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**PROFITABILITY AND CHOICE OF MILK MARKETING CHANNELS BY
DAIRY FARMERS IN MBARARA DISTRICT**

BY

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216006494

16/U/11570/PS

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**A SPECIAL PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF
AGRIBUSINESS AND NATURAL RESOURCE ECONOMICS IN PARTIAL
FULLFILLMENT FOR THE AWARD OF BACHELOR'S DEGREE IN
AGRIBUSINESS MANAGEMENT AT MAKERERE UNIVERSITY.**

SEPTEMBER, 2019

DECLARATION

I **SSEKIBAALA GONZAGA** hereby declare that this research is my original work and it has never been submitted to any University of institution of higher learning for any award or certificate, diploma or a degree.

Signature.....  Date..... 29/09/2019.

SSEKIBAALA GONZAGA

APPROVAL

This special project has been submitted for examination with my approval as the university supervisor.

Signed.....

Dr. JOHN ILUKOR

PHD

Date.....

DEDICATION

I dedicate this report to my beloved mother Major General Ayesha Dede, as well as my entire family in general for the support and encouragement offered in my academic journey. May Allah bless us all! I also dedicate this report to my deceased dad General Ali Musa. May your soul rest in peace eternal.

ACKNOWLEDGEMENT

I wish to express my profound gratitude to the almighty Allah for his sufficient and unfailing grace and protection throughout my life, during the period of my study and when writing of this thesis. I convey my sincere gratitude to my dear academic supervisors Dr. John Ilukor and Mr. Deogracious Opolot for working tirelessly and passionately to give shape to this work. It is through their professional mentorship, guidance, and timely comments and suggestions that I have been able to achieve this far. I am humbled for the sacrifice and many hours you spent guiding me to come out with the best research work.

I am grateful to my Colleague Mr. Shaban Tumwijeho for all the assistance you rendered to me during data collection mainly language translation while in the field. Ur efforts were tremendously appreciated. Thanks for your time brother. Lastly, I extend my appreciation to the dairy farmers in Mbarara District who cooperated with me in data collection, you were really hospitable. May Allah bless us all!

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ABSTRACT

Despite the importance of the dairy sector in improving livelihoods of people through income generation, it is still faced by numerous challenges such as low milk prices, post-harvest losses, poor transport networks, poor animal breeds and the biggest of all is poor milk marketing facilities and channels. Although, formal milk marketing through cooperatives has been advocated for, the milk marketing sector has remained largely informal. To understand why the informal milk marketing is still popular, the study sought to the profitability of milk marketing channels by dairy farmers and understand the drivers of choice of informal versus formal milk marketing channel. The study was conducted in Mbarara district and 120 households were randomly selected to participate in the study. The results showed that farmers who sell to formal channels (cooperative) were mainly from male headed households, married, attained primary education as highest level of education, and keep large cattle herds. Moreover, they participate in other income generating projects as compared to farmers to the informal milk marketing channels. Probit model analysis results revealed that the significant determinants for choice of marketing channel are milk selling price, total milk volumes sold, age of farmers, payment period, source of market information, gender, participation in other income generating projects and education levels of farmers. The gross margin analysis results revealed that formal channels were the most profitable with an average monthly gross profit of Shs 1,415,088.9/= per farmer for 1000 litres of milk sold compared to Shs 991,206.3/= per households in the informal channels. The probit model indicated that age, milk volumes, engagement in off-farm work and milk prices significantly influenced farmers' decision to sell milk to the formal channel. This study concludes by recommending provision of loans to enable farmers acquire good dairy breeds so as to enable them produce high milk volumes that motivate them to sell to the formal channel as well as establishment of cooperatives at sub county level to ease access to the formal marketing channels by all farmers.

Key words: cooperatives, cattle, profitability and milk production.

CHAPTER ONE

1.1 Background to the Study

The livestock sector is one of the most important sectors in the agricultural economy contributing up to 40% of the global value of agricultural output and supports livelihoods and food security of almost a billion people worldwide (World Bank, 2019). Livestock are regarded as assets, serving as a store of wealth, collateral for credit, and an essential security net during calamitous times, (Hammar, 2014). Globally, the sector also contributes 15% of total food energy and 25% of dietary protein (Grovermann et al 2018). Milk and dairy products play an important role in a healthy balanced diet (Dror, & Allen, 2014). Normal cow's milk contains approximately 87.4% water and 12.6% milk solids, (Goff, 2010). The solid consists of 3.9% fat, 3.2% protein, 4.6% lactose quality, (Goff, 2010). This mineral, along with other nutrients present in dairy foods, such as protein, magnesium and phosphorus, is essential to build and maintain strong bones thus maintaining a healthy population to provide a productive labor force, (Manzato et al 2019). Milk is also good for the bones because it offers a rich source of calcium, a mineral essential for healthy bones and teeth. Cow milk is fortified with vitamin D which also benefits bone health. Vitamin D helps prevent osteoporosis, (Daginder, 2015).

The Food and Agricultural Organization (FAO) report that livestock production is growing rapidly and the growth is linked to increasing demand for animal products (Milk, meat), (FAO, 2019). Indeed, since 1960, milk production has nearly doubled, (Sasson, 2012). Population growth, changes in lifestyle, as well the increase in wealth in many countries are driving the growth, (Fengler, 2010). In Uganda, the dairy sub-sector contributes about 50% of total output from the livestock sector, 20% of the food processing industry, and 4.3% of the national Gross Domestic Product (National Development Plan, 2010). The dairy sector contributes to about 34% cattle in Uganda, giving a milk output of 14,000 million liters annually (Wozemba and Nsanja, 2016). The sector has been growing at a rate of 9% annually. This growth rate has been attributed to the favorable macroeconomic policy environment and institutional reforms including the privatization of the dairy sub-sector, increased demand for milk by both local and international milk consumers and milk processing plants, better herd management, adoption of improved breeds, and improved animal health and support services. (National Development Plan, 2010).

The growth in dairy sector in Uganda has been commensurate with growth in milk production. For instance, according to Uganda Dairy Development Authority milk production

has been increasing with about 2.08 billion liters of milk produced in 2015 and 2.5 billion liters in 2017/2018 indicating annual milk production growth rate of 6%, (Jacky, 2018). In terms of consumption, it is shown that the per capita consumption of milk in Uganda has increased from 25 liters in 1986 to 62 liters in 2017, (Jacky, 2018). According to the government Dairy Development Authority (DDA), in October 2018, annual national milk output stood at 2.2 billion liters, up from 1.8 billion liters annually, as of July 2012. As of 2017, per capita milk consumption in Uganda stood at 62 liters, up from 25 liters in 1986. 80 percent of the milk produced is marketed while 20 % is consumed by the farming households. 33 percent of the marketed milk is processed, while 67 % is sold as raw milk. However, the current annual milk consumption is low at only 62 liters/person compared to the recommended milk consumption per person per annum by FAO of 200 litres indicating that there is an opportunity for growth of the dairy sector in Uganda, (Nakiganda & Ahmed, 2019).

Following liberalization of the dairy industry in 1993, the government owned Dairy Corporation lost monopoly and control over dairy processing and marketing activities in the country. The private sector established more than fifteen (15) new dairy processing plants in different parts of the country. However, five out of the ten plants established in the first decade of liberalization (1993-2003) collapsed/closed down owing to various company specific and general industry inefficiencies, (Balikowa, 2011). Today, the growth in milk production has been attributed to supportive environment by the government of Uganda (Nakiganda & Ahmed, 2019). other development partners such as Heifer International, Techno Serve, and DANIDA have initiated grants to support small-scale processors, institutional capacity building on value addition and support to foreign agro food processors (NDP 2010). As a result, an efficient dairy chain has been developed targeting Small-scale farmers who dominate Uganda's dairy production owning over 90% of the cattle population of Country. It is established that out of 96% of citizens who live in rural areas, approximately 60% of households keep mainly indigenous cattle, (Tijjani, & Yetişemiyen, 2015).

In terms of regional production, the western region (35.6%) is the highest producers of milk followed by central (34.2%) and eastern (33.9%) and lastly northern region (25.7%), (Staal & Kaguongo, 2003). In 2009/2010, the Western region still was the leading producer of milk with per farm milk output of about 2,600 litres per year and Northern region has the least raw milk productivity per annum. This production is predictable and available all year round.

However, during the dry season, the Northern, North Eastern and Eastern parts of Uganda experience drastic reduction in milk output due to insufficient waters and pastures to feed dairy animals as a result of extensive sunshine that strikes the regions, (Uganda Dairy Development Authority, 2018).

Poor milk handling practices and marketing challenges remain a major hindrance to the dairy sector. Milk is marketed through formal and informal channels (Mbowa *et al.*, 2012). The formal milk marketing channel handles only about 20% of the total national milk marketed operates an organized system of milk collection using well established bulking centers with coolers and transport infrastructure (milk tanks). On the other hand, the informal milk marketing channel that controls about 80% of the total milk marketed is characterized by lack of milk collection infrastructure and facilities for pasteurization and hygienic handling of milk, limited quality and safety control, and adulteration of milk with water and other chemicals (Kihoro *et al.*, 2019).

Due to many players involved in milk marketing, the DDA, a dairy sector regulatory body in Uganda has found it difficult to enforce good milk marketing practices, (Kiggundu *et al.*, 2019). This has exposed farmers to low milk prices, yet downstream retail prices are high (Reardon *et al.*, 2019) despite offering substandard-quality milk products to consumers (Anjani and Steven 2010). Oppenkowski *et al.* (2019) noted that the best motivation for farmers to diversify and invest in dairying is the presence of safe and profitable market outlets. This justifies the need for efficient milk marketing channels in Uganda that are easily regulated and monitored.

1.2 Problem Statement.

Despite the high profitability of the formal milk marketing channel, the extent to which farmers are opting for it is still too low. Previous research in the Ugandan dairy industry has only mainly focused on marketing of processed milk, dairy productivity, competitiveness of milk processing firms and intensification of dairy farming (Grimaud, Sserunjogi & Grillet, 2007; Ekou, 2014; Duguma, anssens, 2014; Reardon *et al* 2019). A number of questions remain unanswered. First whether what drives farmers to sell milk informally. Secondly, what is the difference in returns from sell of milk in informal markets and formal markets? There is a need to fill the knowledge gap existing on milk marketing channels' activities, by determining the most profitable marketing channel and drivers of farmers' decisions to sell to formal channels. This will help farmers to evaluate and choose the most beneficial marketing

channel under the current high demand of dairy products as well as policy-makers and other stakeholders to best address challenges farmers are facing in different marketing channels through institutional and policy reforms. Therefore, this study aims at assessing the profitability of various milk marketing channels as well as the determinants of farmers' for a milk marketing channels.

1.3 General Objective

To contribute to increased milk production and sales by milk producers in Mbarara District.

1.4 Specific Objectives

- i. To characterize milk producers by milk marketing channels.
- ii. To determine the profitability of selling milk to each of the various milk marketing channels.
- iii. To assess the determinants for choice of milk marketing channel.

1.5 Hypothesis

- 1) Farmers who sell milk in formal Channels are more likely to make profits than Farmers who sell milk in informal Market Channels.
- 2) Volume of milk produced, Market prices, and access to market information are more likely to influence choice of a marketing channel

1.6 Significance of the study

Milk production is the major source of food and income to dairy farmers in Mbarara district (Kataike *et al.*, 2018). The findings of this study are expected to generate evidence on the current economic value attached to milk. This will help farmers to evaluate and choose the most beneficial marketing channel under the current high demand of dairy products. It will as well help policy-makers and other stakeholders to best address challenges farmers are facing in different marketing channels through institutional and policy reforms. The study will also help policy makers in designing and implementing of new policies that will have a positive impact on encouraging dairy farmers engage in efficient marketing of their milk so as to increase their profitability levels.

The study will also add on existing literature about milk marketing and profitability to help in identifying further research gaps.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of the Dairy Sector Trends, Challenges, and Opportunities

The earliest formal conceptions of marketing channels focus on the functions performed by a distribution system and the associated utility of these functions with the overall system, (Shaw, Wilkinson, Rosenbloom, & Dimitrova, 2011). Reflecting their presence in industrial and transitional economies, marketing channels gradually came to be viewed as the set of interdependent organizations involved in the process of making a product or service available for use or consumption, (Hausman, *et al.*, 2016). In agricultural context, the marketing channel is defined depending on the specific organizations that are interdependent and interrelated with agricultural products along with the relevant services that can be transferred from producers to consumers or sellers, (Lovelock & Patterson, 2015). This institution-oriented perspective draws attention to the channel actors (for example, wholesalers, distributors, and retailers) that comprise the distribution system and engage in the delivery of goods and services from the point of conception to the point of consumption (Palmer & Truong, 2019).

According to Young-Bohk *et al* (2019), farmers have many marketing alternatives, such as delivery (sales), storage or time, product form, and pricing. The choices made within any of these categories affect prices and incomes. For agricultural products to reach the consumers in different forms--such as raw farm products, processed products, branded products, and specialty (niche) products marketing agents (individual sellers and cooperatives), marketing agreements and bargaining association should exist, (Trienekens, 2011). Agricultural markets offer different forms of products to different customers, and this justifies the different delivery alternatives, including commission houses or brokers, auction houses, terminal markets, farmers' markets, roadside sales, and international markets, (Nkwasiwe, Mugisha, Elepu & Kaneene, 2015). Producers and consumers are linked together by different marketing channels, which coexist for efficient functioning of the market. These marketing channels are structured differently depending on the members, the form of the product handled, and the pattern relationship among other organizations, (Baker, 2014).

Milk, like any other agricultural product reaches the consumer through various marketing channels. It is sold through itinerant traders (hawkers, neighbors, and restaurants), dairy cooperatives and milk processing factories, national dairies and street vendors (Somano,

2008). Further Falkowski, (2011) noted that milk producers deliver milk to dairy processors through two channels: direct collection from the cooling tank at the farm (modern marketing channel) and milk delivery to a collection station operated by a dairy company (traditional marketing channel).

Oloo & Pfeifer (2018) noted that “informal market” in the dairy sector refers to traders at variance with widely accepted international norms that would emphasize cold-chain organization and pasteurization of marketed milk prior to sale. In addition, Rushton, et al., (2018) looked at informal markets as those that embrace un official transactions between farmers and traders and consumers. Nkwasiwe, Mugisha, Elepu, & Kaneene, (2015), looked at the informal marketing channels of licit and illicit informal channels. Within licit informal marketing channels, channel activities would not be illegal if taxes were paid and regulations were followed. Illicit informal markets are markets that produce goods and services that are illegal, therefore, taxes are not collected on income or sales from illicit activities and markets are not regulated by the government or other agencies.

Many scholars such as Kulshreshtha (2011); Feige, Edgar (2009) have looked at the informal market as being characterized by low levels of organization, lack of taxation, lack of regulation, lack of legal protection for contract and property rights enforcement, violation of non-criminal law, low wages, transactions mainly conducted in cash, low productivity due to the smaller size of the market, limited access to credit and connection to activities that complement the formal economy. Kulshreshtha (2011) concluded that informal markets are traditional supply chains that cannot be taxed and are not monitored by any form of government. These informal markets form black markets leading to shadow economies, (Linzner & Lange, (2013, May)

On the other hand, Rajiv (2010) observed that formal markets in agriculture can be described as those governed by high quality and food safety standards, and where the activities of dairy traders are monitored (within supermarkets, export chains, and processing industries).Therefore, from the various ways in which the concept of informal and formal markets have been defined, described, and empirically used, the formal milk marketing channel from the milk producer to the next actor in the marketing chain node can be defined as a legal, regulated, monitored, and taxed mode of milk marketing system; whereas the informal is the illegal, unregulated, unmonitored, and non-taxed mode of marketing system.

The dairy sector is one of the critical sectors in Uganda, COMESA and East African Community (EAC), with high potential for improving food security and welfare (Oloo & Pfeifer (2018). Recent analysis provides clear evidence of increasing demand for dairy products (and other foods of animal origin) in Sub Saharan Africa (SSA) and other developing regions of the world as a result of rapid population growth, urbanization and increasing purchasing power (Salami, Kamara & Brixiova, 2010).

In 2012, the national census put the Uganda's livestock sector at 48,670 animals (Cattle, Sheep, Goats, Pigs and Poultry); however, 2010/16 household survey estimates the animals at 51,531 (Kabi et al 2019). The national cattle population over the years has experienced steady growth from an estimated 365 million litres in 1999 to 1.4 billion litres in 2016 (estimate based on livestock numbers). The national herd size is about 7.5 million cattle of (indigenous, exotic and crosses), (Tayebwa et al 2018).

The livestock sub sector contributes 18% of agriculture gross domestic product (GDP) and between 7%-9% of the national gross domestic product (GDP). Of the GDP attributed to the livestock sub sector the dairy sector is estimated to contribute up to 45% and plays an important role as a source of food, income and employment (Wang et al 2019). Dairy farming is concentrated in 42 districts found in the cattle corridor which stretches from the South Western region through central to north eastern (Kasozi, et al., 2018). On average, 60% of the households in the cattle corridor keep livestock.

Uganda produces a variety of milk products; these include pasteurized milk, UHT milk (long life milk), cheese, yoghurt, cultured milk, butter, ghee, creams and ice cream (Cerqueira & Pastrana (2019). A substantial amount of milk and milk products is also imported indicating that the domestic production is not sufficient to meet market demands (Phillips (2018). Uganda also exports dairy products mainly to the regional market. The annual growth rate of milk production between 2010 and 2018 has been 9 percent leading to total national milk output growing from 900 million litres in 2010 to 1,400 million in 2018.

Wozemba & Nsanja, (2008) noted that the cattle population in Uganda today is 7.5 million with indigenous lot accounting for 95 percent while the exotic and crosses accounting the balance. Because of the high productivity associated with intensive dairy farming methods such as zero grazing of improved breeds. Most farmers have adopted modern farming techniques at various levels of production. The population of goats has also increased from

5.8 million in 1997 to over 7.8 million according to 2010/16 household survey (Kabi et al 2019). The number of the exotic dairy goats has proportionately increased with Kasese continuing to lead in this area. Most of the milk produced is however consumed at household level with minimal processing (Lukwago et al 2019). Within the livestock industry, dairy development continues to receive the greatest attention in the development of the animal industry in Uganda.

According to Rukiko, (2019), the productivity of smallholder dairy farms is generally low due to the many challenges/ constraints faced which are partly responsible for the poor production performance. Despite various initiatives to enhance quality at various stages of the dairy chain, many weaknesses still exist. The hygiene and handling practices at farm level are generally poor. The collection and transportation of warm milk as well as sale of loose unprocessed milk are still a big challenge as far as improving quality in the dairy chain is concerned. There are five major Milk regions (sheds) and based on their differences in terms of; number of cattle, milk production capacities, market conditions, dairy infrastructure and climate^{7,6}. The Western region is leading producer of milk with per farm milk output of about 2,600 litres per year as in 2010/2016 and Northern region has the least raw milk productivity per annum (Wambugu, Kirimi, & Opiyo, 2011).

2.2 Milk processing and milk products in Uganda

The efforts that were undertaken in early 1990s to make dairy industry freed from the monopoly of the Dairy Corporative created opportunities for private investment and as a result most of the dairy products that were previously being imported from other countries started to be manufactured in the country (Roberts et al 2018).

There are about 38 milk processing plants and only 20% of the total milk produced is processed (Wacoo et al 2019). The daily milk processing capacity by 2016 was estimated to be 1,329,180 liters per day (Matovu et al 2019). There exist over 100 more small scale dairy processors with production capacity ranging between 100 and 500 liters of milk per day. There is a range of 90 -100 milk collection centers with capacity ranging between 2000 to 50000 liters per cooler in all regions of the country (Sybesma et al 2019). There is an estimate of about 50 large milk traders, 60 milk delivery tanks operating in all the dairy regions of the country and each tank is having a handling capacity of about 400,000 liters of milk (Anyimo et al 2019). From 1993 to 2016, fifteen mediums to large scale processing plants were licensed. As of August 2017, total national installed capacity was about 1,400,000 liters per

day (Wambui et al (2018). The major milk processing companies in Uganda included the following: Brookside Dairy Limited, Jesa Farm Dairy, Pearl Dairy Farms Limited, Amos, Dairies Uganda Limited, Paramount Dairies Limited, GBK Dairy Products Limited, Lakeside Dairy Limited, Rainbow Industries Limited, Kooky Enterprises Limited, Holland Dairy Limited AND Vital Tomosi Dairy Limited. (Tayebwa et al 2018)

Uganda's milk production is largely dominated by small scale holder farmers who own 90% of the total national cattle population (Phillips (2018). In rural areas where 96% of the poor Ugandans live (Schatz et al (2018), up to 60% of the households keep indigenous cattle (Chetry et al (2018).

The majority of the milk production systems in Uganda are characterized by low input-low output approach, livestock is not an important source of cash but a source of food, store of wealth and a symbol of high status as well as milk demand being at an increasing rate which is deriving more and more farmers to intensify and diversify so as to increase house hold returns (Kamau et al (2018).

Garcia, et al., (2008) noted that the dairy sector is considered to be the most organized livestock subsector in Uganda. Currently the DDA is in efforts of promoting quality milk production, completion among producers and monitoring of markets for milk and milk products. To achieve this, the DDA is collaborating with multiple private sector organizations operating in Uganda. The growth of milk production has greatly been attributed mainly to the increase in cattle population rather than increased milk productivity per cow. Increase in milk production per cow is being hindered by low adoption of modern dairy farming techniques and technologies (Bingi, & Tondel, 2015).

Vernooij, Wals, & van der Lee, (2015) noted that due to market forces and higher competition for production factors, milk production systems are intensifying, necessitating proper understanding of the new production tendencies. Three intensive and four extensive production systems were identified and analyzed, using TIPI-CAL (Technology Impact Policy Impact Calculations model). The results show that the production systems are very different in many respects but share similar development trends. Whereas intensive systems use graded animals and invest heavily into feeding, buildings and machinery, extensive systems use local breeds and invest minimally. Total cost of milk production falls with increasing herd size, while dairy returns vary among farms from 18 to 35 USD/100 Kg of

milk (Fre et al (2017). All systems make an economic profit, except the intensive one-cow farm, which heavily employs family resources in dairying, (Ndambi, et al., 2008).

Devendra, (2001) noted that due to better management of resources and access to inputs and markets, dairy farming closer to urban areas and using improved breeds is highly profitable, especially with larger herd sizes. Stakeholders should favour such practices as well as others which can improve productivity, especially in African countries where traditional systems dominate dairying.

2.3 Quality regulations in the dairy sector in Uganda

Developments and regulations in the dairy industry are efforts mandated by the Dairy Development Authority (DDA) through registering and inspecting all facilities used during handling, processing and marketing milk and milk products. Only operators that meet standards are issued operation licenses by DDA, (Tijjani & Yetişemiyen, 2015). In liaison with UNBS, DDA enforces dairy standards and regulations that help to ensure quality and safety in the dairy industry. DDA enforces regulations in the dairy sector through conducting sensitization and training of all the stakeholders on methods of milk handling, processing, quality control principles, transportation, marketing and International Standards Organization certification protocols. DDA abolished the use of plastic jerrycans and other plastic containers used mostly by the informal channel traders. DDA also abolished open boiling of milk in big saucepans, recommended use aluminum or stainless-steel cans and sale bulk pasteurized milk for milk safety. DDA encourages small holder farmers who have no pasteurizers to contact dairy processing companies to pasteurize their milk at a fee estimated at US \$ 25/ ton before delivering to the coolers. However, this fee was considered to be high and therefore the system regarded not is user friendly by traders saying that it would make the business unprofitable (Lukwago et al 2019). DDA however plans to make more negotiations between the traders and processing companies regarding user friendly systems before affecting the ban to selling raw milk, (Wafula, *et al.*, 2016).

Balikowa, (2011), noted that after completion of the first phase of rehabilitation the dairy industry in 1992, Government of Uganda adopted a whole dairy sector approach as opposed to interventions in limited areas. A complete review of the official dairy sector policy was undertaken through a comprehensive dairy sector Master Plan study. The findings and recommendations of the Dairy Master Pan study together with lessons learned during implementation of the UNDP/FAO dairy project formed the basis for a comprehensive dairy

sector policy published in 1992. The official policy, besides endorsing the UNDP/FAO Project model on producer marketing groups, clearly emphasized the role dairy producer groups would play in development of the sector. The second area of emphasis concerns the provision of support services to dairy farmers. Government support services would be rehabilitated and concentrated in milk sheds selected on the basis of comparative advantage. Where the service benefited the dairy sector and the nation in general, government would fund the service. Where the service directly benefited individual farmers or farmer groups and where the latter would be willing and able to pay for the service such as artificial insemination, the users would incur the cost of service. Veterinary services would be privatized. With regard to research, the policy clearly stated that research would address practical problems faced by dairy farmers in Uganda and research priorities would be established in close collaboration with the farmers. The new dairy sector policy also recommended the establishment of a Dairy Board to regulate, co-ordinate and promote development of the dairy sector. Farmers would be strongly represented on the Board. The policy also introduced a unified agricultural extension service. Key aspects of the official dairy sector policy are contained in the Dairy Master Plan that was adopted by government in 1993.

The Dairy Master Plan made a number of recommendations aimed at reviving the dairy sector. Some of the key recommendations include: i) Liberalization of the dairy industry) Restructuring of the government owned dairy processing company, Dairy Corporation into a commercial company that would be privatized later) Establishment of a Dairy Board to assume the development and regulatory functions of Dairy Corporation. Indeed, government liberalized the dairy industry in 1993 and five years later, Parliament enacted the Dairy Industry Act, 1998, which provided the legal framework for establishing a new statutory body, Dairy Development Authority to regulate the liberalized dairy industry. The Act also provided for restructuring of the government owned Dairy Corporation into a commercial company; Dairy Corporation Limited (DCL) initially owned 100% by government but would be privatized later. The Dairy Master Plan (1993) has continued to provide the key guidelines for transforming the dairy sector within the framework of a number of other broader government policies such as decentralization, privatization, and trade liberalization. The above three recommendations of the Dairy Master Plan namely liberalization of the dairy industry, establishment of a regulatory body as well as restructuring and privatization of Dairy Corporation were implemented fully, (Balikowa, 2011).

The Dairy Industry Act, 1998, provides the legal framework for implementing the key recommendations of the Dairy Master Plan. The Act established Dairy Development Authority (DDA) as a semi-autonomous, statutory body to oversee the development and regulation of the dairy industry. The Act also provided the legal framework for restructuring of the government owned Dairy Corporation into a commercial company; Dairy Corporation Limited (DCL) initially owned 100% by government but would be privatized later. Privatization was completed in 2006 when a new private operator, Sameer Agriculture and Livestock Ltd took over full control and management of the company asset.

2.4 Milk marketing in Uganda

The current per capita consumption of milk is about 40 litres (Lukwago et al 2019). This level of consumption is far below the recommended rate by Food and Agriculture Organization (FAO) and World Health Organization (WHO) of 200 litres (Mukisa *et al.*, 2019). Various reasons account for low milk consumption in Uganda, namely: economic, social, and cultural factors (Thomson, 2016). The major market for milk is the urban population, which is only 12% of the total population. Even among the urban dwellers, only a small fraction of households can afford to buy milk regularly (Atukwase et al 2019). In a survey of 374 households in various parts of the country, over 70 percent of them said that low household income was the main reason for the limited consumption of milk (LOL, 2011). Furthermore, the culture of milk consumption in Uganda is generally very poor. For example, there is a general consumer preference for raw milk over dairy products (Kaaya *et al.*, 2019). A number of initiatives are being implemented to increase consumption of milk and dairy products and build a strong local market. The Dairy Development Authority is liaising with the Ministries of Health, and of Education and Sports to promote milk consumption in schools. Similar initiatives are being supported by the private sector, particularly Non-governmental organizations such as Land O' Lakes (Marennya, and Barret, 2016). Of the total milk produced annually, it is estimated that only 70 percent of it is marketed and the other 30 percent is consumed on the farm (Tumwebaze *et al.*, 2019).

There are two marketing channels for milk i.e. informal and formal marketing channels (Rajiv, 2010). According to Hung and Tak-Wing (2019), 80-90 percent of the marketed milk is sold through the informal marketing channel as raw milk, the remaining 10-20 percent is sold through the formal marketing channel as processed milk. In terms of market, all the milk passing through the informal marketing channel is sold to the domestic market. On the other

hand, 10 percent of the processed milk is exported to the regional markets such as Kenya, Democratic Republic of Congo and Rwanda (Blanchard *et al.*, 2019).

Since the 1960s one of the most critical problems facing dairy farmers in Uganda has been recognized as that of marketing their milk (Lukuyu *et al.*, 2019). This problem has been recognized in the overall context of the importance of marketing considerations not only in stimulating increased milk production but also in raising dairy farm incomes and living standards and improving the nutritional well-being of the population in rural as well as urban areas (Rowley *et al.* 2019). Hence, in Uganda the development of milk marketing infrastructure has been inextricably linked with the development of the dairy industry (Voors and Haese, 2011).

Although Government dominated the early initiatives in organized milk marketing in Uganda, a few independent producer marketing groups were established. (Onyilo & Adong, 2019). Notable among the early groups established in the 1960s were Toro and Kigezi dairy cooperative societies. (Steinhart, 2019). However, all the development initiatives in the dairy sector got a setback in the 1970s on account of civil disturbances and political instability Handelman, & Brynen (2019). It was not until 1987 that a serious programme to reconstruct the national economy was put in place. Accordingly, the Uganda Government prepared the National Rehabilitation and Development Plan for the period 1986 - 1990 which was later extended to 1992 (Tsourgiannis *et al.*, 2018) The Government programme was the basis for co-operation with many multilateral external donor agencies in the development of the dairy sector in Uganda. To a very large extent, implementation of the programme was coordinated by the UNDP funded and FAO executed technical assistance project, UNDP/FAO Dairy Industry Development Project UGA/84/023 and follow-on UNDP/FAO Rural Community Dairy Production and Marketing Project UGA/92/010 (FAO, 2012).

Elepu (2016) and Balikowa (2018) noted that informal channel accounts for 80 percent -90 percent of the total milk trade in Uganda today. The trade in unprocessed milk has had a tremendous impact in mopping surplus milk from dairy farmers and it is reported to have eliminated the outcry that used to be associated with the rainy season (MAAIF, 2014). Informal channel has become an important source of income to many people and a serious competitor to the formal milk channel (Marenya *et.al.*,2016), However, this channel has a lot of weaknesses which include: lack of facilities for pasteurization and hygienic handling of milk, adulteration of milk with water and other chemicals, use of poor quality vessels in

transportation of milk (for example jerrycans), boiling of milk in very unhygienic environments, lack credit, and difficult to monitor and supervise quality standards (Mburu *et al.*, 2017).

Formal milk marketing channel, on the other hand, operates an organized system of milk collection, using well-established bulking and transport infrastructure (Fuller *et al.*, 2014). Milk coolers are set up in the countryside for milk collection by farmers, cooperative societies, or agents. Thereafter, chilled milk is transported in insulated milk tankers to the factory where it is processed and packaged before marketing. According to Elepu (2016), formal marketing channel has a lot of strengths that include production and marketing of high quality milk and dairy products, increased shelf life of milk and dairy products, credit development, easy monitoring, absorption huge amounts of milk and supervision of quality standards, supporting an organized and elaborate nation-wide milk collection Tsougiannis *et al.* (2018) in the study of marketing strategies of agricultural producers in objective one Greek regions noted that the choice of milk marketing channel especially processing plants channel was positively influence by the volume of milk produced by the farmer per day.

However, formal milk marketing channel also has some weaknesses which include large initial capital outlay, few/ inadequate bulking centers, high processing, transport and packaging costs, high prices of processed milk, low prices of raw milk and dairy products, obtaining milk from farmers on credit and delayed payments and credit transactions with consumers are absent (Vijay *et al.*, (2019). Steal *et al.*, (2016) emphasizes that farmers' choice of the marketing channel is positively influenced by form of payments that is cash or monthly payments.

2.4.1 Marketing channels for milk and dairy products

One of the key challenges to milk production and marketing may not be the generally poor milk collection, transportation and marketing infrastructure but lack of harmony between the formal and informal marketing channels. There is a need for policies to streamline the procurement and marketing of milk in the country.

According to Lewis *et al.*, 2019), the very earliest formal conceptions of marketing channels focusing on the functions performed by a distribution system and the associated utility of these functions and the overall system. Reflecting their presence in industrial and transitional

economies, marketing channels gradually came to be viewed as a set of interdependent organizations involved in the process of making a product or service available for use or consumption (Ansoff *et al.*, 2019). This institutional oriented perspective draws attention to those members (wholesalers, distributors, retailers,..) comprising the distribution system and engaged in the delivery of goods and services from the point of conception to the point of consumption (Ansoff *et al* 2019). Kipley *et al* 2019) noted that dairy farmers market their milk in raw or processed form. Profit potentials exist for producers serving niche markets via small scale processing ventures. Chawala *et al* (2019) in their study of determinants of smallholder farmers' adoption of various milk marketing channels in Kenya found out that farmer's market their milk through itinerant traders (hawkers, neighbors and hotels) and dairy co-operatives. However, their study indicated that majority farmers adopted co-operatives. This was because co-operatives acted as source of production information, and credit services to farmers.

According to Onyilo & Adong (2019), the use of market information generated by certain marketing, increases the output sales of the farmer in market and therefore more willingness to participate in a channel.

Damianos *et al* (2018, in the study of marketing strategies of agricultural producers in Greek regions whose aim was to examine the factors affecting the selection of marketing channels of sheep and goat producers in the region of east Macedonia and Thrace in Greece relative to the distribution of their livestock and milk produce. The survey concluded that farmers sold milk through local private processing plants, co-operative processing plants, national or regional dairies and own consumption.

Wetzels *et al* (2018), in their study of co-operative tendencies and alternative milk marketing channels whose aim were to determine the cooperation of milk producers and to analyze the milk marketing structure in Turkey. It was noted that dairy farmers marketed their milk through five channels; milk processing factories, small scale milk processing plants, milk processing co-operatives, milk collection cooperatives and street sellers.

2.5. Determinants of market channel choice

Since 1990s, milk and dairy products' markets in Uganda have been liberalized, this has put the product market price into hands of market forces and therefore free participation of private sector and also increased marketing standards and regulations of dairy products Jouanjean (2009).

Milk marketing in Uganda is two folded, that is the formal and informal milk marketing (Oloo & Pfeifer (2018)). The formal milk marketing is characterized by organized distribution structure, established infrastructures and hygienic handling practices where milk reaches the final consumer in processed form (Ghee, ice cream. UHT, Yoghurt) while informal milk marketing channels (sell raw milk to consumers directly, cooperative milk marketing and itinerate traders) which involving selling raw milk to consumers that is inefficiently handled by dirty handling materials such as plastic containers, adulterations and poor quality preservation practices (Oloo & Pfeifer (2018)). However irrespective of high profile given to the formal milk marketing channel, majority farmers have ignored participating in the formal markets due to demographic, economical and dairy farm characteristic factors as they are explained below;

Educational level Education has a significant positive influence on market participation (Fuller et.al, 2004) Education level is measured in numbers years a person spends in the formal educational institution (Ndinomupya. 2008). Education enhances managerial competencies and successful implementation of improved production, processing and marketing practices (Marenya and Barret, 2006, this makes it possible for farmers to take new agricultural innovations. This is because, the more the education level achieved the higher the chances of adopting a new marketing channel due to new knowledge exposure. Therefore, education is statistically significant in the choice of modern milk channels (Cooperative and private dairy plants) (Vijay et al.2009).

The Buyers' price also influences choice of a marketing channel. Ndinomupya. M (2008) in the study of determinants of sustainable coffee marketing channel choice and supply response and UTZ certified smaller holder farmers: Evidence from Uganda, defined Price as a reward offered by the market to the supplier of the goods and services. Artukoglu et.al. (2008),

Tsougiannis et al. (2008) noted that the choice of the marketing channel by dairy farmers heavily depended on the price offered by that channel. Marketing channels that offered price premiums to farmers received lot milk compared to those channels which were offering low prices. This is because additional Ugandan shillings will increase farmers' propensity to participate in the marketing channel (Qi and Tang 2009). Price is an important impediment to market entry as well as adoption of improved technologies (Vijay et al, 2009). The lower the price, the greater price risk. This tend to increase farmers shift to channels which are transparent and offer stable price (cooperatives and organized private dairies) compared to traditional channel were players offer prices depending on the production season that is high price during lean and low in flush seasons or sometimes disappear from the market.

Marketing costs also influences choice of a marketing channel. According to Manyong et al, (2018) in the study of effects of transaction costs on market participation which included marketing costs like transport, market fees and license indeed had significant negative effect on farmers' market participations of maize supply and fertilizer demand. More so Artukoglu et al. (2018) in the study of cooperative tendencies and alternative milk marketing channels noted that the higher the transport cost incurred by dairy farmers, the less the interest of participation in the channel. High transport costs are associated with long distance that significantly reduces the percentage of milk supplied to the marketing channel (Otieno et al. 2019) because they reduce farmers' gross margins earned. However institutional innovations such as group marketing can mitigate the costs of accessing markets (Manyong et al, (2018).

Source of market information also influences choice of a marketing channel. The intensity of advertisements and the extent of farmer exposure to market information positively influence market participation. Marketing channel that have streamlined structure of market information flow encourage customer participation (Fuller et al, 2014). Awudu et al (2019) in their study of milk marketing channel choice found that dairy farmers sold their milk depending on the source of market information. This is due to the fact that use of market information generated by certain marketing increases the output sales of the farmer in market and therefore more willingness to participate in such channel (Otieno et al, (2019).

Volume of milk produced also influences choice of a marketing channel. According to Vijay et al, (2018) both modern private dairy plants and traditional channels prefer suppliers from large farmers who can supply large quantities of milk. Tsougiannis et al. (2018) in the study of marketing strategies of agricultural producers in objective one Greek regions noted that the

choice of milk marketing the channel especially processing plants channel was positively influenced by the volume of milk produced by the farmer per day. This is because of reduced costs on the sides of processors particularly transport and quality milk production since large volumes of milk are produced by big farmers that have access to veterinary services (Vijay et al. 2018).

The total number of animals milked also influences choice of a marketing channel. Vijay et al. (2018) and Tsougiannis et al. (2014) noted herd size as a significant determinant in market channel participation in modern market channels. In case of organized private market channel, there is appositive impact of herd size on market participation as the herd size increases, farmers' shift suppliers to organized private dairy channels. This is because large producers get price incentives/ high price because of high bargaining power as well as lower transaction costs. The number of animals kept by the farmer determines the total production costs and therefore influencing the amount of working capital needed on the farm this forces farmer with a large herd size to prefer supplying their milk to channels that handle big volumes and pay the whole lump sum milk revenues for continuity running of dairying operations. However, Vijay et al, (2018) noted for the case of cooperative channel choice, herd size hard a negative impact. This because increase in the herd size which eventually leads to an increase in milk volumes that cause to farmers' shift from cooperative to other channels. This is because farmers in cooperatives receive the same price (no price incentive) irrespective of quantity of milk supplied by individual farmers.

Non-dairying farmers' income also influences choice of a marketing channel. This represents income accruing to the household from the sale of other enterprises (other sources) other than dairying. Income from other sources acts as a source of capital for farmers to purchase the necessary inputs to meet the channel requirements through production good quality and large quantity of marketable products (Marenya et.al, 2016). Mburu et al, (2017), in their study of determinants of smallholder farmers' adoption of various milk marketing channels in Kenya noted revealed that farmers' choice of cooperatives channel was positively influenced by farmers' income.

Membership in farmer marketing organization also influences choice of a marketing channel. Mburu et al., (2017), in their study of determinants of smallholder farmers' adoption of various milk marketing channels in Kenya noted that groups are seen as conceptualized and framed to operate as profitable milk market units where small farmers organize themselves in

collecting, processing, marketing of milk and value added products. The study results revealed that farmers' choice of the marketing channel was influenced by presence of dairy cooperatives and membership to farmers' organization. Vijay et al. (2018) noted that membership of farmers' group significantly determines smallholder dairy producers' participation in modern markets. This because of strong relationship known that collective action enables small farmers to attain bargaining power, economies of scale and reduced transaction costs. Furthermore, farmer organizations such as cooperatives are very vital in market adoption and participation because they enable farmers to make necessary investments in order to quality of produce, access financial resources, farming practice education and marketing information that enable to venture into new innovations (Ndinomupya 2010).

Household size also influences choice of a marketing channel. Kassie et al, (2018) noted that, big household size is an indicator of labour availability that positively influence adoption given the costs attached to new technologies that the resource poor households cannot afford. Ndinomupya (2010) underlines the importance of labour in the availability of farm households to increase the amount of produce. Staal et al., (2016) found out that farmers' choice of the marketing channel was positively influenced by household size. The study results revealed that higher the number of adults in the household, the more the likely that private trader channel or co-operative/private processor channel will be selected than individual customers. Given that sales to individual customers may require high transaction costs, the rationale behind may reflect the scale of production.

Form of payments used by various marketing channels also influences choice of a marketing channel. According to Steal et al, (2016), dairy farmers sell their milk on cash or credit payment arrangements. In the study of analysis of determinant farmers' choice of milk marketing channel, it was found out that farmers' choice of the marketing channel was positively influenced by form of payments that is cash or monthly payments. The study revealed that households were less likely to select channels that paid cash or took milk on informal credit compared to channels that offered monthly payments or provided formalized credit terms (written contracts) which were more likely to be selected.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The chapter focused on the methodology that was used in the study. It presents the research design, study area, population, sample size, sampling frame, methods of collecting data, sources of data and instruments, research procedure, data quality control, data analysis and ethical considerations.

3.2 Research Design

Amin (2005) described a research design as the conceptual structure within which the Administrative research is conducted and constitutes the blue print for measurement of variables, selection and analysis of data. In this study both qualitative and quantitative design approaches were used in data collection and analysis for the determinants of marketing out let choices of milk by dairy farmers and the levels of profitability of the various milk marketing channels across the study area.

3.3 Study Area

The study was conducted in Mbarara district located in the South-Western region of Uganda. The district was purposively selected because of having high milk production and for being the leading milk suppliers in Kampala and other milk processing factories in Uganda. Mbarara District is bordered by Ibanda district to the North, Kiruhura district to the East, Isingiro district to the Southeast, Ntungamo district to the Southwest, Sheema district to the West and Buhweju district to the Northwest. The district headquarters is at Mbarara the largest city in the sub-region, are located approximately 290 kilometers (180 miles), by road, Southwest of Kampala, Uganda's capital city, and largest metropolitan area. The coordinates of the district are: 00 36S, 30 36E. The district is subdivided into one municipal council, Mbarara district, and 19 sub-counties namely; Kashari, Bubaare, Bukiro, Kagongi Kakiike, Kashare, Rubaya, Rubindi, Rwanyamahembe, Biharwe, Kakoba, Kamukuzi Nyamitanga, Rwampara, Bugamba, Mwizi, Ndaija, Nyakayojo, Rugando.

The district receives an average annual rainfall of 1,200 millimeters (47 inches). Temperatures ranged between 17⁰ C (63⁰ F) and 30⁰ C (86⁰ F), while climate was of equatorial temperate (especially in the highlands). The general climatic conditions encouraged pasture growth to support dairy production.

3.4 Data Sources and Data Types

Primary data was collected from dairy farmers in Mbarara districts during field visits. Primary data collected include socio-demographic data about the farmers, including their age, source of income, marital status, and size of the household, level of education. Also captured was data on production costs, marketing costs, the various milk marketing channels used and the factors influencing choice of milk marketing channel by farmers.

Secondary data was collected from earlier related studies and literature available from publications to give a detailed understanding on the research topic. This information was obtained from Makerere university library, district surveys, and organizations (e.g. DDA, MAAIF) as well as the internet.

3.5 Sampling technique and sample size

A systematic random sampling technique based on sub-counties and parish was adopted to sample a total of 120 milk farmers from seven (7) sub counties in Mbarara district. In systematic random sampling, each respondent had an equal chance of being selected for the interview first. A total of 120 respondents were randomly selected from 7 sub counties of Kashari, Bubaare, Bukiro, Kagongi, Kakiika, Kashare, and Rubaya in Mbarara district.

3.6 Data collection tools and procedures

The Questionnaire was the most significant instruments of data collection tools that was used. According to Kumar, (2011) a list of questions to which respondent's record their responses forms a questionnaire. The questionnaires had both structured and unstructured questions, with questions covering the socio-economic variables such as age, sex, education level, and marital status, the size of the household. Regarding milk marketing and profitability of various marketing channels, emphasis was put on two categories of marketing channels, formal (cooperatives) and informal (others) milk marketing, and data including price offered, payment period, average volumes of milk supplied by individual dairy farmers, membership to dairy marketing organizations, farmers' non-dairy monthly income, distance to milk collection centers, sources of market information, and form of farmer payments by milk buyers was collected. The respondents were given the questionnaires at their working places; this method reduced the chances of receiving unfilled questionnaires because the questionnaires were collected after the researcher was satisfied that the respondents have filled inappropriate responses. Respondents were assured of the confidentiality of the information they gave. The questionnaire strategy was utilized to gather information from 120 respondents, who included the milk smallholder farmers.

3.7 Validity and Reliability

3.7.1 Reliability of the Research Instrument

In this study, the reliability of the research instrument was ensured by pre-testing the questionnaire with a selected sample group during the piloting. In order to test the reliability of the instruments, internal consistency techniques were applied using Cronbach's Alpha. The alpha value ranges between 0 and 0.9 with reliability increasing with the increase in value. Coefficient of 0.6-0.7 is a commonly accepted rule of thumb that indicates acceptable reliability and 0.8 or higher indicates good reliability. A high value of alpha (> 0.90) may suggest redundancies and show that the test length should be shortened (Tavakol & Dennick, 2011).

3.7.2 The validity of the Research Instrument

Gall and Borg (2003) define validity as the degree to which a test measures what it purports to measure, while Mugenda & Mugenda (1999) define it as the accuracy or meaningfulness of inferences which are based on research results. To achieve content validity, this researcher sought assistance from experts (supervisor) on various section of the questionnaire which become the primary instrument for data collection. Adjustments were incorporated in the instrument, thus fine-tuned the items to increase the validity. Validity is also ascertained by checking whether the questions measured what they are supposed to measure such as clarity of wording and whether the respondents are interpreting all questions in similar ways. The feedback from the pre-test was used to revise and modify the questionnaire in order to enhance the validity of the instruments.

3.8 Ethical considerations

Ethical consideration means respecting the culture & moral aspects of the people involved in the research. Ethics refers to the moral principles or values that usually govern the conduct of an individual or group, (Amin, 2005, PP. 35). Consideration of the ethical issues is necessary for the purpose of ensuring privacy as well as the safety of the participants (Doley, 1995, pp. 23). Since this study involved many different people; the researcher employed ethical aspects while doing research. The study strived to avoid any form of harm to respondents by observing the ethical rules. This is in line with (Mugenda & Mugenda 2003) who stated that researchers should avoid physical or psychological harm to the participants. The information obtained from the respondents in the process of the whole research was kept confidential. The

research questionnaires not require respondents to provide personal information and consent was sought first before the respondent answered a questionnaire.

3.9 Data analysis and presentation.

Primary data was processed and analyzed using major descriptive statistics which included the use of means, ratios, frequencies, percentages and standard deviations of the socio-economic variables. Prior to analysis, primary data was downloaded from my kobo Toolbox account where I had saved it while in the field and computed into excel spread sheets. In the excel spread sheets, it was cleaned and filtered to convert it into numerical form, coded and entered into STATA spreadsheets for analysis. Regression analysis was used to characterize milk producers by marketing channel. A gross marginal analysis was conducted to calculate the profitability of various milk marketing channels and to help understand the cost-benefit analysis of each of the channels and also a probit model was run using STATA to assess the determinants for choice of marketing channel.

3.10 Model specifications

To characterize milk producers by milk marketing channel, farmers who sold milk to cooperatives were considered to have used the formal channel for milk marketing whereas the farmers who used the other marketing channels such as roadside selling, milk retailing and on farm milk sales were considered to have sold milk to informal channels as perceived in a similar study by Mburu & Kang'ethe (2007) when characterizing dairy farmers in Kenyan highlands. Descriptive statistics such as frequencies and percentages were used to examine the available marketing channels, the distribution of farmers among various marketing channels and services provided by various marketing channels in the study area.

To estimate the level of milk sales and profitability of the various milk marketing channels in the study area, milk volumes in liters sold in each channel were standardized to 1000. A gross margin analysis was used to determine the profitability levels. The average variable cost was computed by combining the entire variable costs. Finally, the sum total was divided by the total number of dairy farmers to come up with average variable cost. The average gross margin was then computed by taking the difference of the average total revenue and average variable cost.

$$GM = Y - \sum p_i X_i$$

Where: GM= Gross Margin

Y= Milk sales (total revenue)

$\sum p_i X_i$ = summation of costs of production (total costs)

To examine determinants for choice of milk marketing channel, a probit regression analysis was run using STATA to assess the relevance of various variables that included; age, milk prices, gender, education levels, participation in other income generating projects, education levels, milk volumes produced and marketing costs incurred.

The observed out-come y equals 1 if the farmers sold their milk to a cooperative and equals 0 if otherwise. If the probability of a farmer selling to a cooperative is denoted as p , then the probability mass function for the observed outcome y is $py(1 - p)^{1-y}$, with $E(y) = p$ and $Var(y) = p(1 - p)$. Considering the discrete nature of farmers' decision to sell to a cooperative or not, qualitative choice binary models are most suitable, including linear probability, logit, and Probit models (Scott and Freese, 2006). Using binary models, the probability of a dairy farmer selling milk to a cooperative p is expressed as a function of the underlying predictor variables represented by a vector x . The outcomes of the models can be given a latent variable interpretation to provide a link with the linear regression model. Since y is the observed binary outcome that a farmer sold milk to a cooperative, the underlying continuous unobservable or latent variable y^* can be expressed as the following single index model:

$$y^* = x' \beta + \mu \quad (1)$$

Although y^* is not observed, we can observe that

$$Y = \begin{cases} 1, & y^* > 0 \\ 0 & y^* \leq 0 \end{cases} \quad (2)$$

Therefore,

$$\Pr(y = \frac{1}{x}) = \Pr(x' \beta + \mu > 0) = F(x' \beta) \quad (3)$$

The linear probability model suffers from three important shortcomings: the error term μ is heteroscedastic and may possess elements of non-normality; and the predicted value of the dependent variable may not fall within the unit interval (Wooldridge, 2002). Whereas generalized least square models may solve the problem of heteroscedasticity, the problem of estimating parameters of a threshold decision model remains unresolved when truncating values of the dependent variable through logit analysis (Press and Wilson, 1978; Jones et al., 1989; Scott and Freese, 2006). The probit model overcomes problems of the other models because of its ability to generate bounded probability estimates for each observation (Tambi, 1999). For this reason, we apply the probit model in this study.

To estimate a probit model, we consider the classical model of rationality which considers farmers who sell to a cooperative as rational agents who are interested in maximizing their utility such that the likelihood of the j th dairy farmer selling milk to a cooperative will depend on the following utility indexes:

$$U_j = \{U_{1j}, U_{2j}, \dots, U_{ij}\} \quad (4)$$

Utility indexes are linearly related to a vector of explicit attributes or features of the cooperative and can be expressed as in the subsequent function of specific attributes or features of a cooperative below:

$$U_{ij} = x_{ij} \alpha_{ij} + \mu_{ij} \quad (j = 1, \dots, j)(i, \dots, N) \quad (5)$$

In Eq. (5), x_{ij} is a row vector of the j th cooperative attributes, α_{ij} denotes a column vector of parameters to be estimated, and $\mu_{ij} \sim \text{MVN}(0, \delta)$ where MVN is a multivariate normal distribution function. The random error term μ_{ij} is included in Eq. (5) to capture the effects of all unmeasured variables that influence the likelihood of a farmer to sell milk to a cooperative. The higher the utility index $\mu_{ij}x$, the higher the likelihood that a farmer will sell milk to a cooperative. Therefore, a farmer will sell milk to a cooperative if the utility $\mu_{ij} > \omega_{ij}$ where ω_{ij} is a constant threshold (Kwakyi and Epperson, 1989; Tambi, 1999). The likelihood of a farmer selling milk to a cooperative is assumed to be independent of other farmers' decisions to sell, such that μ_j are independently distributed:

$$\mu_j = \{\mu_{1j}, \dots, \mu_{ij}\} \quad (6)$$

Where $\mu_j \sim \text{MVN}(0, l_j)$ and the covariance matrix l_j is the identity matrix of order m .

Based on Scott and Freese (2006), the probit model on which the utility function depends can be specified as:

$$\Pr(y = \frac{1}{x}) = \int_{-\infty}^{\beta + ax} \frac{1}{\sqrt{2\pi}} \exp^{-\frac{t^2}{2}} dt \quad (7)$$

Where y is a vector of binary variables, such that $y = 1$ if a farmer sold milk to a cooperative and equals 0 if otherwise, and x is a vector of predictor variables that predict or explain a farmers' decision to sell milk to a cooperative. These variables are assumed to be independent and uncorrelated with the error term (Tambi, 1999; Wooldridge, 2002).

A maximum likelihood (ML) probit model was estimated using STATA 15. The ML estimates of the parameters maximize the value of the probability density function $\Pr(y = 1/x)$. Diagnostic tests to detect the presence of collinearity were performed by computing the correlation coefficients and the variance inflation factor for all variables in the model. As mentioned above, sample selection bias could arise from the non-random selection and clustering of farmers (Moulton, 1990; Cameron and Trivedi, 2009). A probit model with cluster robust standard errors was estimated to account for the sample selection bias.

To predict the effect of the change of a predictor on the probability of a farmer selling milk to a cooperative, marginal probabilities are computed. For continuous variables, such as the prices of milk and age, marginal effects were estimated at their mean values of the predictor variable. The marginal probability was computed by multiplying the computed coefficient estimate α_i with the probability density function $n(x_{ij}\alpha_{ij})$, of the probit model evaluated at mean values of the predictor variables. For dichotomous predictors, the marginal probability was calculated as the difference between the standard probability density function of the probit model when $x_i = 0$ and $x_i = 1$ for the discrete variable.

Table 1: Description of variables that influence the choice of milk marketing channel based on data collected from 120 dairy farmers in Mbarara district.

variable	description	impact
sold	1 if the farmer sold milk to a cooperative, 0 if otherwise	NA
Gender	1 if male, 0 if other wise	-
Age	Age of farmers in years	-
Education	1 = No-education, 2 = Primary, 3 = High school, 4 = Certificate, 5 = Diploma, 6 = Degree	-
Access	1 if the farmers accessed market information, 0 if other wise	+
Association	1 if the farmer is a member of any association, 0 otherwise	+
milk produced	The total daily volume of milk produced by a farmer	+
Milk prices	the price of milk per litre in various markets	+
marital status	1 = married, 2 = single, 3 = divorced, 4 = widowed.	-
Cows	The total number of cows milked by the farmers	-
other income	1 if the farmer generates off farm income, 0 if otherwise.	-

(+) Represents a positive hypothesized impact of a given variable on selling milk to a cooperative and (-) represents a negative impact. NA, not applicable;

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Socio demographic characteristics

The research findings of this study indicate that the respondents exhibit the following socio-demographic characteristics:

Overall, the results show that about 57.5% of the respondents were male, owned on average 7 acres of land, with about 220 heard of cattle. Moreover, about 47 cows are milked every day with each daily milk production of about 500 litres per household. The results also show that majority of the respondents were married (59.2%) compared to those that were single (20.8%), widowed (10.8%), and divorced (9.2%).

The education level of the respondents is measured by years of schooling. Table 2 indicates that majority of the respondents (54.2%) completed 7 years of schooling (primary Level), 27.5% completed O 'Level, 11.7% attended A' level and the 6.7% attended past A' level. Nyangito (1986) showed that the adaptation of the new technologies in agriculture can be positively related to education level attained by farmers. He also noted that the more educated the farmer is, the more he/she gets too adapted to problem solving. Educated people are now involved in farming due to modernization of agriculture. (MAAIF, 2009).

The proportion of women that was actively engaged in milk production and marketing does not exceed 23%. Instead, women engaged in other main activities that range from farm clearing (maintaining pastures), feeding of animals, cleaning and washing of the milking equipment. Disaggregating results by type of marketing channel by households show that Dairy farmers who participated in the formal marketing channel in Mbarara district were significantly older ($P \leq 0.05$) than those in the informal channel (Table 2). This could be attributed to resource endowment needed to commercialize dairy farms, a characteristic that is common with old farmers, which translates into more output (Ndinomupya 2010).

It was evident that formal channel participants produced significantly ($P < 0.01$) more milk (monthly average of 670.80 liters per farmer), compared to informal marketing channel participants who produced about 47% less. The high milk production by formal channel participants could be because the dairy marketing union provided member farmers with the necessary information on milk production and marketing, which was vital in making production and marketing decisions.

Majority of the married respondents (39) sold their milk to a cooperative because their spouses engage in other income generating projects that can enable them sustain a living as they patiently wait for milk payments since cooperatives don't pay instantly.

Majority of the single, divorced, and widowed farmers sold off their milk to the informal milk marketing channels such as selling at farm gate to enable them get instant cash to sustain a living since milk production is the only source of earnings to them.

Highly educated respondents (of degree, certificate, diploma and A 'level) sold off their milk to a cooperative because they have knowledge of gross margin analysis and opportunity cost that makes them eager to operate profitably as compared to the low educated respondents (of O'level, primary and nursery) of whom majority sold to the informal marketing channels because they have less considerations of profit margin but rather consider earning instant cash. A similar study by Nyangito (1986) showed that the choice of a marketing channel in agriculture can be positively related to education level attained by farmers. He noted that the more educated the farmer is, the more he/she gets conscious about profitability.

The descriptive results indicated that farmers with large land acreage (5 acres and above) sold their milk to a cooperative because the large chunks of land enable them grow nutritious pastures such as elephant grass and green leaf disodium that enhance increased milk production that forces them to sell to a cooperative since it has ability to handle large milk volumes as compared to other milk marketing channels. Farmers with small chunks of land (4 acres and below) sold their milk to the informal milk marketing channels (at farm gate, nearby markets and along the road sides) because by the fact that they owned small land pieces, they kept fewer animals that yielded lower amounts of milk partly due to insufficient grazing area which forced the farmers to sell in other marketing channels easily accessed.

Further, the results also indicated that farmers who sell to the formal channel are associated with long distances to access their market because cooperatives are centrally located in Mbarara town to easily tap farmers from all parts of Mbarara and to ease access to processing firms like JBK dairies and big hotels and schools who buy in bulk while farmers who sell to other milk marketing channels get involved in short distances because their customers are widely spread everywhere.

The descriptive results also indicated that respondents with large cattle herds (270 cattle and above) and large numbers of cows being milked (59 cows and above) sell off their milk to a

formal channel because of high milk production capacities whose market can only be catered for by a cooperative due to its ability to buy and sell in bulk. Farmers keeping small herd sizes (136 and below) with small numbers of milking cows (29 cows and below) sold off their milk to the informal milk marketing channels due to small milk volumes produced that makes it uneconomical to travel long distances transporting milk to a cooperative.

The descriptive statistics also revealed that mature farmers (52 years and above) sold their milk to a formal channel because they have no immediate pressing needs like school fees since they own adult children which makes them patient to wait for a better but delayed pay from cooperatives while the young farmers (48 years and below) sold off their milk to the informal milk marketing channels that pay instantly like at farm gate due to pressing needs such as school fees and their impatience character that render them un able to adopt delayed payments associated with selling milk to a cooperative.

The study also revealed that the age of the household heads ranges from 19 yrs-90years with a mean age of 48.40 yrs. This indicated that majority of respondents in the study area are within the productive years. This is because the sector requires efficient and productive labor to carry out the Labour intensive dairy activities.

Table 4 1.Descriptive Characteristics of milk producers by marketing channel

Variable (%)	Formal (N=78)	Informal channels(N=42)	OVERALL (N=120)
Marital status			
Divorced	10.26	7.14	9.17
Widowed	14.10	4.76	10.83
Married	62.82	52.38	59.17
Single	35.71	35.71	20.83
Level of education			
Degree	7.69	1.05	1.67
A 'level	28.21	14.29	23.33
Certificate	21.79	30.95	9.17
Primary	7.69	11.90	17.50
Nursery	21.79	9.52	11.67
Diploma	2.56	14.29	11.67
O'level	10.26	18.00	25.00
Gender (%)			
Male	69.05	51.28	57.50
Female	30.95	48.72	42.50
Distance to the market			
Very far	39.74	2.38	29.17
Near	15.38	23.81	12.50
Very near	10.26	38.10	0.83
Far	34.62	16.67	34.17
Land owned/individual	36.00(35.93)	22.95(27.20)	7.22(5.58)
Number of Cows kept/day	270.10(428.72)	135.90(37.67)	223.13(389.10)
Number of Cows milked/day	58.91(111.77)	29.65(37.67)	47.28(93.95)
Liters of Milk collected/day	670.80(1387.92)	291.60(535.04)	538.08(1173.91)
Age	52.32(15.65)	40.95(15.10)	48.40(16.35)

Table 4 2: Profitability of milk marketing in formal and informal channel

VARIABLES	INFORMAL		FORMAL	
REVENUES	MEAN	Std. Dev	MEAN	Std. Dev
Liters of milk sold	1000.00		1000.00	
Price of milk	1111.91	186.37	1679.22	1770.99
TOTAL REVENUE	1111910		1679220	
VARIABLE COSTS				
Maintenance costs	36561.07	50943.28	47090.47	57406.97
Feeding costs	42822.38	45377.13	63608.28	74920.81
Consultancy costs	1357.949	149.304	11595.81	11899.66
security costs	3321.152	3216.84	21030.02	1708.356
Veterinary costs	17453.01	19160.05	40427.31	47003.39
Milking costs	12629.49	9054.91	24850.44	28166.77
Marketing costs	670.455	1591.893	6669.061	62187.36
Transportation costs	3317.858	28456.35	47576.34	49985.72
Uncertainties	1570.305	1481.05	1283.374	1421.785
Total variable costs	120703.7	160775.8	264131.1	334700.8
Gross profit	991,206.3		1415088.9	

Source. Computed by researcher.

The descriptive statistics revealed that large milk volumes (936.76 liters) were sold to a cooperative by farmers per day because the cooperative has stable and ready large markets for milk in hotels, schools, processing plants and agencies. Also, cooperatives received large milk volumes from farmers due to their attractive prices of UGX 1679.22/= per litre which attract majority of the farmers (78/20) to sell to the cooperative. The statistics also revealed that the informal marketing channels (farm gate, nearby markets and road sides) attracted low milk volumes sold per day (269.07 litres) because of their inability to handle large milk volumes as a result of unreliable markets, low funds to stock large milk volumes and lack of proper storage facilities to keep milk for a prolonged time before its sold off as well as low milk prices of UGX 1111.91 per litre.

Also, the milk prices were higher in cooperatives with an average of Shs 1679.22 due to the high quality standards attributed to their milk such as prohibited milk dilution, high fat to batter content, proper sieving as well as good milk hygiene all which guarantees cooperatives reliable customers willing to pay a higher price for their milk as compared to that from other milk marketing channels. The high prices were also attributed to the high bargaining power posed by cooperatives since there are few sellers against many buyers in the markets. The statistics also revealed that informal marketing channels (farm gate, nearby markets and road sides) attracted lower milk prices with an average of (UGX1111.91/litre) because of low milk

quality as a result of undefined milk quality attributes in these channels that leads to milk dilution and improper milk hygiene lower their customer base thus low prices. The low prices were also as a result of low bargaining power by individual farmers in the market since there are many sellers against few buyers.

It was also revealed that farmers who sold to a cooperative attained higher Revenues of UGX622448.10/= each monthly due to high milk volumes sold at higher prices of UGX 1679.22/= per litre. The statistics also indicated that farmers who sold milk to the informal milk marketing channels attain low revenues of UGX 213701.16/= due to low milk volumes sold at lower prices of UGX 1111.91 per litre.

Farmers who sold their milk to cooperatives incurred high costs both production and marketing of UGX 2455463.94/= monthly due to large herd sizes owned which increase their feeding, milking, veterinary, maintenance and marketing costs due to large milk volumes produced. The statistics also indicated that farmers who sold their milk to the informal marketing channels incurred lower production and marketing costs monthly of UGX 1813895.42/= small herd holdings that lower their feeding, maintenance, milking, veterinary and marketing costs.

The gross margin analysis of the profitability of the various milk marketing channels indicated that the cooperatives were the most profitable channel to use with a gross profit of at least UGX 577706.03/= per farmer due to high milk prices in cooperatives that raised the farmers' revenues and subsidies such as milk transportation aids for those who produced in bulk, free advisory services, subsidized inputs such as feeds which all lower their overall total variable costs. The analysis further indicated that the informal milk marketing channels (at farm gate, nearby retail markets and road sides) had a lower gross profit margin of **UGX 162937.05/=** per farmer as a result of lower milk prices in the channels which lowered the farmers' revenues.

4.2 Determinants of choice of marketing channel

Table 4 3: Determinants for choice of milk marketing channel.

VARIABLE	Marginal Effects
Volume of milk sold	0.6(0.7) ***
Price of milk/litre	0.6(0.5) ***
Off farm income projects	0.6(0.7) ***
Age of farmers	3.5(1.7) *
Gender	8.3(4.9)
Marital status	-1.1(-2.9)
Education level	-2.0(-1.2)
Access to market information	-2.5(-5.3)

Source. Computed by the researcher.

The results of choice of marketing channel are presented in Table 4.3. The probit regression analysis of the determinants for choice of milk marketing channels by farmers indicted that the most significant factors were; volume of milk sold, price of milk and age of farmers.

The probit analysis indicated that for every one litre increase in the volume of milk produced, the farmers who sold milk to a cooperative increased by 0.6%. As hypothesized, the volume of milk produced had a positive and significant ($P \leq 0.01$) relationship with farmers' choice of the marketing channel.

Farmers that participated in the formal milk marketing channel had large herd sizes that enhanced large milk production. As milk production increases, farmers were more likely to participate in the formal channel also increases. This is because of the channel's capacity to handle large volumes of milk compared to the informal channel. In addition, farmers regarded the formal channel as the most trustworthy and reliable market. Studies by Staal (2016) and Sherma et al (2019) found that small and resource-poor dairy farmers were mostly excluded from formal markets mainly because traditional marketing channels are usually very competitive and cost effective in linking producers and consumers, but also due to the high transaction costs involved in modern markets.

As hypothesized, the price at which milk was bought from farmers had a positive and significant ($P \leq 0.01$) influence on the proportions of milk that farmers sold to the formal channel. The formal channel offered a relatively higher price due to collective bargaining power of dairy cooperative unions. Price is an important driver of farmers' market entry, satisfying the assertion that high price has a two-fold effect: influencing market participation decision and raising the volumes for marketing (Tushemereirwe et al 2007).

Participation of dairy farmers in off farm income generating projects positively influenced the choice of selling milk to a cooperative. The probit model analysis indicated that for every 100 farmers who adopt an off-farm income generating project, the number of farmers selling milk to a cooperative increase by 1.2%. This is because income from other sources acts as a source of capital for farmers to purchase the necessary inputs to meet the channel requirements through production of good quality and large quantities of marketable products (Marenya et.al, 2016). Mburu et al, (2017), in their study of determinants of smallholder farmers' adoption of various milk marketing channels in Kenya noted revealed that farmers' choice of cooperatives channel was positively influenced by farmers' income.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The first objective of the study was to characterize milk producers by milk marketing channels. The study noted that the dairy farmers who participated in the formal marketing channel in Mbarara district were significantly older with a mean age 52.32 years than those in the informal channel whose mean age was 48.40 years. It was evident that formal channel participants produced significantly more milk (monthly average of 670.80 liters per farmer), compared to informal marketing channel participants who produced about 47% less. The study indicated that majority of the farmers selling to cooperatives were men (57.5%) as compared to women (42.5%). The study also revealed that the majority of the respondents were married (59.17%), 20.83% were single, 10.83% were widowed and 9.17% were divorced. 25% of the respondents had completed O'level, 23.3% completed A 'Level, 17.50% attended primary level, 11.67% completed only nursery section, 11.67% completed diploma level and 9.17% went up to certificate level while only 1.6% of the responds attained a degree.

The profitability of selling milk to each of the various milk marketing channels was computed. The study revealed that large milk volumes (936.76 liters) are sold to the formal channel by farmers per day as compared to the (269.07 litres) sold to the informal channels. The study also revealed that the milk prices were higher in formal channels at Shs 1679.22/= per litre as compared to Shs 1111.91/litre in the informal channel. The study revealed that farmers who sold to the formal channel attained high revenues of UGX 1,679,220/= each monthly as compared to Shs 1,111,910/= attained in the informal channels. The study indicated that farmers who sold their milk to the formal channel incurred high costs both production and marketing costs of Shs 264131.1/= as compared to Shs 120703.7/= incurred monthly by framers in the informal channel. The gross margin analysis of the profitability of the various milk marketing channels indicated that the formal channel was the most profitable channel to use with a monthly gross profit of Shs 1,415,088.9/= per farmer as compared to the Shs 991,206.3incurred in the informal channels.

Results for determinants for choice of milk marketing channel show that volume of milk sold, price of milk and age of farmers influenced farmers' decision to sell to formal sectors. The probit analysis indicated that for every one litre increase in the volume of milk produced, the farmers who sell milk to a cooperative increase by 0.6%. As hypothesized, the volume of milk produced had a positive and significant relationship with farmers' choice of selling milk to a cooperative.

As hypothesized, the price at which milk was bought had a positive and significant influence on the proportions of milk that farmers sold to the formal channel. The formal channel offered a relatively higher price due to collective bargaining power of dairy cooperative unions. Participation of dairy farmers in off farm income generating projects positively influenced the farmers' choice of selling milk to a cooperative. The probit model analysis indicated that for every 100 farmers who adopted an off-farm income generating project, the number of farmers selling milk to a cooperative increased by 1.2%.

5.2 Conclusions

In conclusion, generally selling milk to a formal channel is more profitable than selling to the informal one due to higher prices in the formal channel. Feeding costs are highest for farmers selling to a formal channel than those selling to informal channels as a result of large herds kept by farmers in the formal channel.

Age, milk volumes, being engaged in off-farm work and milk prices significantly influence farmers' decision to sell milk to the formal channel

5.3 Recommendations.

Provision of loans to enable farmers acquire good dairy breeds so as to increase milk production in terms of quantity.

Establishment of cooperatives at sub county level to encourage more farmers to sell to the formal channel.

5.4 Suggestions for Further Research

This study mainly concentrated on milk marketing. Future studies should incorporate more knowledge on reasons for few women and youth participation in dairy farming as well as analyzing the constraints hindering commercialization of the dairy sector country wide because it is a profitable venture.

There is need for further research to carry out the qualitative assessment to capture the real perceptions of farmers regarding the factors influencing their choice of marketing channel. This would provide concrete evidence to guide policy makers and government in formulating better rules and regulations for the actors in the milk value chain.

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APENDICES

Appendix I: Questionnaire

This is to introduce to you SSEKIBAALA Gonzaga a year three student perusing a bachelor's degree in Agribusiness management from Makerere University, college of agricultural and environmental sciences who is carrying out research about profitability and the determinants for choice of milk marketing channels by individual farmers in Mbarara district. The information collected will be used to enhance the knowledge on and contribute to the improvement in the cost effectiveness of milk production and profitability in a bid to strengthen farmer groups (cooperatives) in the dairy sector.

The information collected will strictly be used for this academic research purpose only and shall be treated with utmost confidentiality. Your participation in this research study is highly appreciated

Please answer all the questions truthfully. You will not be judged on your responses; you may refuse to answer any question and you may choose to stop the discussion at any time

I request for your honest response hereunder

Are you willing to Participate? Yes No

SECTION A:

GENERAL INFORMATION ABOUT RESPONDENTS.

Date of interview: Day: Month Year_____

A1 Village:

Interviewed by:

A2 Parish:

Questionnaire number:

A3 village :

Name of the respondent:

A4 Phone contact:

SECTION B: DEMOGRAPHIC DATA

Household Composition

NB: A household is a group of persons who normally live and eat together. Very often the household will be a family living in the same house or compound and eating together. A household will normally consist of a man, his wife and children and sometimes relatives and maids who has spent more 6 months (UBOS).

How many people live in this household?

Name of Household	Sex (1=Female; 0=Male)	Age (Complete years)	Education (Complete years of education) Skip, if Age <=10	Relation to household head 1*	Marital Status Skip, if Age <=10	Participate in Agricultural tasks regularly (1 = yes, 0 = no) Skip, if age is <=6	Participate in off-farm income generating employment (1= Yes, 0= No))	Can he/she read	Can she write	Does [Name] have any form of disability? (1= Yes, 0= No)
<p><i>1*Relation to head: 1=HHH; 2=Spouse; 3=mother; 4=father; 5=grandfather; 6=grandmother; 7=male child; 8=female child; 9=grandson; 10=granddaughter; 11=niece; 12=nephew; 13=other specify</i></p> <p><i>Marital codes: 1= Married 2=Single 3=Widowed 4= Separated</i></p>										

SECTION C. LAND ACCESS

Have you accessed land in the last one year?	Yes <input type="checkbox"/> No <input type="checkbox"/>
If yes, how did you access the land?	1=bought 2=own 3=rent 4=borrowed out
How much land did you access?(acres)	
How much land do use for agriculture	
How much land do you allocate for crop husbandry (acres)	
How much land is used for animal husbandry (acres)	

SECTION D.ACCESS TO SERVICES, MARKETS AND SOCIAL MARKETS

I am going to ask you about your household's saving and banking.

Saving and Access to Credit

Have you made any cash savings in the last 12 months? 1=Yes 0=No

How much savings have you made in the last 12 months (Ushs)?

Access to Credit over the last 12 months

Credit Source Is it available	Did you access credit from Source	How much credit (UGX) did you get in the last 12 months from the source?	What was the main purpose of acquiring the loan	What type of guarantee did the lender demand?

**Codes for Credit Source: 1 = Microfinance, Commercial Bank, 3 = SACCO, 4 = ROSCA, 5 = VSLA, 6 = Money Lenders., 7 = Friends and Relatives*

**** Codes for Reasons; 1=buy seed, 2=buy fertilizer, 3=pay school fees, 4=build a house, 5= buying food, 6= other specify*

***** Codes for Guarantee: 1 = titled land, 2 = non-titled land, 3 = housing, 4 = harvest, 5 = livestock, 6 = vehicle/machinery, 7 = other specify*

SECTION E. PRODUCTION AND MARKETING OF MILK

How many cows do you keep?	
Which breed do u keep?	A=Ankole B=freshian C=East African zebu D=jersey
How many of the cows do you milk? (litres)	
Which other animals to you keep?	
Do u milk the animals?	
How many animals do you milk?	
How much milk do u get daily? (Litres)	
How much of the milk do you sell?	
How much of the milk do you consume?	
How much of the milk do you feed to	
What quantity of your milk gets spoilt?	
Where do you sell your milk?	D=at farm gate E=at nearby market F=at more distant/larger market G=through cooperative H=N/A (didn't sell any)
Why do you sell there?	1= better price, 2= buyer easily available 3= buys in bulk, 4= pays promptly, 5=Other specify
What is the distance to that market from your farm? (1 mile=1.61 km)	
How do you pack your milk?	J=milk cans K=jerry cans L=polythene bags M=others(specify)
How do you transport the milk to the market?	N=bicycle O=motorcycle P=on foot Q=milk trucks
What are the prices of milk in that	
How are you paid?	S=cash T=barter trade U=cheque

SECTION F. Social Participation and Access to Information

Do you or any other member of your household currently participate in any of the following social groups?

Which groups do you participate in or are you a member of?	Membership (1=Yes 0=No)	Main Reason for Participations	How did you know about the group?	Which other services does the group offer?
A farmers' group (
Farmers' marketing				

***Codes for how you knew about the group.1=Radio 2=Newspaper 3=Mobile phone 4=Television 5=Posters 6=Farmers' or social/ religious groups 7=Extension agents at all levels 8=Stockist (input suppliers) 9=NGOs (national or international) 10=Family 11=neighbors 12=friends 13=Researchers (NARO, IITA, ILRI)

***Codes for services.1=advisory services.2=inputs.3=fertilizers.4=market.5=machinery.

SECTION G.AGRICULTURAL AND PRODUCTION INFORMATION AND ADVISE

In the last six months, have you received any agricultural information (for example, recommendations about plot market prices, feeds and better animal breeds.) from any of the following? **Agricultural advise and information.** Need to ask them mention two radio stations and Tv stations mostly listened to

Source of information	Is the source easily accessible	Effectiveness of Source (1 = Very ineffective , 2 = Ineffective, 3 =Average, 4 Effective, 5 = Very Effective) – Quality, access, reliable, details of information
Radio	<input type="checkbox"/> 1=Yes <input type="checkbox"/> 0=No	
What are the two main radios you listen to?		
Newspaper	<input type="checkbox"/> 1=Yes <input type="checkbox"/> 0=No	
Mobile phone	<input type="checkbox"/> 1=Yes <input type="checkbox"/> 0=No	
Television	<input type="checkbox"/> 1=Yes <input type="checkbox"/> 0=No	
Posters/flyers/leaflets	<input type="checkbox"/> 1=Yes <input type="checkbox"/> 0=No	
Farmers' or social/ religious groups	<input type="checkbox"/> 1=Yes <input type="checkbox"/> 0=No	
Extension agents at all levels	<input type="checkbox"/> 1=Yes <input type="checkbox"/> 0=No	
Stockist (input suppliers)	<input type="checkbox"/> 1=Yes <input type="checkbox"/> 0=No	
NGOs (national or international)	<input type="checkbox"/> 1=Yes <input type="checkbox"/> 0=No	
Family/neighbors/friends	<input type="checkbox"/> 1=Yes <input type="checkbox"/> 0=No	
Researchers (NARO, IITA,ILRI)	<input type="checkbox"/> 1=Yes <input type="checkbox"/> 0=No	

SECTION H. PRODUCTION COSTS.

	Hired labour	Family Labour
Farm maintenance costs per month		
Feeding costs per month		
Milking costs per month		
Veterinary services per month		
Costs of supplementary feeds.		
Security		
Advisory/extension services		

SECTION I. MARKETING COSTS

	Hired labour	Family labour
Transportation		
Packaging		
Tax and other related costs		
Other marketing costs (specify)		

THANK YOU FOR YOUR TIME