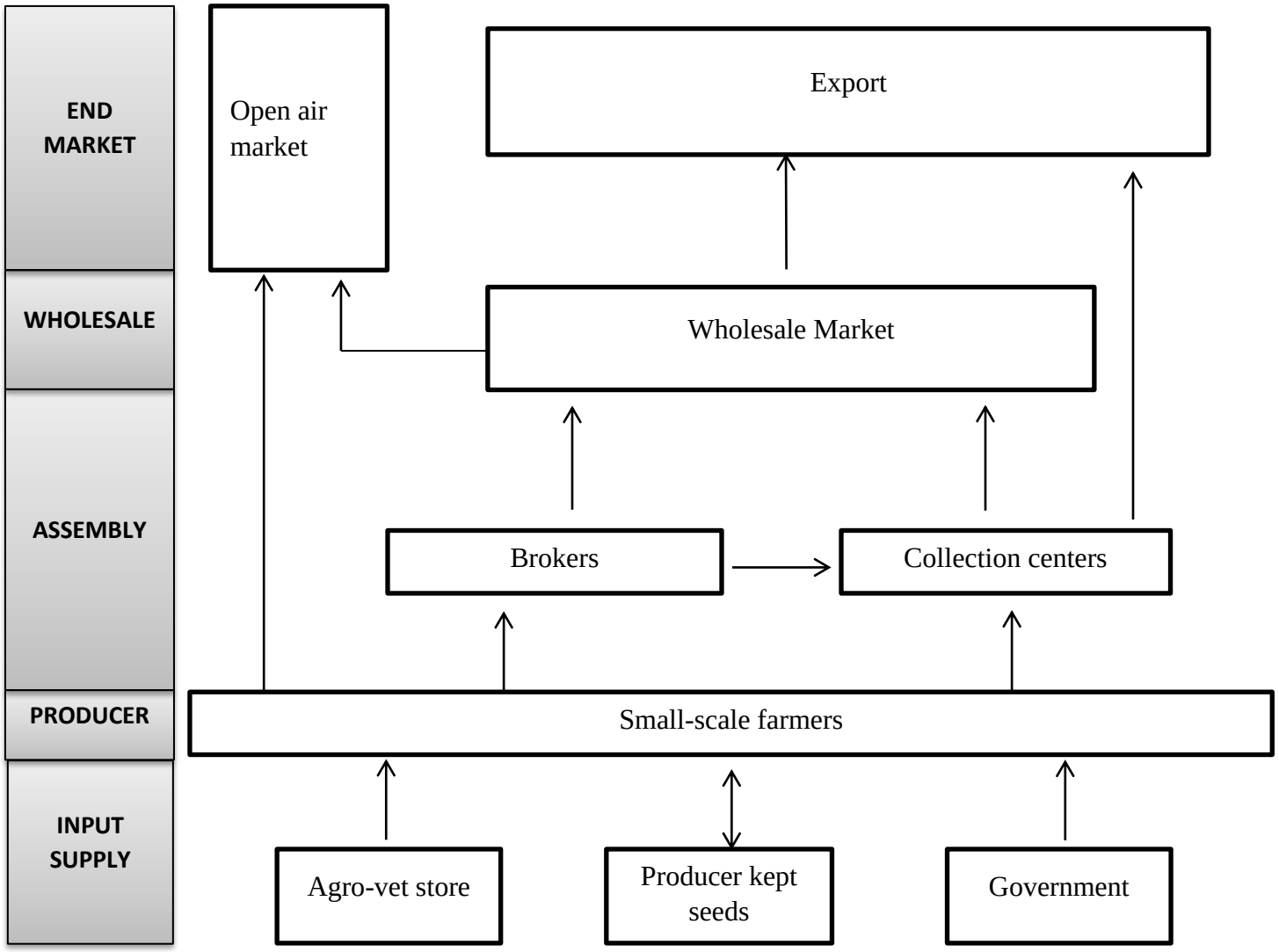

Figure 4: Potato Marketing Channels in Rwanda

Source: Author

4.3 Characteristics of Respondents Across Different Marketing Channels

Descriptive statistics such as mean and standard errors were used to characterize respondents who sold to different marketing channels. Collection center was taken as the base category because it had many observations and the t-test was used to compare the mean difference between farmers who sold to the collection centers and those who sold to other marketing channels. The $t\text{-test}_1$ was used to compare the mean difference between farmers who sold to collection centers and those who sold to brokers while $t\text{-test}_2$ was used to compare the mean difference between farmers who sold to the collection centers and those who sold open-air market.

The results showed that there was no significant difference in age between farmers who sold to collection centers and those who sold to broker and open-air market (Table 5). The mean age shows that farmers who used collection centers were slightly younger than those ones who sold to brokers. This could be because younger farmers were willing to venture into new marketing channels compared to older ones. In addition, young farmers can easily access market information from diverse social networks, which allows them to look for different marketing channels. Similarly, Maina et al.(2015) found that older mango farmers in Kenya preferred brokers compared to other marketing channels because they have built a strong network with them due to repeated transactions.

Table 5: Socio-Economic and Farm Characteristics of Respondents Across Different Marketing Channels (n=210)

	Marketing Channels				
Characteristics	**Collection center**	**Broker**	**Direct market**	**T-test$_1$**	**T-test$_2$**
Age	44.36 (10.48)	44.91(11.55)	44.1(12.52)	0.49	0.99
Years in school	5.02 (3.24)	5.6 (3.34)	7.2(3.59)	0.355	0.01***
Household size	5.16 (1.58)	4.86 (1.82)	5.03 (1.35)	0.1*	0.64
Experience	20.32 (10.07)	16.17 (10.9)	17.46(11.39)	0.00***	0.99
Quantity	22.72 (22.31)	2.60(4.43)	5.90 (5.93)	0.00***	0.00***
Total land size	3 (1.75)	1.22 (1)	1.94 (1.35)	0.00***	0.00***
Land Portion under Potatoes	2.05 (1.09)	0.87 (0.75)	1.64 (1.33)	0.00***	0.1*
Off-farm Income	23,485(51,287)	20,987(42441)	39,453 (83285)	0.1*	0.03**
Trans_cost	10,976(18191)	1,220 (2983)	8,500 (16429)	0.00***	0.48
Distan_to_road	4.21 (4.81)	1.71 (2.82)	4.37 (5.05)	0.00***	0.90

*****, **, * significance levels at 1, 5 and 10 percent respectively**

T-test$_1$: Test the difference in mean between collection center and broker

T-test$_2$: Test the difference in mean between collection center and open-air market.

Standard errors in Parentheses

Source: Survey Data (2017)

There was a significant difference in the number of years of schooling between farmers who sold to collection centers and those who sold to open-air market. Farmers who sold to open-air market had more years of schooling (7.2) compared to those who sold to collection centers (5.2). This is likely because, in the study area, farmers with more years of formal education are less likely to join agricultural cooperatives as they are busy with other occupation. Thus, they prefer selling individually at open-air markets rather than selling through collective marketing. These results are consistent with those by Chigwere (2014) who found that farmers who sold directly to local market had more years of education compared to those who sold to clubs and associations. Chigwere (2014) attributed this to the fact that farmers with more years of education can easily access information on different markets which enables them to choose better markets.

There was a significant difference in household size between farmers who sold to collection centers and those who sold to brokers. Farmers who sold to collection centers had larger household size (5.16) compared to those who sold to brokers (4.86). This could be because larger households prefer reliable markets to be able to cater for their family`s needs. Similarly, Bilaliib (2015) found that large families chose to sell to buyers who are consistent to be able to cater for their family needs.

There was also a significant difference in years of experience in potato farming between those who sold to collection centers and those who sold to brokers. Farmers with fewer years in potato farming sold to brokers (16.17) while the most experienced ones used collection centers (20.32). This could be because farmers who have been growing potatoes for many years have built connections with different actors in the value chain which enables them to access information on profitable markets. However, those with few years of experience in potato farming sell to buyers

who come first. Similarly, Berem et al. (2015) found that farmers with more years of experience chose to sell to cooperatives as opposed to other channels because they have information about different channels which enables them to choose lucrative markets.

There was a significant difference in quantities produced between farmers who sold to collection centers and those who sold to brokers and open-air market. Farmers who produced a high volume of potatoes sold to collection centers (22.72) while those with low volume sold to brokers (2.6). This is can be attributed to the capacity of collection centers to absorb large quantities. These findings concur with those by Soe et al. (2015) in Myanmar who found that farmers who produced a low volume of rice were more likely to choose brokers compared to collectors. They attributed this to the fact that farmers who produced low quantity prefer selling at the farm gate to reduce transportation costs.

There was a significant difference in the land portion under potato farming between farmers who sold to collection centers (2.05) and those who sold to open-air market (1.64) and brokers (0.87) respectively. Farmers who allocate big land to potato farming are more likely going to produce high quantities; thus they seek to use a channel that will absorb a high volume. These results are consistent with those by Zivenge and Karavina (2012) who found that farmers with bigger land size sold to a marketing channel that will take all of their production to avoid post-harvest losses.

There was a significant difference in mean of the distance to the paved road between those who sold to collection centers and those who sold to brokers. Farmers who sold to collection centers traveled a long distance (4.21) to reach the paved road compared to those who sold to brokers (1.71). Farmers who are farther from the paved road sold to collection centers likely because they have bigger land size and produce a high quantity of potatoes. Thus, they chose to sell to

collection centers as they could buy large quantities of potatoes. These findings concur with those by other authors (Martey et al., 2012; Muthini et al., 2017) who observed that farmers farther from the paved road prefer selling collectively to gain from economies of scale.

Farmers in the study area incurred different types of transaction costs such as costs associated with market searching and price negotiations. There was a significant difference in transaction costs incurred by farmers who sold to collection centers (10,976) and those who sold to brokers (1,220). Transaction costs were higher among farmers who sold to collection centers because they are not close to farmers, unlike brokers who buy at the farm gate.

4.4 Price Disparity Across Different Marketing Channels

Figure 5 shows that potatoes prices per kilogram have increased from 150 to 180 Rwandan francs in two years and they have been almost the same across the three marketing channels during the same year.

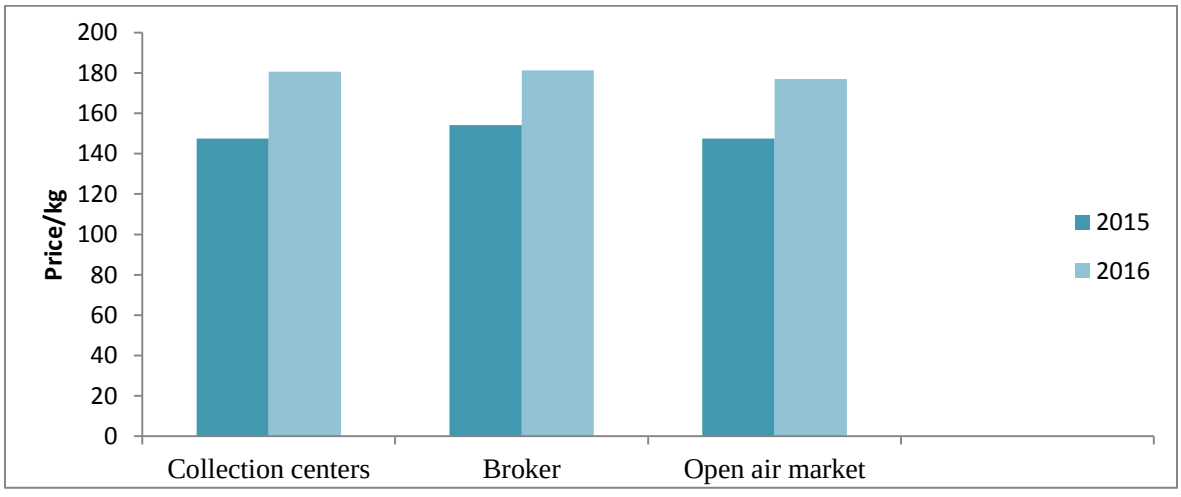

Figure 5: Comparison of Prices from Different Marketing Channels

Source: Survey Data (2017)

The analysis of variance (ANOVA) was used to determine if there was a difference in prices between different marketing channels (Table 6). The results showed that there was no difference in prices offered by the three marketing channels as the p-value was insignificant (p=0.82).

Table 6: Analysis of Variance (ANOVA)

	Sum of squares	Df	Mean square	F	P-values
Between Groups	172.49	2	86.24	0.20	0.82
Within Groups	91247.9	207	440.81		
Total	91420.42	209	437.41		

Source: Survey Data (2017)

The t-test was also used to test the difference in price between collection centers and other marketing channels. The results showed that there is no significant difference in prices between collection centers and brokers (p= 0.72), and collection centers and open-air market (p= 0.85).

4.5 Reasons for Using Different Marketing Channels

Farmers decided to use a given marketing channel after foreseeing that they will benefit more from it. Most farmers have reported that they sold to collection centers because they were reliable markets (58.82%) and offer higher prices (53.76%) compared to other marketing channels which improve farmer`s income and enable them to cater for their family needs (Table 7). The majority of those who sold to brokers (70%) reported that they chose them because they were the nearest channels as they buy at the farm gate, therefore reducing transportation costs and saving time. Those who sold to open-air market reported it is because of timely payment as

buyers pay cash before taking the products which helps farmers to prepare for the next season on time.

Table 7: Reasons for Using Different Marketing Channels

Reasons	**Marketing channel (%)**		
	Collection center	**Broker**	**Open-air Market**
High prices	53.76	31.19	15.05
Reliable	58.82	35.29	5.89
Timely payment	39.02	19.51	41.46
Nearest	10	70	20

Source: Survey Data (2017)

4.6 Institutional Factors in Potato Marketing

The results in Figure 6 showed that 49% of respondents had access to extension services. Farmers were trained in different subjects such as good farming practices, pest and diseases management, fertilizer application and marketing strategies. The study also revealed that 70% of respondents were members of groups. Previous studies on the choice of marketing channels found that groups have a positive relationship with farmer`s decision to sell collectively (Mujawamariya, 2007; Verhofstadt and Maertens, 2014). Only 33% of the respondents had access to credit.

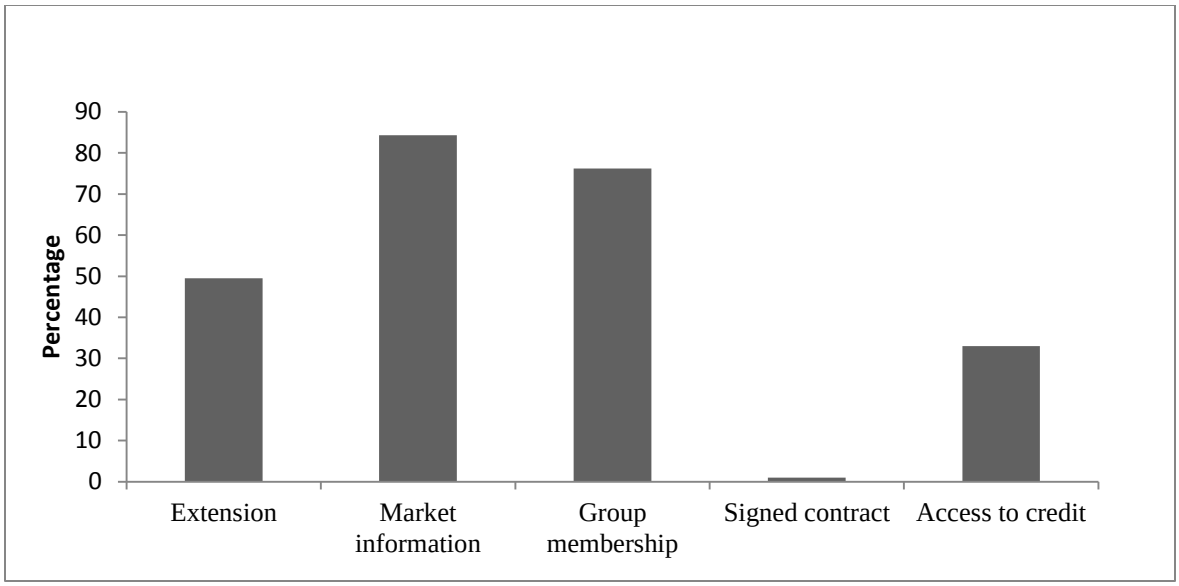

Figure 6: Institutional Factors in Potato Marketing

Source: Survey Data (2017)

Access to market information reduces risk and uncertainty in markets which allows optimal allocation of resources by farmers. The majority of smallholder farmers in Rwanda have limited access to market information, thus, they rely on buyers as their source of information which opens opportunities for exploitation by buyers (Bizimana, 2013). Similarly, the current study found that buyers were the main source of market information (86%). Farmers also reported that they got market information from their neighbor (8%) and from other sources such as the government, local NGOs and farmer groups (Figure 7).

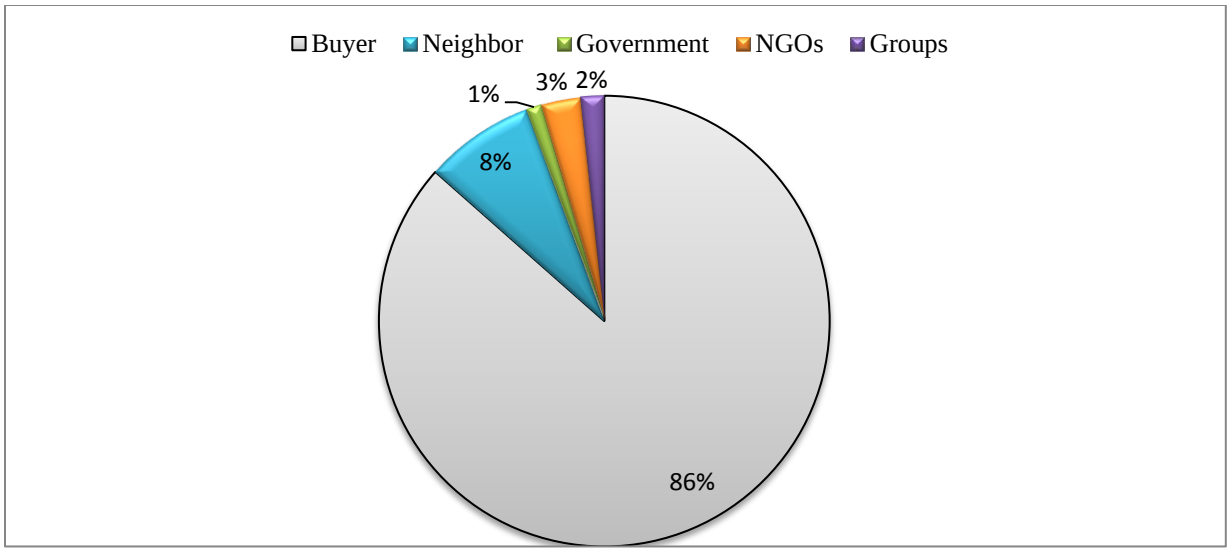

Figure 7: Sources of Market Information

Source: Survey Data (2017)

Farmers have reported that they face a problem of information asymmetry as buyers were the major sources of market information. Brokers don`t provide full information to farmers in order to benefit more. According to Mitra et al. (2013), the imbalance in market information between farmers and buyers leads to uncompetitive markets which are characterized by low prices. Also, under asymmetric market information, farmers become uncertain which increases risks and limits their choices (Oduor, 2015).

4.7 Challenges in Potato Production and Marketing

Results in Figure 8 showed that the main challenges that faced potato farmers were high costs of production (75%) due to high costs of improved seeds and fertilizer. Similarly, the findings from the potato value chain analysis revealed that potato seed market was not well developed in

Rwanda as seed multipliers only sold 30% as seeds and the remaining as ware potatoes (USAID, 2015a).

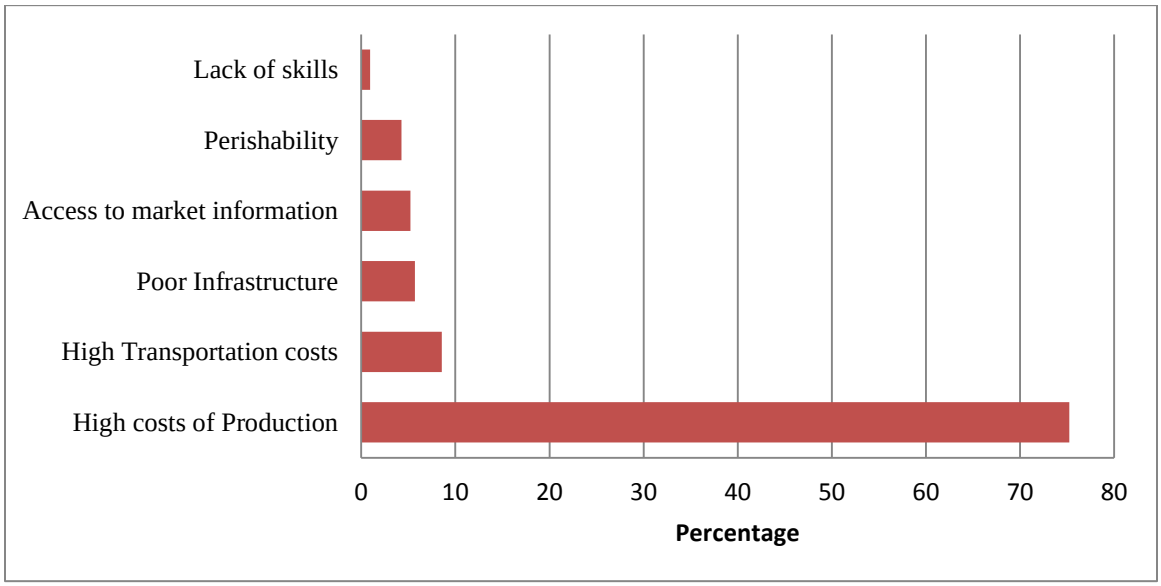

Figure 8: Challenges in Potato Production and Marketing

Source: Survey Data (2017)

4.8 Factors Influencing Farmers' Choice of Marketing Channels

Prior to the Multinomial Logit Model, some diagnostic tests were done to check for multicollinearity, heteroskedasticity and the independence from irrelevant alternative (IIA). This was meant to assess if the independent variables were suitable for inclusion in the model. The variance inflation factor (VIF) was used to test for multicollinearity and the results showed that the mean VIF was 1.54 and it ranged between 1.13 and 2.63 (Appendix III). According to Greene (2002), the VIF greater than 5 shows that there is a high correlation among explanatory variables. Since the results showed that all variables had aVIF that was below 5, it implies that

there was no linear correlation between the independent variables included in the model. In addition, Pearson's correlation analysis was done to test whether there is a linear correlation between independent variables. The results showed that there is no strong linear correlation as all independent variables were not close to 1 (positive linear correlation) or -1 (negative linear correlation) (Appendix IV).

Results from Breusch-Pagan/Cook-Weisberg test showed that there was heteroskedasticity as the p-value was significant (0.00). In order to correct for this problem, robust standard errors were used. According to Williams, (2015) Robust standard errors don`t change coefficients but give accurate p values. The Hausman specification test was used to test whether the assumption of independence from irrelevant alternatives (IIA) was violated or not. The results showed that the IIA assumption was not violated because all the P-values were not significant (p=1). This implies that the Multinomial Logit Model was correctly specified.

The Multinomial logit model (MNL) was used to analyze the factors that influence the choice of marketing channels among potato farmers in Musanze District. Collection center was taken as the base category because it had more observations. MNL gives a McFadden's R^2 (Pseudo R^2) of 0.5212 which means that the explanatory variables explain 52.12% of the variation in the dependent variable. The estimated probability was greater than the chi-square value (Probability > Chi-square = 0.0000) which implies that the variables were jointly significant in explaining the dependent variable (Table 8).

Table 8: MNL Estimates for Determinants of the Choice of Marketing Channels

	Open-air Market			Brokers		
Variable	**Coef**	**Robust Std. Err**	**P>|Z|**	**Coef**	**Robust Std. Err**	**P>|Z|**
Sex	1.773	1.216	0.145	-0.200	0.781	0.797
Age	0.011	0.041	0.784	0.055	0. 028	**0.048****
Year_ In_School	0.194	0.096	**0.043****	0.073	0.073	0.305
Experience	-0.011	0.045	0.805	-0.046	0.030	0.135
Off-Farm_Inc	0.002	0.006	0.744	-0.006	0.003	**0.060***
Land_Size	0.137	0.253	0.587	-0.493	0.407	0.226
Price	0.001	0.019	0.943	0.005	0.012	0.650
Quantity	-0.078	0.051	0.124	-0.114	0.047	**0.015****
Distan_To_ Road	0.061	0.065	0.342	-0.190	0.067	**0.004*****
Own_Transport	-4.574	0.868	**0.000*****	-1.438	0.786	**0.067***
Trans_Cost	-0.003	0.001	0.805	-0.001	0.005	**0.020****
Extension	-0.554	0.267	**0.038****	-0.154	0.186	0.408
Market_Info	1.058	0.759	0.163	-0.400	0.621	0.520
Group_ Member	0.780	0.732	0.286	-0.616	0.454	0.175
Cons	0.456	4.429	0.918	-1.400	3.485	0.688

Number of obs = 210, Wald chi2(30) = 101.13, Log pseudolikelihood = -99.86

Prob > chi2 = 0.0000, Pseudo R2 0.5212

***, **, * significance levels at 1, 5 and 10 percent respectively**

Source: Survey Data (2017)

The marginal effects were computed to assess the change in covariates on the dependent variables (Table 9)

Table 9: Marginal Effects of Determinants of the Choice of Marketing Channels among Potato Farmers

	Open-air Market			Brokers		
Variable	**dy/dx**	**Std. Err**	**P>|Z|**	**dy/dx**	**Std. Err**	**P>|Z|**
Sex	0.065	0.065	**0.095***	-0.061	0.076	0.425
Age	-0.000	0.002	0.784	0.005	0.002	**0.063***
Year_In_ School	0.009	0.005	**0.094***	0.003	0.007	0.674
Experience	0.000	0.002	0.870	-0.004	0.003	0.146
Off-Farm_Inc	0.002	0.002	0.278	-0.007	0.003	**0.033****
Land_Size	0.019	0.021	0.368	-0.054	0.031	**0.087***
Price	-0.000	0.000	0.956	0.000	0.001	0.605
Quantity	-0.002	0.003	0.610	-0.010	0.004	**0.014****
Distan_ To _Road	0.008	0.004	**0.059***	-0.021	0.005	**0.000*****
Own_ Transport	-0.304	0.025	**0.000*****	-0.253	0.051	**0.000*****
Trans_Cost	0.000	0.000	0.158	-0.0013	0.005	**0.025****
Extension	-0.029	0.014	**0.042****	-0.003	0.017	0.852
Market_ Info	0.071	0.050	0.155	-0.065	0.068	0.339
Group_ Member	0.060	0.039	0.125	-0.081	0.048	**0.092***

*****, **, * significance levels at 1, 5 and 10 percent respectively**

Source: Survey Data (2017)

As expected, the male headed household had a higher probability of selling to open-air market by 6.5% relative to collection centers. This is because males have more information about existing marketing opportunities due to their contact with more buyers, unlike women who spend most of their time doing household`s tasks. Also, men are less likely to join farmer groups compared to female; therefore they prefer selling to local markets. This finding concurs with observations by

Martey et al. (2012) and Nyaga et al. (2016) who found that being male reduced the probability of selling to cooperative markets because males have more financial resources than women which enable them to look for other markets, unlike women who prefer collective marketing to gain from economies of scale.

Contrary to what was expected, the age of the household head was positively related to the choice of brokers. One year increase in age of the household head was associated with 0.55% increase in the probability of choosing brokers as marketing channel relative to collection centers. This could be because older farmers have built networks and trust with brokers because of frequent transactions; thus they chose to continue selling to them rather than trying the new marketing channels. These findings concur with those by Kihoro (2016) who found that age increased a farmer`s likelihood of selling to brokers compared to other channels among green gram farmers in Kenya. This was attributed to stronger networks between old farmers and brokers due to many years of trade. Gido et al. (2016) found that an increase in age of the household head increased farmers` probability of selling at the farm gate outlet among indigenous vegetable farmers in Kenya because older farmers can easily access information about reliable markets that offer better prices due to their networks.

As expected, the household head`s literacy level significantly affected the choice of open-air market. An additional year in school was associated with 0.9 % increase in the probability of selling to open-air market as opposed to collection centers. This is because farmers with higher literacy level are more likely to be employed elsewhere and don`t have time to join farmer groups. Hence they opt to sell individually at open-air markets rather than selling through collective marketing. These findings are in line with arguments by Chigwere (2014) who found

that an increase in farmer`s years of education increased their probability of selling their cotton directly to ginners as opposed to associations. Similarly, Chirwa (2009) found that maize farmers with more years of education were more likely to sell to local markets compared to other channels in Malawi because educated farmers can easily access information on available markets, therefore they chose to sell to a marketing channel that is more profitable.

As expected, there was a negative relationship between off-farm income and the choice of brokers. The probability of choosing brokers decreased by 0.7% for every Rwandan franc increase in off-farm income compared to collection centers. This means that farmers who had other sources of income were more likely to sell to collection centers. The plausible explanation is that as farmers get wealthier, they are not constrained by cash; hence instead of selling at the farm gate, they could delay selling and look for alternative buyers who offer better prices. This concurs with the previous study by Moturi et al. (2015) who found that farmers with higher off-farm income were less likely to sell at the farm gate because they had financial means to look for other markets.

As expected, the quantity produced was negatively associated with the choice of brokers, with 1% decrease in the probability of choosing brokers for every ton increase in quantity produced compared to collection centers. This implies that as farmers produce more, they opt for a channel which will accommodate their high production to avoid postharvest losses and collection centers buy much more compared to brokers. These results collaborate the findings by Fafchamps and Hill (2005) who found that farmers were less likely to sell at the farm gate if their volume was high. Similarly, Soe et al. (2015) found that an increase in the quantity of rice produced reduced

farmers probability of selling to brokers at the farm-gate because high quantities motivate farmers to look for better markets.

As hypothesized earlier, there was a negative relationship between land portion under potato farming and the choice of brokers. One acre increase on land under potato farming reduced farmer`s probability of selling to brokers by 5.4% relative to collection centers. However, these findings are inconsistent with those from previous studies by Mutura et al.(2015) and Rajanna (2017) who found that farmers with big land size were less likely to sell through cooperatives unlike those with small land who wanted to benefit from economies of scale. The results of this study could be attributed to the fact that farmer who allocated large sizes of land to potato farming, were more likely to produce more; therefore, they choose collection centers because they can absorb their high volume.

Contrary to what was expected, the distance to the nearest paved road was negatively associated with the probability of selling to brokers compared to collection centers. One kilometer increase in the distance to the nearest paved road reduced the probability of selling to brokers by 2.1% and increased the probability of selling to open-air market by 0.8% relative to collection centers. These results are in line with findings by Martey et al. (2012) who observed that as the distance to tarmac road increased, yam farmer`s probability of selling to cooperative increased too. However, they contradict the findings by Slamet et al. (2017) who reported that a unit increase in the distance to asphalt road increased farmer`s probability of selling at the farm gate due to increased travel time and transportation costs. The plausible reason could be because in the study area farmers with big land size are the ones located far away from the paved road, thus they are

more likely to produce high quantities of potatoes. So, they chose to sell to channels that can accommodate their high production.

As hypothesized, ownership of a transport facility was negatively associated with the choice of brokers. Having a transport facility reduced farmer's probability of selling to brokers by 25% compared to collection centers. This could be because farmers who possess a transport facility would be able to transport their products to better markets rather than selling at the farm gate as they are not constrained by transport facility. These findings concur with those by Soe et al. (2015) who found that possession of a transport facility was negatively associated with the probability of using brokers among paddy rice farmers in Myanmar. This was attributed to the fact that farmers who don't have a transport facility sold at the farm gate to reduce transportation costs.

Contrary to what was expected, an increase in transaction costs by one franc reduced a farmer`s likelihood of selling to brokers by 0.13% compared to collection centers. These results contradict those by Mutura et al. (2015) who found that transaction costs were positively associated with the choice of brokers because they buy at the farm gate which reduced costs of searching for markets. The results of this study could be attributed to the fact that prices from brokers depend on farmer`s bargaining power and most of the times farmers have weak bargaining power. Also, the bargaining process takes time; therefore, farmers opt for collection centers where prices are pre-determined to avoid post-harvest losses.

Contrary to a priori expectation, access to extension services had a negative effect on the choice of open-air market. An increase in the number of visits by the extension agent reduced farmer`s probability of selling to open-air market by 2.9% as opposed to collection centers. The reason

could be because access to extension services enables farmers to improve their production skills, therefore, leading to increased production. With increased production, farmers are willing to sell to channels that can absorb high quantities. Similarly, Tarekegn et al. (2017) found that access to extension services influenced farmers to sell through cooperatives because it facilitated them to have access to market information which in turn increased farmers' capability to choose the best marketing channel for their products.

As expected, group membership reduced the probability of selling to brokers by 8.1 % as opposed to collection centers. This is likely because group membership facilitates easy access to market information through training; thus enables farmers to look for profitable markets. In addition, group membership reduced costs of looking for market and transportation costs, therefore, enabling farmers to gain from economies of scale. Similarly, previous studies showed that group membership facilitated participation in collective marketing and that there was a negative association between being a member of a group and the choice of brokers (Maina et al., 2015). They attributed this to the fact that groups provide the platform of collective marketing that reduced costs for searching for markets. Hence, the farmers choose to sell to cooperatives to reduce transaction costs as a result of economies of scale.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The analysis of factors that affect potato farmer`s choice of marketing channels is of great importance because it will help in understanding socio-economic and institutional factors that influence farmer`s decision to sell to collection centers, therefore, providing information on areas that need more efforts to make the new trading system work effectively. The results of this study showed that three main marketing channels were used by potato farmers in the study area. These are collection centers, brokers, and open-air market. Almost a half of respondents used potato collection centers while the rest used brokers and open-air market. The study revealed that farmers who sold to these three marketing channels had different characteristics. Farmers who sold to open-air market had more years of schooling compared to those who sold to collection centers, while farmers who sold to collection centers produced high quantities of potatoes compared to those who sold to brokers and open-air market.

The results from the Multinomial Logit model showed that factors such as sex, age, the household head`s years of schooling, off-farm income, land size under potato farming, the quantity produced, the distance to the paved road, ownership of a transport facility, access to extension services and group membership were significant. The determinants of the choice of open-air market were the sex of the household head, with being male increasing the probability of selling to open-air market, and the number of years in school, as an increase in years of schooling increased the probability of selling to open-air market. Other factors such as the access to extension services reduced farmer`s probability of selling to open-air market as opposed to the collection center.

The main determinant of the choice of brokers was age, with an increase in the age of the household head influencing the choice of brokers over the collection center. The study, also found that off-farm income, the land size under potato farming, the quantity of potato produced, and group membership reduced farmers 'probability of selling to brokers compared to collection centers. The study concludes that socio-economic and institutional factors such as age, sex, education, off-farm income, and group membership are important determinants of the choice of marketing channels among potato farmers in Musanze District.

5.2 Recommendations

The study highlights the importance of group membership and the quantity produced in determining farmer`s choice of marketing channel. Thus, farmers should organize themselves in groups and cooperatives to be able to bulk their production to access better markets and negotiate for better prices. Groups would also enable farmers to easily access market information; therefore enabling them to make an informed decision about the choice of marketing channels.

Extension services should enlighten farmers on the importance of collective action in potato marketing. This can be done by private service provider, farmer to farmers or nongovernmental organization through training. Further, the extension service provider should also educate farmers to improve their production through good farming practices. Access to extension services would also enable the farmer s to access market information which would help them in choosing better marketing channel.

Off-farm income was another significant factor that influenced the choice of marketing channel, thus farmers should consider using their groups as saving groups that will act as sources of off-farm funds which would enable them to look for better marketing channels.

The study further showed that farmers who sold to collection centers incurred high transaction costs compared to those who used other channels. There is a need for policy interventions to review existing pathways for market information such as the short message system to facilitate farmers to easily access market information. This would reduce costs incurred in searching for markets. Further, farmers should be trained on how to use those technologies to be able to access market information.

5.3 Suggestion for Further Research

The current study focused on the determinants of choice of marketing channels among potato farmers. So, it is necessary to understand which marketing channel is more profitable than the others. Therefore, future studies should look at the profitability of potato marketing channels. Having information on marketing channel profitability would help in coming up with new measures to make potato marketing channels more efficient.

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Appendix I: Household Interview Questionnaire

UNIVERSITY OF NAIROBI

DEPARTMENT OF AGRICULTURAL ECONOMICS

IRISH POTATO FARMER`S QUESTIONAIRE

This questionnaire aims at collecting data on Irish potato in Musanze District for academic purpose. Responses obtained will be treated with confidentiality and no names will appear in the report. Your assistance will be highly appreciated.

DETERMINANTS OF CHOICE OF MARKETING CHANNELS AMONG POTATO FARMERS IN MUSANZE DISTRICT, RWANDA: EVIDENCE AFTER THE 2015 POTATO MARKET REFORMS

A. HOUSEHOLD CHARACTERISTICS

A.1 Location

Questionnaire Number:	Date:	District:
Sector:	Cell:	Village:

Name of the enumerator:

A.2 Identification

1.	Name of respondent:
2.	Name of the Household head:
3.	Telephone Number:

B. DEMOGRAPHIC AND SOCIO-ECONOMIC INFORMATION

i. Background of the household

	Household members/Name	**Sex**	**Age**	**Relationship with the household**	**Education (years of schooling)**	**Occupation**
1						
2						
3						
4						
5						

Sex	**Relationship with the HH head**	**Occupation**
1= Male	1= HH head	1= Farming
2= Female	2= Spouse	2= Business
	3= Child	3= Salaried employer
	4= Parent	4= Student
	5= Other (specify)	5=Casual Laborer
		6= None
		7= Other (Specify)

ii. How many years have you been growing Irish potatoes: _____(Years)

iii. What is your total monthly off-farm income: _____(Frw)

C. PRODUCTION INFORMATION

i. Land Ownership

Plots	**Size (ha)**	**Size under potato cultivation (ha)**	**Ownership**
Plot 1			
Plot 2			
Plot 3			
Plot 4			
Plot 5			
Total (ha)			

Ownership

1= owned with title deed 3= rent 5= owned by group

2= owned without title 4= owned by relatives 6= other (Specify)

ii. What is your type of cropping for potatoes?

Type of cropping	**Size (ha)**
Pure cropping	
Intercropping	

iii. What is the average quantity of potato produced per year: _____(Kg)

iv. What is your main source of labor?

1. Family ☐
2. Hired (casual) ☐
3. Hired (permanent) ☐

v. Where do you purchase your inputs?

1. Agro vet store ☐
2. Cooperative ☐
3. Government ☐
4. Other (specify):----------

vi. What are the costs do you incur in potato farming per year (*Please fill the table)*

Materials

	Materials	**Quantity**	**Unit cost**	**Total costs**
1	Hoes			
2	Bags			
3	Seeds			
4	Fertilizer			
Total				

Activities

	Activities	**Number of days**	**Cost per day/unit**	**Total cost**
1	Ploughing			
2	Planting			
3	Fertilization			
4	Weeding			
5	Irrigation			
6	Harvest			
7	Storage			
8	Transport			
Total				

vii. What are other sources of on farm income from crops?

Crop	**Area under cultivation (Ha)**	**Income per year (frw)**

Crop

1= Maize 3= Wheat 5= Other Specify)

2= Pyrethrum 4= Beans

viii. Do you own livestock?

1. Yes ☐

2= No ☐

If yes how many

	Livestock owned	**Number**	**Income per year (Frw)**
1			
2			
3			

D. MARKETING INFORMATION

Please fill the table below

Year	**buyer**	**Quantity sold (kg)**	**Price/Kg**	**Income**	**Distance to the market(km)**
2014					
2015					
2016					

Buyer

1= Collection center

2= Broker

3= Open-air market

i. Which one do you consider to be your main buyer?

Buyer

1= Collection center 3= Open-air market

2= Broker

ii. How frequent do you sell to that buyer

1. Daily ☐

2. Weekly ☐

3. Monthly ☐

4. Once per season ☐

5. Other (Specify):----------

iii. Why did you choose to sell through that channel?

1. High prices ☐

2. Reliable ☐

3. Timely payment ☐

5. Nearest ☐

10. Other (Specify):----------

iv. What are the requirements for that buyer?

1. Quality ☐

2. Size ☐

3. Group membership ☐

4. None ☐

4. Other (specify): ----------

v. Are you satisfied with that buyer?

1. Yes ☐

2. No ☐

If No Why

1. Strict on quality ☐

2. Large quantity ☐

3. Long distance ☐

4. High costs ☐

5. Unreliable ☐

6. Other (specify):----------

vi. Is there any support that you get from the buyer?

1. Yes ☐

2. No ☐

If yes which one

1. Input ☐

2. Training ☐

3. Credit ☐

4. Market information ☐

4. Other (specify):----------

vii. Price setting

Buyer	**Price setting**
Collection center	
Brokers	
Open-air market	

Price setting

1= Individual negotiation 4= Farmers set the price

2= Group negotiation 5= Other (Specify)

3= Buyer set the price

viii. Are you happy with this means of price setting?

1. Yes ☐

2. No ☐

If No why: ----------
---

ix. Do you own a storage facility?

1. Yes ☐

2. No ☐

x. Do you carry out any value addition before selling?

1. Yes ☐

2. No ☐

If yes which one:

Value addition	**Costs (Frw)**
1. Grading	
2, Washing	
3. Packaging	
4. Transformation into chips	
5. Other (Specify)	

xi. How far is your farm to the nearest paved road (km):---------

xii. What is the condition of the paved road?

1. Very Poor ☐
2. Poor ☐
3. Good ☐
4. Very Good ☐

xiii. Do you own means of transportation?

1. Yes ☐
2. No ☐

If yes which one

1. Bicycle ☐
2. Motorbike ☐
3. Car ☐

4.Other (Specify)----------
---

xiv. Do you incur costs during the following marketing activities? (Yes/No)_____

1. Searching for market (Transport, airtime):_____

2. Price negotiation (transport, airtime);_____

3. Contract elaboration (fees, lawyer);_____

4. Maintaining contract (transport, airtime):_____

5. Incidental costs: _____

xv. What are the main challenges do you face in potato production and marketing?

1. Access to market information ☐

2. High transportation costs ☐

3. Poor infrastructure ☐

4. Lack of skills ☐

5. Perishability ☐

6. Other (Specify):----------

D. ISTITUTIONAL INFORMATION

i. Have you got a visit by extension agents last year?

1. Yes ☐

2. No ☐

If yes how many times per year: _____

ii. What support have you got from them?

1. Good farming practices ☐

2. Pest and disease management ☐

3. Fertilizer application ☐

4. Other (specify): ----------
---

iii. Do you have information on possible markets and prices before selling?

1. Yes ☐
2. No ☐

If No go to question number IV

If yes answer the following questions

Where do you get information from?

1. Government ☐
2. NGO ☐
3. Buyer ☐
4. Cooperative/Group ☐
5. Other (specify): ----------

How often do you receive market information?

1. Daily ☐
2. Weekly ☐
3. Monthly ☐
4. on seasonal basis ☐
5. Annually ☐
6. Other (specify): ----------

What are the means used to get this information:

1. Mobile phone ☐
2. Radio ☐
3. Word of mouth ☐
4. Television ☐

5. Internet ☐

6. Newspaper ☐

7.Other (specify): ----------
---

iv. Are you a member of any group/cooperative?

1. Yes ☐

2. No ☐

If No what are the reasons:

1. There are no groups ☐

2. I don't have time ☐

3. High costs ☐

4. Groups are not beneficial ☐

5. Other (specify):----------

If Yes what kind of group:

1. Agricultural ☐

2. Religious ☐

3. Saving and credit ☐

4. Other (Specify): ----------

v. What benefits do you get from being a member of the group?

1. Credit/loan ☐

2. Access to input ☐

3. Access to extension services ☐

4. Access to market information ☐

5. Training ☐

6. Ready market ☐

7. Other (Specify): ----------

vi. Have you signed a contract with any buyer last year?

1. Yes ☐

2. No ☐

vii. Have you accessed credit in the last year?

1. Yes ☐

2. No ☐

If yes

Source	**Amount**	**Repayment period**	**Form**	**Activities**

Source	**Activities**	**Form**
1. Financial Institution	1. potato farming	1. Cash
2. Family/Friend	2. Other (specify)	2. Inputs
3. Group/Cooperative		
4. Buyer		
5. Other (specify)		

If No why:

1. High interest rate ☐
2. Lack of collateral ☐
3. No need ☐
4. Don`t have information ☐
5. Other (specify): ----------

E. HOUSEHOLD EXPENSES

What are the household expenses per year?

Expenses	**Amount (Frw)**
Food	
Cloths	
School fees	
Medical fees	
Entertainment	
Donation	
Assets	
Saving	
Other (specify)	
Total	

Appendix II: Focus Group Discussion Questionnaire

Key questions:

1. Is potatoes your main source of on farm income
2. How many times do you grow potatoes per year
3. What are the main channels through which you sell potatoes
4. What are the advantages from each channel
5. What are the constraints faced from each channel
6. What is the price per kg in each channel
7. What are challenges do you face in potato production and marketing
8. What would be the solutions to those challenges
9. What are the other main sources of on farm income

Appendix III: Variance Inflation Factor (VIF) for Multicollinearity Test

Variable	VIF	1/VIF
Age	2.26	0.442323
Sex	1.41	0.710558
Year_In_School	1.39	0.720685
Experience	2.33	0.428368
Land_Size	1.92	0.520537
Quantity	2.61	0.382525
Price	1.13	0.884586
Extension	1.52	0.657208
Distan_To_Road	1.49	0.669510
Market_ Info	1.33	0.751515
Trans_Costs	1.28	0.780239
Own_Transportation	1.21	0.827111
Group_ Member	1.15	0.869983
Off-farm_ Inc	1.13	0.881777

Source: Survey Data (2017)

Appendix IV: Pearson`s Correlation Matrix

	Sex	Age	Year_In_School	Experience	Off_Farm_Inc	Quantity	Price	Distan_To_Road	Own_Transport	Trans_Costs	Extension	Market_Info	Group_Member
Sex	1.00												
Age	0.27	1.00											
Year_In_School	-0.30	-0.20	1.00										
Experience	0.17	0.66	-0.21	1.00									
Off_Farm_Inc	-0.00	0.08	0.17	-0.09	1.00								
Quantity	0.09	0.02	-0.04	0.20	-0.11	1.00							
Price	-0.13	-0.08	-0.00	-0.06	-0.16	0.04	1.00						
Distan_To_Road	-0.07	-0.07	-0.12	0.13	-0.05	-0.14	-0.03	1.00					
Own_Transport	0.18	-0.00	-0.28	0.07	-0.08	0.15	0.00	0.03	1.00				
Trans_Costs	-0.08	0.11	-0.05	0.27	-0.04	0.12	-0.04	0.29	0.01	1.00			
Extension	-0.02	-0.04	-0.16	-0.10	0.05	-0.50	-0.03	0.14	-0.03	0.00	1.00		
Market_Info	-0.05	0.00	-0.14	0.17	-0.00	-0.22	-0.23	0.29	0.07	0.12	0.11	1.00	
Group_Member	0.10	0.05	-0.07	0.03	0.02	0.19	-0.02	-0.14	0.17	-0.06	0.02	-0.11	1.00

Source: Survey Data (2017)

Appendix V: Hausman test for IIA

Omitted Choice	**X^2**	**$P>X^2$**
Collection center	0.000	1.000
Broker	0.000	1.000
Open-air market	0.000	1.000

Ho: Odds (Outcome-J vs Outcome-K) are independent of other alternatives

Source: Survey Data (2017)