

**INSTITUTIONAL ANALYSIS OF MILK MARKETING: THE CASE
OF WUKRO KILTEAWLALO DISTRICT, EASTERN ZONE OF
TIGRAY, ETHIOPIA**

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DEDICATED

I dedicated the manuscript of this Thesis to my Mother **Haregu Adisu**, and my Father **Gebre Mehari** for their love, encouragement, support and partnership in the success of my academic career.

STATEMENT OF THE AUTHOR

First, I declare that this Thesis is my bona fide work and that all sources of materials used for this Thesis have been duly acknowledged. This Thesis has been submitted in partial fulfillment of the requirements for an advanced M.Sc. degree at the Haramaya University and is deposited at the University Library to be made available to borrowers under rules of the library. I solemnly declare that this Thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

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ACRONYMS AND ABBRVIATIONS

ADLI	Agricultural Development Lead Industrialization
AGP	Agricultural Growth Program
CSA	Central Statistical Agency
EEA	Ethiopian Economic Association
ILRI	International Livestock Research Institute
LIVES	Livestock and Irrigation Value Chains for Ethiopian Smallholders
LMD	Livestock Market Development
LPA	Livestock Promotion Agency
MVP	Multivariate Probit Model
NBE	National Bank of Ethiopia
NIE	New Institutional Economics
OIE	Old Institutional Economics
TNRS	Tigray National Regional State
VIF	Variance Inflation Factor

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Institutional Analysis of Milk Marketing: The Case of Wukro-Kilteawlaelo District, Eastern Zone of Tigray, Ethiopia

ABSTRACT

Institutional set-up assists and facilitates transaction of products especially like milk that need immediate exchange due to easily spoilage nature. Studies focusing on institutional analysis in dairy marketing have not been done in the study area so far. Thus, this study was conducted in Wukro Kilteawlalo District of Eastern Zone, Tigray. The study aims to analyze the institutional set-up of milk marketing. Both primary and secondary data were used. Primary data were collected from 139 milk producers selected randomly from four kebeles of the district. To analyze the data descriptive statistics and econometric methods were used. In the first stage of double hurdle estimation, age, access to marketing information, number of crossbred cows and milk per day was affected positively whereas land holding was negatively and significantly affected the milk market participation decision. In the second double hurdle estimation milk per day, nonfarm income, extension contact and number of local and crossbred cow affected positively however market distance was affect negatively and significantly the volume of milk marketed. In the probit model, milk produced per day and membership to milk cooperative affected positively where as age, nonfarm income and market distance affected negatively contract use of the dairy producers. The multivariate probit model results indicated that sex of households head, education level, family size, volume of milk sold, distance to nearest market, nonfarm income, access to market information significantly influence milk producers choosing of market outlets. The study has also revealed that due to lack functioning of formal institutions, the informal institution dominant in the dairy marketing. Institutional, production and marketing challenges for dairy marketing were identified. Thus, besides focusing on important significant variables in the results, policy makers should focus on devising appropriate dairy marketing policies, regulations, and rules. In addition to this, efforts should be given to improve the market linkages.

Key words: Institutional analysis; Milk marketing; Double-hurdle; Probit; Multivariate probit

1. INTRODUCTION

1.1. Background of the Study

Ethiopia is an agrarian country where majority of its people are engaged in agriculture. Livestock is an integral part of the agriculture and the contribution of live animals and their products to the agricultural economy accounts for 40% excluding the values of draught power, manure and transport of people. Livestock serves as sources of food, traction, manure, investment, cash income, foreign exchange earnings and social (Teshager *et al.* 2013).

Ethiopia has the largest livestock population in Africa. The estimated number of livestock holding of the country is about 50.9 million heads of cattle, 22 million goats, 26 million sheep and 2.3 million camels (CSA, 2012). Tigray region believed to have cattle population about 3,426,269 which accounts for 7.16 percent of the total cattle population of the country. It was also estimated that 50% of the cattle in Tigray were cows. With particular reference to the study area, the total livestock population of Wukro-Kilteawlaelo was estimated to be about 60,000 (Tigray Regional Bureau of Agriculture, 2016).

According to Abebe *et al.* (2014), on the country's large livestock population and the suitable environment for livestock production, dairy have a huge potential for development. Dairy sector is a major contributor to economic development, especially for the developing countries. As an engine of growth, it provides increased income, employment, food and foreign exchange earnings as well as better nutrition. As income increases with economic development, the share of animal products in total food budget increases faster than that of cereals. This occurs because of the relatively high-income elasticity of demand for animal products.

In Ethiopia, milk and milk products come from cattle, camel and goats. The total cow milk of the country take the great share which is 83% milk production of country, 97% of cow milk comes from indigenous breeds. In addition, the country is endowed with diverse topographic and climatic conditions favorable for dairy production. These evidences support use of

improved, high milk yielding breeds, and offer relatively disease free environment for dairy production. Given the high potential for dairy production, the ongoing policy reforms and technological interventions success is expected (Berhanu, 2012). The total annual national milk production in Ethiopia comes from about 10 million milking cows and is estimated to be 3.8 billion liters that is, 1.54 L/cow on average and the estimate of camel milk of the country is about 176.4 million liters (CSA, 2012).

According to Land O'Lakes, Inc. (2010), approximately 83% of the total milk produced by dairy farmers is consumed at the household level and only 7% is supplied to the formal and informal markets. The remaining balance is distributed between in-kind wages (0.43%), and used for processing local butter, yogurt, and cheese (10.06%) primarily as a means of extending the shelf life during times of surplus.

In Ethiopia, the distribution channels for dairy products are the formal and the informal channels. The formal distribution channel can be defined as the flow of milk that falls within the local business regulatory net including registered business, payment of taxes. The informal sector is everything outside of the formal handling of milk (Land O'Lakes, Inc. 2010). In Ethiopia, the share of milk sold in formal market is less than 2% compared to 15% in Kenya and 5% in Uganda (Muriuki and Thorpe, 2001). As an option, dairy farmers processed 93% of milk produced into milk products. Generally, the low marketability of milk and milk products pose limitations on possibilities of exploring distant but rewarding markets. Therefore, improving position of dairy farmers to actively engage in markets and improve traditional processing techniques are important dairy value chain challenges of the country (Holloway *et al.*, 2002).

Ethiopia's population growth rate is high which causes increasing urban population as a result the demand for dairy product is growing (CSA, 2013). According to Berhanu (2012), the demand for milk in rural areas is for fresh milk and is partially satisfied by home production and purchased from neighboring producers. The demand for processed milk in rural areas is currently low because of spillover effect of education sector expansion, raising awareness of consumers on quality and safety, improved information access, among other factors. The

principal demand continue to be unprocessed fluid milk (because majority of farmers in rural areas and some in urban own cows, taste and flavor, lower price), much of which will be supplied through informal channels.

In Ethiopia, most consumers prefer unprocessed fluid milk due to its natural flavor (high fat content), availability, taste and lower price (SNV, 2008). The national average annual consumption of milk is 19 kg as compared to 26 kg for other African countries and 100 kg for the world (FAOSATAT, 2008). Out of the milk produced per year in rural Ethiopia, 6.55% was sold in the market, 48.48% was home consumed, 0.41% was used for wages in kind and 44.56% was processed into butter and cottage cheese. Out of the total butter production in rural Ethiopia per year, 58.97% is used for household consumption and 36.58% is sold. Out of the total cottage cheese produced in rural Ethiopia per year, 81.85% used for household consumption, 14.35% is sold and 3.8% was used for wage in kind and other purposes (CSA, 2012).

Institutional set-up in dairy marketing supports and facilitates achieving good market performance in the milk producing areas. Institutional arrangement and institutional environment play a crucial role in facilitating any marketing in general and in dairy marketing in particular and increase satisfaction to actors in the dairy marketing. The production and marketing of milk and milk products requires more and more information flows and institutional arrangements among various supply chain stages due to its nature of complex with both formal and informal channels. There are various players in the dairy sector that play critical roles at different levels (Yilma *et al.*, 2011; Agricultural Growth Program-AGP, 2013). An attempt to increase the production and productivity of milk, giving emphasis to institutional factors which affect the dairy marketing is crucial. Hence, this study was intended to fill this gap.

1.2. Statement of the Problem

Agriculture is the main engine of economy in Africa particularly of Ethiopia. However, the performance of agriculture is poor due to the difficulty natural endowment, history of

extractive policies and institutional problems. These problems include poor roads and telecommunications; poor human health; lack of a well-developed and diversified monetary economy; and thin markets for agricultural inputs, outputs, and finance, despite significant direct and indirect dependence of the local economy on agriculture (Staal *et al.*, 1997). According to Dorward and Omamo (2009) thin markets are the result of a business environment generally characterized by weak information (on prices, new technologies, and other potential market players), by difficult and weak contract enforcement, by high risks (not only in production and prices but also in access to inputs and markets and in enforcing contracts), and by high transaction costs (as buyers and sellers protect themselves against risks of a transaction failing by searching for and screening potential suppliers or buyers and their goods and services, then negotiating and contracting with them, and monitoring and enforcing their adherence to the contract).

Effective institutions can help in translating and implementing policies and investments. Their role is critical in that well designed policies and investments can only be successful with the presence of well-functioning and effective institutions. The role of institutions, such as those that determine the rules of the game, the regulation and the enforcement of contracts and property rights, and the provision of public goods and services, is even more important when these institutions interact with markets (World Bank, 2004).

Dairy marketing, as any marketing, needs institutions that govern the exchange of milk and milk products. The lack of adequate information and contractual arrangements leads the smallholder producers to lack lobbies in the legal environment and are not easily receptive to changes (Kherallah and Kirsten, 2001) and these factors result in high transaction costs which in turn leads to difficulties in formal market participations. When farmers are faced with high transaction costs, they will be either forced to stop participation in marketing or divert their means of marketing.

In Ethiopia dairy marketing activities there are institutional setup problem. The producers claim that there is no promising price for their products as compared to the costs incurred for milk production and there are many other institutional factors that hinder to undertake well-

functioning milk marketing activities. Consumers, cooperatives and processors, on the other hand, claim that there is shortage and unreliable supply and quality of milk and milk products. These two paradoxes indicate that there is problem of institutional arrangement and institutional environment that play a crucial role in facilitating the dairy marketing and add satisfaction to all the actors in the dairy marketing (Tilahun and Zeleke, 2013).

In Ethiopia, due to the favorable environmental conditions, rising population size in the urban areas the demand for dairy product is growing (CSA, 2012). This is a favorable environmental condition for milk production and milk marketing in the country particularly in the study area. Creating favorable marketing environment that can conform to increased supply and demand is must and needs more emphasis. Therefore, there should be effective institutional set-ups that facilitate transaction of products especially products that need immediate exchange due to their nature of easily exposed to spoilage such as milk and milk products. These kinds of products need modern type of institutional arrangements such as formal contractual arrangements in order to create reliable and quality supply. Agricultural marketing uses institutional arrangements such as contract, personalized transactions and spot markets (Eaton *et al.*, 2008). These institutional arrangements in marketing create order; hence, they reduce conflicts and ensure mutual benefits for the marketing participant actors (Williamson, 2000).

Despite the importance of institutional environments and arrangements in dairy marketing, there is no empirical evidence in the existing situation and problem with in this set up in milk marketing. Having accurate and reliable information about the status of institutional setup in the milk market has become crucial to investigate and forward policy and institutional options to encourage and create favorable marketing environment in the study area.

1.3. Research Questions

The study attempted to answer the following research questions:

1. What are the institutional environments, institutional arrangements and their constraints in milk marketing in the study area?

2. What are the factors affecting participation decision and volume of milk supply by producers?
3. What are the factors that determine use of contract sale at household level?
4. What are the key factors affecting farmers milk market outlet choice decision?

1.4. Objectives of the Study

The overall objective of the study was to analyze the institutional set-up of milk marketing in the study area.

The specific objectives were:

1. To identify the institutional environments and arrangements in milk marketing;
2. To analyze the determinants of milk market participation and supply to the market in the study area;
3. To identify factors that determine participation in contract sale of milk at household level; and
4. To identify factors affecting market channel choice milk producers.

1.5. Significance of the Study

Institutional analysis evaluates the formal and informal institutions and the current situation of the marketing environment. This study attempted to analyze the problems related to the institutional set-up and major constraints of the dairy marketing in the study area. Recommendations based on these findings will assist policy makers to device better policy options to solve the identified problems such as lack of formal rules or regulations that govern dairy marketing.

In the study it was tried to identify some factors in milk market participation and decision on sales volume by farmers. The governmental or nongovernmental organization could solve these factors to improve market participation and volumes of dairy product supplied to market. In addition, this study contributes to the literature on factors affecting farmers' choice of marketing channels in Wukro-Kilteawlaelo district where no such information currently exists.

There are no empirical studies determining the factors of participation in contract selling of milk by farmers in the study area. This study seeks to contribute to the literature by identifying factors that constrain or encourage participation in contract sale. In addition, this study may help government and other development agents make better decisions about supporting and encouraging farmers to participate in contract sale. It also provides information on available marketing channels for milk in the district. Such information will serve as a benchmark for similar studies in future. In addition to this the findings of this study will also benefit research institutions and other development agencies.

1.6. Scope and Limitations of the Study

Study on institutional analysis is wide and needs deep and large area of coverage. But due to shortage of financial and time constraints, the study was limited only to Wukro-Kilteawlaelo district. The scope of the study was limited to assessing the institutional environment and arrangements on milk market and the determinants of milk market participation and outlet choice. The study covered demographic, socioeconomic and institutional factors that influence market participation, use of contract agreement and market outlet choice made by milk producers. The study was only focused on institutional environments and arrangements in the milk. The study had limitations on deep institutional analysis in dairy market and dairy value chain.

1.7. Organization of the Thesis

This thesis is organized in to seven chapters including the introduction. Chapter 2 contains detailed literature review on relevant topics on the study of dairy market. Chapter 3 deals with the description of study area and explanation of research methodology employed in the study from sampling techniques to the analysis of data collected. In chapter 4 results corresponding to each of the research objectives are discussed. Chapter 5 summarizes and concluded the findings of the study and provides policy recommendations.

2. LITERATURE REVIEW

Under the heading of literature review topics relevant to the area of study were examined. Some basic concepts were defined. Dairy production and marketing in Ethiopia was briefly discussed. Milk marketing and market participation by farmers were reviewed.

2.1. Concepts and Definitions

2.1.1. Definition and concept of institutions

Even the term institution has a long history of usage and is becoming widespread in the social sciences in recent years; there is no agreement in the definition of this concept. Furthermore, the endless conflicts over the definition of the terms of institutions and organizations have led some writers to focus on the practical matter than their definition (Hodgson, 2006).

North (1991) defined institutions as “the humanly devised constraints that shape human interaction”. The constraints include formal and informal rules and norms that determine the activities that individuals are permitted to undertake and how. He also defined institutions as the rules of the game that facilitate co-ordination or govern relationships between individuals or groups. Institutions are of formal rules, informal constraints, and the enforcement characteristics of both. The formal rules include the statute law, common law, property rights, constitutions, and regulations. The informal constraints constitute sanctions, taboos, customs, traditions, and codes of conduct. The informal institutions such as conventions, moral rules, or social norms maintain ‘order without law’ (Mantzavinos, 2001).

Hodgson (2006) defined institutions as “the kind of structure that matter most in the social realm: they make up the stuff of social life”. He also added “institutions are systems of established and prevalent social rules that structure social interactions. Language, money, law, systems of weights and measures, table manners, and firms (and other organizations) are thus all institutions”.

Schmid (2004) qualifies the definition by arguing that institutions are more than just the rules of the game providing constraints. They are also enablement to do what the individual cannot do alone. They also affect beliefs and preferences and provide signals to uncalculated action.

The term institution also refers to many different types of entities, including both organizations and the rules used to structure patterns of interaction within and across organizations. This indicates that institutions are broad and encompass organizations and doing institutional analysis of institutions includes, most of the time, organizational analysis. Institutional and organizational analysis refers to the analysis of and generation of understanding about institutions and organizations (Mathew, 2014).

Organizations are the players: groups of individuals bounded by a common purpose to achieve objectives. The constraints imposed by the institutional framework and with the other constraints define the opportunity set and therefore the kind of organizations that will come to existence. Organizations include political bodies, economic bodies, social bodies, and educational bodies. Political bodies include political parties, the senate, a city council, a regulatory agency. Economic bodies include firms, trade unions, family farms, and cooperatives. Social bodies comprise churches, clubs, athletic and associations. The educational bodies of organization include schools, colleges, and vocational training centers (North, 1995).

Hodgson (2006), on the other hand, defined organizations as special kinds of institutions with additional features. They are special institutions that establish their boundaries distinguish their members from nonmembers. They involve principle of sovereignty concerning who is in charge; and chains of command delineating responsibilities within the organization. This definition of Hodgson on organization differs from that of North in that North has characterized institutions from organizations in different ways. This different definition indicates that there is no such a universal and distinctive boundary between institution and organization and in some cases, they can be used interchangeably.

According to Aldrich (2007), organizations have important features such as their structure and functions and are designed to achieve specific goals; they have identifiable boundaries; they

work within, or are influenced by; the institutional context, while usually also attempting to influence the 'rules of the game'; and they use resources, knowledge or technology to perform work related activities. Organizations are more closely associated with the association and action elements of the conceptual framework (Mathew, 2014).

Institutional arrangements: These are the set of rules and structures that govern contracts and agreements (Dorward and Omamo, 2009). These institutional arrangements lower transaction costs and the institutional environment may also play a key role in determining the potential for this economizing to take place (Eaton *et al.*, 2007).

Contract farming: It is an institutional arrangement in response to high transaction costs or to market failure. It helps to solve the difficulties of producers to access inputs and to market their commodities. Contract farming also helps the buyers or processors in solving the difficulty of obtaining sufficiently, timely and qualitative supplies. Effective contractual agreement needs conducive institutional environment (Eaton *et al.*, 2007).

Three main objectives of contracts are identified by Bogetoft and Olesen (2002). The first one is that contract aims to ensure the right products are produced at the right time and place. The second objective is to help parties to have individual incentives to make coordinated decisions. Finally, the third objective is to provide coordination and motivation at the lowest possible cost. Contracts can be informal (i.e., oral) or formal (i.e., written). With informal contracts the agreed norms of coordination can take the form of implicit conventions established by repeated interaction. Formal contract considers court or public legal enforcement to resolve in case of breaking the agreed issues (Guo, 2006).

Transaction costs: Kirsten *et al.* (2009), defined transaction costs as “costs referring to the costs originating from the various actions taken to reduce the risk of transaction failure”. Transaction costs involve the establishment and enforcement of exclusive property rights and/or the definition and enforcement of the attributes of the good or service being exchanged. Transaction costs include costs for searching information.

Institutions enable ordered thoughts, expectations, and action by imposing form and consistency on human activities. Institutions have constraining and enabling behavior. The existence of rules in institutions implies the constraining effects. This presence of constraint can open up possibilities such as enabling choices and actions that otherwise would not exist. The rules allow us to communicate (languages); to flow more easily and safely (e.g. Traffic rules); to increase personal safety (rule of law).

The effectiveness of enforcements determine the degree to which there is an identity between the objectives of the institutional constraints and the choices individuals make in that institutional setting. Enforcement is carried out by three parties i.e. by the first party (self-imposed codes of conduct), by the second party (retaliation), and/or by a third party (societal sanctions or coercive enforcement by the state).

Institutions, together with the technology employed, affect economic performance by determining transaction and transformation (production) costs and raise the benefits of cooperative solutions or the costs of defections. In transaction cost terms, institutions reduce transaction costs and production costs per exchange so as to realize the potential gains from trade (North, 1991).

The need for institutions in trade or (marketing) arises with the growing of marketing (exchange) and new developments. With the new development, there arises new rights and then new law or rule comes to protect that right. As trade expands beyond a single village, the possibilities for conflict over the exchange grew. With the growth of the size of markets and with the increase in the transaction costs due to the dense social network, more resources must be devoted to measurements and enforcements. In the absence of a state that enforced contracts, religious percepts usually imposed standards of conduct on the players. As the scope of trade increases, the need for institutions such as enforcement (both the enforcement of agreement and protection) of the goods and services in route from pirates, brigades, and so on, increases. Personal ties, voluntaristic constraints, and ostracism are no longer effective as more complex and impersonal forms of exchange emerge. But this does not mean that

personal and social alternatives are unimportant, personal and social ties are still very important even in today's world (North, 1991).

Institutional aspects and their role in marketing and economic development revolve around transaction costs, market information flows and the institutional environment (Jari and Fraser, 2014). Institutional environment includes property rights, regulations, policies, informal rules, etc. The lack of adequate information and contractual arrangements leads the smallholder producers to lack lobbies in the legal environment and are not easily receptive to changes (Kherallah and Kirsten, 2001) and these factors result in high transaction costs which in turn leads to difficulties in formal market participations. When farmers are faced with high transaction costs, they will be either forced to stop participation in marketing or divert their means of marketing.

2.1.2. Definition of marketing

In a narrow sense, marketing may be defined as selling and buying of goods and services. The concept of marketing must incorporate the entire organization i.e. it cannot be accomplished in isolation. Marketing involves more than just activities performed by a group of people in a defined area or department, but it is a process that focuses on delivering value and benefits to customers, not just selling goods, services, and/or ideas but it uses communication, distribution, and pricing strategies to provide customers and other stakeholders with the goods, services, ideas, values, and benefits they desire when and where they want them.

Marketing encompasses all business activities with the transfer of a product from the producers to the consumers (Kohls and Uhl, 2002). Marketing is an economic activity which stimulates further production and if efficiently done, both the producer and the consumer get satisfied. The producer gets sufficient price for his product and this encourages him to continue to produce more. The consumer gets the product at an affordable price and this stimulates continued consumption (Umar, 2005; Mafimisebi, 2012). Marketing is all about creating utility. Marketing activities play a major role in the creation of utility. By working to ensure that people have the type of product they want, where and when they want it, the marketing system makes our lives easier (Solomon *et al.*, 2008).

Agricultural marketing: The word agricultural marketing is composed of two words-agriculture and marketing. Agriculture, in its general term, means growing and/or rising of crops and livestock. The word marketing indicates a series of activities involved in moving the goods from the point of production to the point of consumption. Marketing includes all the activities involved in the creation of time, place, form and possession utility. From this point of view, agricultural marketing refers to the performance of all business activities involved in the flow of food products and services from point of initial production until they are in the hands of consumers (Berhanu *et al.*, 2012).

Marketing channel: The word channel is derived from the latin word '*canalis*', to mean canal. A marketing channel (also known as channel of distribution) can be viewed as a large canal through which products, their ownership, communication, financing and payment, and accompanying risk flow to the consumer (Charles *et al.*, 2008). Marketing channel as “a set of interdependent organizations that ease the transfer of ownership as production moves from producer to business user or consumer”. Marketing channel is a route through which agricultural such as dairy products move from producers to consumers. They are alternative routes of product flows from producers to end consumers. With the purpose of moving products to their final consumption destination, marketing channel reaches from the point of product origin to the consumer.

Marketing channel facilitates the physical movement of goods through the supply chain, that represent place or distribution in the marketing mix and encompassing the process involved in getting the right product to the right place at the right time. There are different types of parties that participate in marketing channels. These channel members are also known as intermediaries, resellers, and middlemen negotiate with one another, buy and sell products, and facilitate the change of ownership between buyer and seller in the course of moving the product from the producer in to the hands of the final consumer and thereby, they can create a continuous reliable supply.

2.1.3. Marketable and marketed surplus

Marketable surplus is the quantity of produce left out after meeting farmers' consumption and utilization requirements for kind payments and other obligations (gifts, donation, charity, etc). Marketed surplus shows quantity actually sold after accounting for losses and retention by farmers, if any and adding previous stock left out for sales. Thus, marketed surplus may be equal to marketable surplus, it may be less if the entire marketable surplus is not sold out and farmers retain some stock and if losses are incurred at the farm or during transit (Thakur *et al.*, 1997). The importance of marketed and marketable surplus has greatly increased owing to recent changes in agricultural technology as well as social pattern. In order to maintain balance between demand for and supply of agricultural commodities with rapid increase in demand, accurate knowledge on marketed/marketable surplus is essential in the process of proper planning for procurement, distribution, export and import of agricultural products (Malik *et al.*, 1993).

2.2. Dairy Production in Ethiopia

Ethiopian dairy industry development history was started in the early 1950s and the development structure of the sector influenced by political and structural changes occurred in the country (Getnet, 2009). According to same source Ethiopian Dairy industry history has three phases which are free market economic system and the emergence of modern commercial dairying (1960–74), a centralized economic system and state farms (1974–91), and the current phase of free market and market liberalization (since 1991).

Modern dairy production was introduced by established Addis Ababa dairy farm in 1950. The establishment of dairy farm is important milestone in development of dairy industry in Ethiopia. To facilitate the growth of the sector, UNICEF established a public sector pilot processing plant at Shola on the outskirts of Addis Ababa in 1960 (Berhanu, 2012).

Milk production in Ethiopia increased significantly during the 1960s. Between 1961 and 1974, milk production from all species increased by 16.6% from 637,375 to 743,100 tones an average annual growth rate of 1.63%. After 1974 shifted the economic policy to socialism all

private farms and industries were nationalized. The focus of the government was the state farms, farmers' cooperatives, service cooperatives and the peasant associations. After 1991 revolutionary the Democratic Party comes with investment policy which contributes for the growth of the sector. Encourage local and foreign investors to invest by providing different incentive strategies including duty free import of machinery, land, tax holidays, financing. Then a number of private commercial dairy enterprises has been established and engaged in production, processing and marketing of dairy products around the city and towns (Getnet, 2009).

Ethiopia dairy production system includes large number from small to large sized and subsistence to market oriented farms. Based on climate, landholdings and integration with crop production criteria, the production systems in Ethiopia are viewed as pastoral dairy production, smallholder dairy production, urban and peri-urban dairy production, intensive dairy farming (Abebe *et al.*, 2014). The peri-urban dairy production located mainly in the highlands of Ethiopia and the main objective of the production system is to sale milk as a means of additional cash income. The system basically characterized by small scale intensive husbandry with cross breeds not more than 10 heads. Intensive dairy system is basically characterized by a more specialized dairy farming practices by state and private commercial farms.

Small scale rural dairy production system is the dominant dairy production system practiced in the country. In the highlands, dairy production is subsistence with smallholder mixed crop-livestock farming. The number of small scale farmers who use crossbred cows have increased and commercial dairy production come into existence in towns (Berhanu, 2012).

2.3. Review of Empirical Studies

2.3.1. Milk marketing system

Market is a process in which ownership of goods is transferred from point of initial production to final consumers or intermediaries. Markets for agricultural products refer to marketplaces which are open spaces where commodities are traded. In Ethiopia, dairy products such as fresh

milk, butter, buttermilk and cottage types of cheese are distributed through the informal and formal marketing systems.

In formal marketing system, milk is collected at the cooperative or private milk collection centers and transported to processing plants. In this system, milk quality tests (principally acidity using alcohol and clot-on-boiling test, and density) are performed on delivery, thereby assuring the quality of milk. This has encouraged the producers to improve the hygiene conditions, storage and transportation of the milk in order to avoid rejection of the product on delivery to the collection Centre (Zelalem, 2010).

Informal marketing involves direct delivery of fresh milk by producers to consumer in the immediate neighborhood and sale to itinerant traders or individuals in nearby towns. In the informal market, milk may pass from producers to consumers directly or it may pass through two or more market agents. In informal marketing system, milk and milk products may pass from producers to consumers directly or through one or more market agents. This system is characterized by no license to operate, low cost of operation, high producer prices as compared with formal market and no regulation of operation (SNV, 2008). The informal market involves direct delivery of dairy products by producers to consumers in the immediate neighborhood and sales to itinerant traders or individuals in nearby towns (Getachew, 2003).

Studies are conducted by different scholars on dairy marketing. According to CARE Ethiopia (2009), formal milk markets are particularly limited to peri-urban areas and to Addis Ababa. The informal market involves direct delivery of fresh milk by producers to consumer in the immediate neighborhood and sale to collectors or traders nearby towns. The informal system is characterized by no licensing requirement to operate, low cost of operations, high producer price compared to formal market and no regulation of operations. The informal market has remained dominant in Ethiopia. The traditional processing and trade of dairy products, especially traditional soured butter, dominate the Ethiopian dairy sector.

According to the survey conducted by Seifu (2012) to characterize the dairy value chain and to identify challenges and opportunities for development of the dairy industry in Dire Dawa, the dairy farmers have only two market-outlets for selling their milk which are selling to

neighbors (i.e., individual consumers) and retailers. There is no formal milk marketing system both in the urban and peri-urban areas of Dire Dawa.

Marketing outlet is the final market place to deliver dairy products into which it may pass from different channels. According to Berhanu (2012) dairy products deliver to final consumer through different channels. Milk channels are narrower than butter channels due to its relatively high perishable nature. Butter outlets from rural farmers are restaurants, traders, consumers, retailers and wholesalers.

As cited in a study conducted by Land O'Lakes, Inc. (2010) the informal market involves direct delivery of milk by farmers to individual consumers in immediate neighborhood and sales to itinerant traders or individuals in nearby towns. In informal market, milk may pass from producers to consumers directly or it may pass through two or more market agents. It is characterized by no licensing requirement to operate, low cost of operations, high farmer price and no regulation of operations. In some parts of the country, creation of new market accesses through milk marketing cooperative brought major improvement in production, marketing and consumption behavior of dairy households.

The survey conducted by Woldemichael (2008) identifies that dairy products were marketed through different marketing channels. The most important marketing type for butter and milk was informal marketing. Milk semi-whole sellers and dairy producers' cooperative societies were registered milk marketing agents of the milk shed but they were inefficient and ineffective.

Girma (2014) prevailed that 59% of dairy farmers sold their raw milk through informal milk marketing channels. Whereas 41% of the respondent farmers sale their milk through formal channel. There are many milk marketing channels through which smallholder dairy farmers sell their dairy products. However, most of the dairy farmers in the study area preferred to sell their milk through informal chain where they get high price per liter of milk. This finding has similarity with the finding of Van der Valk and Tessema (2010) cited by Berhanu (2012), reported that 98% of milk produced in rural area were sold through informal chain whereas only 2% of the milk produced is reached the final consumers through formal chain.

2.3.2. Factors affecting milk market supply

Different studies are conducted on determinants of milk market supply identified that number of dairy cows, education level of the dairy household head, visits by extension agents and distance from nearest market centers were found to be important factors affected milk market supply. The impact of these variables on dairy household's milk market supply was confirmed by the different studies.

A study conducted by Reyes (2012) on market participation and sale of potatoes by smallholder farmers in the central highlands of Angola using Double hurdle econometric estimation procedure suggest that sex of household head, owning productive assets and having access to government extension services affected positively quantity produced the participation and quantity sold while transaction costs has negatively affect on market participation and quantity sold.

A research conducted by Abebe *et al.* (2014), on milk value chain in Ada'a district, East Shawa zone of Oromia regional state by using Chi-square tests and descriptive statistics. The result indicates that high bargaining power of private milk collectors, high feed cost, weak relationship of Ada'a dairy cooperative, reduction in volume of milk produced by smallholder farmers due to low availability and high cost of animal feeds and strong competitors are the major factors affecting the volume of milk procurement by Ada'a dairy cooperative in the study areas.

Gizachew (2005) analyzed factors affected milk marketed surplus using Tobit model. He found that education level of household head, extension visits and income from non dairy sources had positive relationship with entry decision. He also found that dairy cow breed, loan, income and extension visit, education level of spouse and distance from milk market are related to marketed surplus positively. Distance from the district town and education level of household head negatively affected milk marketed surplus.

A study conducted by Woldemichael (2008) on dairy market chain analysis using Heckman two-stage econometric estimation procedure. Family size, education level, experience in dairy

production, distance from milk market and number of cross breed milking cow owned were found to exert significant factors which affect sale volume of milk supply. Family size has a positive effect size; the more volume of milk is supplied to market per day. Education has positive effect on milk sale volume per household per one formal year education leads the dairy household to raise daily milk sale volume by 0.401 litter. Large number of crossbred milking cow causes the marketable milk surplus of the dairy household to rise. This result is plausible and suggests that marketable milk surplus of the household in the study areas are more responsive to number of cross breed milk cow. Furthermore, this result elaborates that marketable milk surplus per day increases in response to the increase in milking cow number.

Holloway *et al.*, (2002), found that household with larger dairy cows positively associated with value of sale of dairy products. Bargaining power of private milk collectors, high feed cost, reduction in volume of milk produced by smallholder farm and income from non dairy sources, loan, income and extension visit, distance from milk market, family size, education level, experience in dairy production and distance from milk market determine the market supply of milk production. Also a number of cross breed milking cow owned have effect on milk market supply. Large number of crossbred milking cows cause the marketable milk surplus of the dairy household to rise. This result indicates that marketable milk surplus per day increases in response to the increase in milking cow number.

2.3.3. Factors influencing the choice of market outlets

Choice for the market outlet is the farmers decision on where to or not to sell their farm produces. Regarding factors affecting channel choices of the households, different researchers used multivariate probit, multinomial logit and probit for categorical marketing system for different agricultural commodities.

Shewaye (2016) employed multivariate probit model to analyze of factors affecting haricot bean market outlet choices in Misrak Badawacho district, Ethiopia. The result indicated that the outlet choice of rural assemblers was negatively and significantly influenced by number of equine owned and use of credit and positively influenced by distance to the nearest district market and distance to all weather roads whereas direct consumers outlet was positively and

significantly affected by number of equine owned. Urban traders' market outlet was positively and significantly affected by number of equine owned, membership in cooperative, access to price information and use of credit and also negatively and significantly affected by distance to the nearest district market.

Addisu (2017) employed multivariate probit model to identify factors affecting onion market outlet choices in Ejere district, West Shoa zone, Oromia region of Ethiopia. The finding of his study revealed that quantity of onion sold, extension contact, farmers' experience, distance to nearest market, access to off/non-farm income, current farm gate price of onion, trust in traders, ownership of motor pump and land size allocated for onion were among determinants which affect significantly onion producers to choose the alternatives market outlets.

Bai *et al.* (2006) conducted study on consumer choice of retail food store formats in Qingdao, China. The study used multivariate probit model with four categories of retail food store formats (wet markets, small grocery stores, super markets, and hypermarkets) in Qingdao and the study indicate that the new hypermarkets are substitutes for supermarkets, but they do not compete extensively with wet markets and small grocery stores.

Mekonin (2015) used multinomial logit model to identified factors that determine coffee marketing channel choice of producers in Lalo Assabi district of Oromia region among three channels available for coffee marketing (to private traders, end users, and cooperative). The result indicated that the choice of end consumer outlet is positively and significantly affected by access to transportation facility, access to price information and access to credit compared to private trader outlet whereas quantity of coffee sold and access to extension service negatively affected the main choice of end consumers' outlet. The study also identified that choice of cooperative outlet is positively and significantly affected by distance to the market, access to transportation facility, access to price information and access to training compared to private trader outlet.

Jari and Fraser (2009) identified that market information, expertise on grades and standards, contractual agreements, social capital, market infrastructure, group participation and tradition significantly influenced household marketing behavior. The study uses multinomial regression

model to investigate the factors that influence marketing choices among smallholder and emerging farmers.

Rao *et al.* (2010) confirmed that educational level of the operator, off-farm employment, own means of transportation and age of operator had positive effect where as household size was negatively associated with supper market channel choices. In second stage second stage of treatment model, off-farm employment and own means of transportation affected income of vegetables growers positively. Furthermore, dummy variable for channel choices were positive and significant. This indicated that supplying vegetable to supermarket channels rendered better income gain over spot marketing channel. On the other hand, ownership of livestock negatively influenced income of vegetables growers supplying traditional or spot marketing channel.

Anteneh *et al.* (2011) employed tobit model and identified factors affecting market outlet choice of coffee farmers in Sidama zone. The finding of their study revealed that younger coffee farmers, with better education, higher proportion of off-farm income to total income, and higher proportion of land allocated to coffee tend to diversify their market choices by selling to traders. Farmer delivering exclusively to the cooperatives seems to be the older ones, with a relative lower individual performance. Among non-members however, younger farmers with lower proportion of off-farm income are ones using the cooperative outlet channel through their friends or relatives.

Mamo and Degnet (2012) employed multinomial logistic model and identified that gender and educational status of the household head together with household access to free aid, agricultural extension services, market information, non-farm income, volume of sales and market distance had statistically significant influence on choice of market outlet.

Kadigi (2013) employed multinomial logistic regression to identify factors influencing choice of milk outlets in Iringa and Municipality and Tanga city. The result revealed that access to credit decreases the choice of neighbor milk market outlet. The probability of choosing to sell to milk vendors is positively influenced by the price paid per liter and a possibility of dairy farmer being a female than a male. Milk vendors who offer better price are likely to increase

dairy farmers' willingness to market their milk produce through the milk vendor market outlet, which are more rewarding than milk collection centers. Female headed dairy producer household, would increase the probability for marketing milk to milk vendors.

Geoffrey (2015) conducted study on the factors affecting the choice of marketing outlets among small-scale pineapple farmers in Kericho country. The result of multinomial logistic regression revealed that gender, group marketing, pineapple produce, price information and vehicle ownership significantly influenced the choice of pineapple marketing outlets. The result confirmed that price information had a positive influence on the choice of local market outlet while vehicle ownership positively and significantly influenced the choice of both local and urban market outlets.

Abreham (2013) employed multinomial logit model to identify the determinant of choice of marketing outlet for vegetable in Oromia region. The results of the study indicated that the probability to choose the collector outlet was significantly affected by access to extension service, owning transport facility, membership to any cooperatives and post harvest value addition compared to wholesale outlet. Similarly, the probability of choosing retailer marketing outlet was affected by district dummy, educational status of household head, access to extension service and owning transport facility compared to wholesale outlet.

Solomon *et al.* (2016) used multinomial logistic regression model to identify factors determining coffee market outlet preference. The study identified that there are four coffee market outlets (Informal buyers, formal traders, brokers and cooperatives). Multinomial logistic regression result shows that number of extension visit and transport cost to the main market has significant effect on formal traders preference relative to informal buyers. Distance to cooperatives has negative and significant effect on the preference of farmers for cooperatives and number of visit by extension visits has negative and significant effect on formal dry coffee markets and brokers and positive and significantly effect on cooperatives as compared to informal market.

Canwat (2012) conducted study on choice of institutional arrangement for rice marketing indicated that effective price, interlocking transaction and membership of farming groups

appear to encourage transactions under contractual arrangement, but he found that trust and being a rich peasant discourage it. Trust and being a rich peasant tend to encourage personalized transactions, while effective price, interlocking transaction and group membership discourage it.

D'Antoni and Mishra (2012) on their study found farmers educational attainment positively affected the household's use of contract farming in milk marketing, while farm size and milk price negatively affect the use of contract farming in milk marketing.

A study conducted by Bardhan *et al.* (2012) on market participation behavior of smallholder dairy farmers in India analyzed the factors that determine dairy farmers' choices of marketing channels. The study has indicated that volume of milk marketed lead to shift away from cooperatives to market as point of first sale. Milk production and extension contact have emerged as the two most important policy variables favorably influencing intensity of market participation. Distance to market has negatively influenced likelihood of producers' market participation.

A study conducted by Mailu *et al.* (2014) has indicated that collective action institutions such as milk cooperatives encourage farmers to engage in formal contractual agreements while households that do not participate in some form of collective action engagements in most cases made informal contracts.

Samuel (2016) used logit model to access impact of contract farming on smallholders the case of chickpea growers in Ethiopia. The study indicated that farming skills and experience in agriculture, farmers attitude towards risk averse and he relative wealth status of households are the major factors affect the use of contract farming.

2.3.4. Major constraints of dairy production and marketing in Ethiopia

Ethiopia has a huge potential for dairy development in Africa. The large and diverse livestock genetic resources, existence of diverse agro-ecologies suitable for dairy production, increasing domestic demand for milk and milk products, better market opportunity, and proximity to international markets indicate the potential and opportunities for dairy development in the

country. However, dairy development has been hampered by multi-faceted, production system-specific constraints related to genotype, feed resources and feeding systems, access to services and inputs, low adoption of improved technologies, marketing and absence of clear policy support to the sector (Azage *et al.*, 2013).

According to Getnet (2009) dairy sector has many challenges which are cost of production, low productivity of cattle because of their generic makeup increased the running and investment cost per unit are the constraints of dairy farmers. In addition, low consumption behavior that is low level of demand pressure to the dairy sector as compared with neighboring countries (Sudan and Kenya), consumers prefer the traditional products than pasteurized and factory produced products lack of modern animal husbandry and management, limited skilled manpower in dairy technology and marketing, prevalence of animal diseases, access to land and scarcity of hybrids and exotic breeds are the challenges for the exiting dairy sector.

The study conducted by Abebe *et al.* (2014) on dairy production system and constraints in *Ezha* districts of the Gurage zone shows that the major constraints facing dairy farmer was lack of land, feed shortage, inefficient artificial insemination (AI) service and water shortage constraint in the area. Milk production is constrained primarily by shortage of land for grazing and cultivation of improved forage crops.

As Girma and Verschuur (2014) stated that, low availability of animals feeds, high cost of animal feeds, high bargaining power of private milk collectors, weak relationship of dairy cooperative and its members were identified as the major factors and actors affecting milk marketing.

Seasonality of demand and supply of milk are the vital problems in dairy marketing. The absence of private or government dairy processing industries in the areas which can absorb excessive milk production during the weak demand for milk, absence of licensing and inspection of competing dairy products traders to ensure achievement of minimum hygiene and quality standards, less access to credit and lack of storage facilities were found to be the vital dairy marketing as well as production problems of the study areas (Weldemichael, 2008).

2.4. The Analytical Framework

This section provides several models that are applied for the analysis of studies of market participation decision and marketed supply and market outlet choice.

2.4.1. Models employed in studies of market supply

In empirical studies of marketing supply several econometric models have been applied, the majority of the studies use appropriate model that takes into account the decision and the level of marketed supply. There are three alternatives models to estimate unbiased, consistent and efficient parameters and to analyze both participation decision and level of supply.

The Heckman sample selection model

The Heckman sample selection model was introduced by Heckman (1977) based on wage offer functions given that some wage data was missing due to the outcome of variable labor force participation. It is a relatively simple procedure for correcting sample selectivity bias. Wooldridge (2006) argues that the selection bias is viewed as an omitted variable in the selected sample which is corrected by the Heckman model. Heckman has developed a two-step estimation procedures model that corrects for sample selectivity bias and to analyze two decisions such as participation and volume of supply simultaneously. The first equation is referred to as the selection equation. It is estimated using a probit model which predicts the probability that an individual household participates or does not participate in the market. The IMR is estimated to account for sample selection bias in the study. The second equation is referred to as the outcome equation. It is estimated using the Ordinary Least squares (OLS). The OLS estimation is done with the inclusion of the IMR as a regressor. The first and the second models incorporate the same variables except that the second model includes some other variables suggested by Wooldridge (2006) as exclusion restriction variables. Different empirical studies were conducted using Heckman for instance (Van den Broeck *et al.*, 2013). The inverse Mill's ratio is a variable for controlling bias due to sample selection and including to the second equation (Heckman, 1979). If the coefficient of the mills ratio is significant then the hypothesis that an unobserved selection process governs the participation equation is

confirmed. However, Heckman two stage was not appropriate for the reason of mills ratio was insignificant ($P > |z| = 0.659$) and it implies that there was not selectivity bias.

The Tobit Model

Tobit model is appropriate for analyzing the factors affecting the joint decision (Greene, 1993). In this case, farmers' market participation problem is modeled as one decision problem and considers whether the decision to participate or not and how much to supply are assumed to be made jointly and hence factors affecting the two level decisions are influenced by similar factors. Tobit model is the use of latent quantities of marketable surplus of nonparticipating households. The dependent variable takes on positive and zero values. When a zero value is observed, it is assumed that the household in question, rather than possessing an excess of the marketable product, actually has the demand for the commodity (that is, a negative supply) (Lapar et al., 2002). Hence, sales quantities are left censored at 0 and Tobit model is also known as censored regression model. Tobit model shortcoming is that it requires that the decision to sell and the decision about how much to sell be determined by the same variables, which makes it fairly restrictive and the partial effects of a particular variable on the probability that the farmer will sell and in the expected quantity sell have the same signs (Wooldridge 2008).

Double Hurdle Model

Double Hurdle regression model was first developed by Cragg (1971) as an extension to the model used by Tobin (1958) to analyse censored data, also known as two tier models, is corner solution model in which zero values associated with non-participation are assumed to be outcome of rational choice (Wooldridge, 2002). The DH model allows for the possibility that factors influencing the decision to sell be different than factors affecting the decision of how much to sell. Therefore, the DH model proposed by Cragg (1971) was implemented in this paper. In DH model, the first hurdle estimates the decision of whether or not to participate in the market and the second hurdle estimates the quantity sold. In the double hurdle, the decision of whether to sell is used to estimate the maximum likelihood estimator of the first

hurdle, which is assumed to follow a probit model. In the second hurdle, the continuous variable of quantity sold is assumed to follow a truncated normal distribution.

A test for the Tobit model against the double-hurdle model comes from the fact that the hurdle model log likelihood can always be written as the sum of the log likelihoods of the two separate models: a probit and a truncated model. As such the hurdle model likelihood function can always be maximized, without loss of information, by maximizing the two components separately (McDowell, 2003 cited in Genanew and Alemu, 2010). Therefore, whether a Tobit or a double hurdle model is more appropriate can be determined by estimating the Tobit and the double hurdle models (the truncated regression model and the probit model) separately and then conducting a likelihood ratio test that compares the Tobit with the sum of the log likelihood functions of the probit and truncated regression models (Genanew and Alemu, 2010). The likelihood ratio test statistics Γ can be computed (Greene 2000) as:

$$\Gamma = -2 [\ln L_{Tobit} - (\ln L_{Probit} + \ln L_{Truncated})] \sim \chi_k^2 \quad (1)$$

Where, Γ = likelihood ratio statistic; $\ln$ = natural logarithm; L_{Tobit} , L_{Probit} and $L_{Truncated}$ = likelihood values for Tobit, Probit and Truncated regression models, χ^2 = chi-square statistic and k is the number of independent variables in the equations.

Decision rule to reject the null hypothesis is when the likelihood ratio statistic (Γ) exceeds the value of the chi-square statistic, (χ_k^2). The chi-square statistic is obtained from the chi-square table for a pre-defined level of statistical significance and degrees of freedom (where, degrees of freedom = number of parameters involved in the analysis).

For good measure, Akaike's Information Criterion (Akaike, 1974) is also included as a model selection criterion. The Akaike's information criteria (AIC), serving as a measure of goodness of fit and model selection is generally defined, for individual models by:

$$AIC = 2K - 2\ln(L) \quad (2)$$

Where, k = number of parameters in the model, L = the likelihood function

The AIC method helps to know that the specified model best explains the data and the preferred model is the one with the lowest AIC value, compared to its alternative model (Hailemariam *et al.*, 2006; Adam, 2010).

2.4.2. Regression Models employed in binary outcome

Regression models use to examine how each explanatory variable affects the probability of use contract agreement for sale milk. Binary dependent variables have two values, negative outcome and positive outcome. The most commonly used qualitative response models are the logit model that corresponds to a logistic distribution function and the probit model that assumes normal distribution (Feder *et al.*, 1985). Logit and probit models are appropriate when attempting to model a dichotomous dependent variable. Logit and probit differ in how they define distribution function. The logit model uses the cumulative distribution function of the logistic distribution. The probit model uses something called the cumulative distribution function of the standard normal distribution to define *distribution function*. Both functions will take any number and rescale it to fall between 0 and 1. Any function that would return a value between zero and one would do the trick, but there is a deeper theoretical model underpinning logit and probit that requires the function to be based on a probability distribution. Both methods are yield similar inferences.

These models specify a functional relationship between the probability of use contractual agreement and various explanatory variables. The logit and probit models are used not only for assessing the effects of various factors that affect the use of contract agreement but also to provide the predicted probabilities of use contract by producer. Both models usually yield similar results. Ignoring the minor differences between Logit and Probit models, Gujarati (1995) indicated that the Probit and Logit models are quite similar, so they usually generate predicted probabilities that are almost identical. Hence, probit model was used for this study to analyze determinant of use contract sale.

2.4.3. Models employed in studies of market outlet choice

Multinomial Logistic model works if a decision between multiple independent alternatives is truly made simultaneously. That is, alternative categories must be independent or mutually

exclusive and individuals can choose only one outcome from among the set of mutually exclusive, collectively exhaustive alternatives. In MNL, the predictors are fixed across choices, but the coefficients vary. The variables that are different for each choice have the same effect across choices. In an MNL model, a predictor is fixed across the choices, but the effect of the predictor is different for each choice. In MNL models all the coefficients describe the relative probability of the positive outcome to the negative outcome which is choice 0 (base for the coefficients). The coefficients describe the relative probability of a choice to a base-choice.

Multinomial logistic model assumes independence across the choices and correlation or substitution between the alternatives does not allow (Wooldridge, 2006 cited in Bezabih *et al.*, 2015). However, in this study producers' market outlets choice are not mutually exclusive; considering the possibility of simultaneous choices of outlets and the potential correlations among these market outlets choice decisions.

In market outlet choice one actor may involved in one or more than one type of market outlets due to these, MVP was preferred because it simultaneously capture the influence of the set of explanatory variables on each of the different outlets choices, while allowing the unobserved (error terms) to be freely correlated. MVP model was used to analyze the determinants of farmers' decisions on market outlet choices; because farmers more likely choose a different outlet simultaneously. The household decision of whether or not to choose is considered under the general frame work of utility or profit maximization which is not observable, but the actions of the economic agents could be observed through the choices they made. The multivariate probit model is a generalization of the probit model used to estimate several correlated binary outcomes jointly. The multivariate Probit model assumes that each subject has T distinct binary responses, and a matrix of covariates that can be any mixture of discrete and continuous variables. Therefore, since milk producers choose different milk market channel the multivariate model was used for this study to analyze milk market outlet choice.

2.5. Conceptual Framework

This framework is intended to identify the main elements to be considered in this study. The framework presented here is the Transaction-Cost Economics (TCE) approach of the New Institutional Economics (NIE). The general hypothesis of TCE is that institutions are transaction-cost-reducing arrangements that may change and evolve with changes in the nature and sources of transaction costs (Krsten *et al.*, 2009). The primary focus of the TCE approach is the analysis of institutions for the exchange of goods and services (David and North, 1971; Jaffee and Morton, 1995).

The framework in TCE emphasizes the influence of the environment (exogenous variables); characteristics of goods and services being exchanged; and characteristics of potential parties to a transaction; which determine the outcome of bargaining over the form and terms of particular institutional arrangements. The environment comprises the physical (infrastructural) environment, institutional environment and social/economic environments. These environments influence actor behavior in and through institutions (Dorward and Omamo, 2009).

The heart of the framework in this study is the identification of the action domain. The action domain defines the sphere of activity and intensity of the dairy marketing. The action domain in the dairy marketing comprises the actors involved in the buying and selling of milk the activities that directly interact with these exchanges and actors, and the institutions that govern these interactions. Exchange processes that actors engage in are included under the term “activities”. The important part of the institutional analysis is the identification of institutions, and activities that are important in a particular action domain. And this identification must be accompanied by examination of the attributes of these elements (Dorward and Omamo, 2009). Since the structure and the behavior of the action domain is not determined only by the elements in it, the other factors that affect the action domain have to be identified.

The action domain can be affected by a wider environment which can be categorized into three parts. These are the physical and infrastructural; the socio economic; and the policy and

governance environments. There is interaction between these environmental factors and the institutions, the activities and the actors (elements of the action domain). This is because the elements of action domain can in turn affect the wider environment. The interactions among institutions, actors, and activities involve actions that lead to outcomes; and these outcomes may change the environment, institutions, activities and actors. A major task in the analysis of institutions in an action domain is the identification of the institutions that are important in the domain (Dorward and Omamo, 2009).

In the institutional analysis, institutions and their attributes should also be identified. But since the institutions are invisible (Ostrom 2005), have multiple definitions, multiple interactions among them, and they operate at multiple levels and inter-nested, and perform a variety of social and economic functions, identifying institutions and their attributes is not an easy task.

This study of institutional analysis was assessed the institutional arrangement in the dairy marketing by analyzing the different formal and informal institutions involved in the sector that affect the outcome of the dairy marketing. This is because the efficiency of specific institutional setting and the governance structure is the result of a mixture of institutions and a given institutional structure.

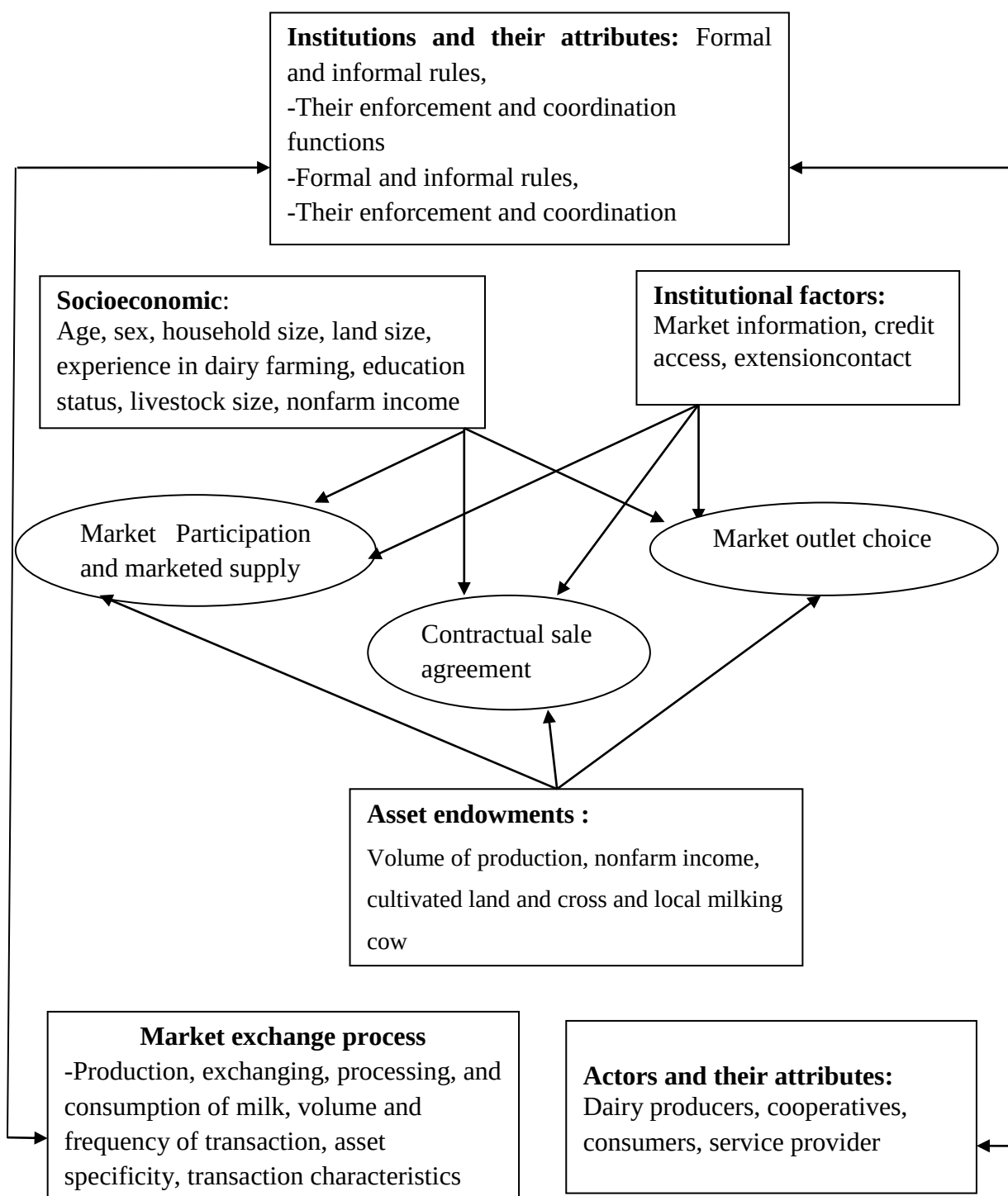


Figure 1 Conceptual framework (Source: Dorward and Omamo, 2009)

3. RESEARCH METHODOLOGY

In this chapter, description of the study area, data type and sources, method of data collections, sample size and sampling procedures, method of data analyses and definition of variables and hypotheses are provided.

3.1. Description of Study Area

Wukro Kilteawlalo district is found in eastern Zone of Tigray National Regional State. The district located at a distance of 825 km North of Addis Ababa, at a distance of about 44 km from the regional capital city, Mekelle and 73 km from the zonal city Adigrat. Administratively the district covers 16 kebeles and 59 sub kebeles. The district is bordered in north by Saese Tsaedaemba district, in the south by Enderta district, in the east by Atsbi-Womberta and in the west by Hawzen district. The district lies at an altitude of 1900-2460 meter above sea level. The district has a total area of about 1010.28 sq km. The annual mean temperature of the area is 17-23 degree centigrade. Rainfall is usually intense and short duration, with an annual average of about 350-450 mm.

According to the information from district Agricultural and Rural Development Office (2016), Wukro- Kilteawlaelo district has a total population of 119,493, of which 58, 552 (49 % of the total) are males and 60,941 (51%) are females. The total household size is about 23,200 out of which the male headed is about 79 percent and the remaining 21percent is female headed.

According to the information from Wukro-Kilteawlaelo district Agricultural and Rural Development planning Office (2016), the dominant cereal crops of the area are barley, wheat, teff and sorghum. The important marketable crop commodities in this area are vegetable crop and pulses. Dairy and horticultural crops are also other important marketable commodities in the area. According to the information from Wukro-Kilteawlaelo district ARD planning Office (2016), livestock sources are cattle-52,496, of which 30588 are cows, goat-15431, sheep-82950, poultry-47265, donkey-9416, mule-1333, horse-79, camel-54 found in the district.

There are number of Farmer Training Centers (FTC) in the study area but their main focus are on crop production and natural resource activities and give less attentions to dairy production

and dairy marketing. The major feed used for dairy production in the study districts is derived from crop residues and grazing land. In urban areas, the main source of feed is purchased hay and in some case urea molasses block also used as source of feed.

In Wukro- Kiltawlaelo district animal health service has been handled by the government veterinary section under district office of agriculture. Disease surveillance, outbreak controlling campaign and provision of vaccines is mainly carried out by the regional animal health clinic/laboratory. Private animal health service is only supply of various drugs and pesticides. In the district milk collection and marketing cooperatives have been initiated and there are six dairy cooperatives which serve on milk collecting and marketing.

Dedebit Credit and Saving Institution (DCSI) and district cooperatives (BoARD) are the major sources of credit to dairy producer households in the study area. These institutions are serving the farm households credit needs at the same time providing training and workshops with regard to credit utilization for improving agricultural productivity.

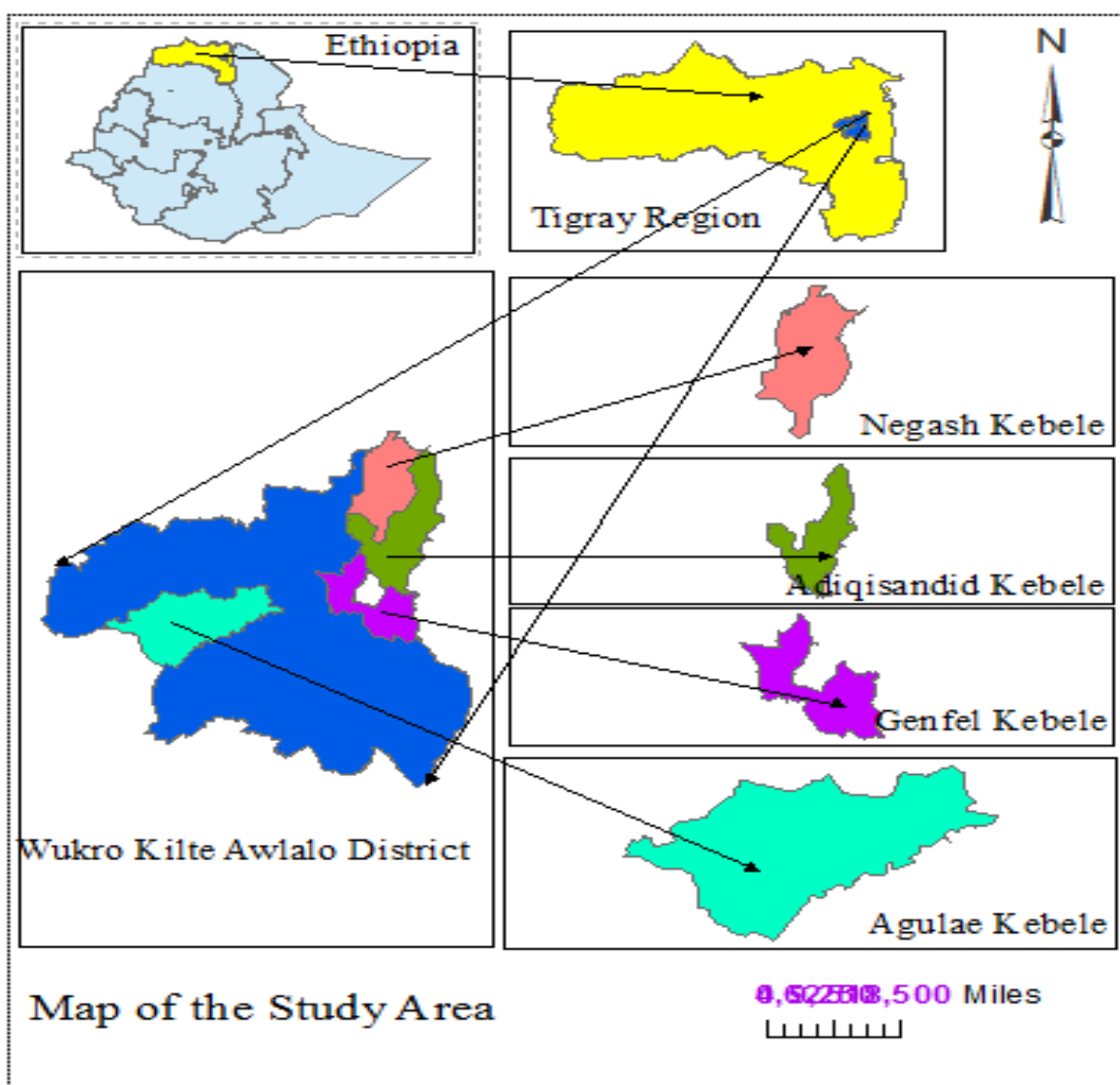


Figure 2 Map of the study areas

3.2. Types, Sources and Methods of Data Collection

Both primary and secondary data were used for this study. Primary data were collected using structured questionnaire for milk producers. Enumerators who are working in the district agriculture office as development agents were selected. Before data collection, the enumerators were trained on the techniques of data collection. The questionnaire was pre-tested to evaluate the appropriateness of the design, clarity, and interpretation of the questions,

relevance of the questions, and time taken for an interview and appropriate modifications were made on the questionnaire prior to conducting the survey. In addition to the questionnaire, an informal survey in the form of focus group discussion and key informants' interview was employed using checklists to obtain additional supporting information for the study. Secondary data were collected from different published and unpublished sources, government institutions, and websites.

3.3. Sample Size and Sampling Procedure

In Wukro-Kilteawlaelo district there are 16 *kebeles* and have similar agro-ecological zone for dairy production. For this study, in order to select a representative sample, a two-stage random sampling technique was implemented to select milk producing households. In the first stage, out of 16 *kebeles* of Wukro Kilte-awlaelo district, 4 milk producing *kebeles* which are Agulae, Negash, Genfel and Adikisandid were randomly selected based on the method of lottery method. In the second stage, from the selected 4 *kebeles*, complete lists of all the milk producers for the selected four *kebeles* were prepared and households who have dairy cows were listed for each *kebeles*. From the list respondents were selected by simple random sampling method based on probability proportional to size.

Sample size for the dairy producer households was determined using Yamane's (1967) simplified formula for sample size determination, that is,

$$n = \frac{N}{1+N(e^2)} \quad (3)$$

Where,

n Sample size

N Total milk producer households in the study district

e² level of precision, that is, 0.08

$$n = \frac{3225}{1 + 3225(0.08^2)} \sim 139$$

Based on the formula for sample size determination, the total sample size was 139. Sample of cooperatives and consumers were included for the study. Due to the lack of list of non-random, snowball sampling method was used for consumers due to the lack of list of milk consumers. Three dairy cooperatives were also selected for the study and interviewed through structure questionnaire. Four producer group discussions were also made to support the data found from the main questionnaire and to gather additional information. Four key informants from the selected *kebeles* were interviewed regarding general dairy production and dairy marketing in the corresponding *kebeles*. Totally, 139 dairy producer households; 10 consumers, 4 restaurants; 3 cooperatives were interviewed.

3.4. Method of Data Analysis

The collected data from the field were edited, coded, and cleaned to ensure consistency, uniformity, and accuracy. Data were entered into computer software for analysis. STATA version 12 was used to manage and process data. Descriptive statistics and econometric model were used for analyzing the data.

3.4.1. Descriptive statistical analysis

The descriptive statistics such as mean, standard deviations, minimum and maximum values, frequencies, ratio and percentages were used to describe the socio-economic and institutional characteristics of the milk producer households in the study area. Furthermore, t-test, chi-square test and F-test were also used to compare different characteristics of farm households.

In addition to this, the formal and informal institutions and their roles in governing the various exchange arrangements were described. The interaction or the relationships within the dairy producers and marketing actors were also analyzed. Levels of trust that the dairy producers have on dairy cooperatives were measured using Likert scales based on Kane and Trochim (2006). To measure the level of trust the dairy producers have on the cooperatives, several Likert-type items or instruments are added onto the questionnaire. Cronbach alpha (α) is then used to measure internal consistency reliability of Likert-type items as stated in Cronbach

(1951). Cronbach alpha is mostly used when the research being carried out has multiple-item measures of a concept (Tavakol and Dennick, 2011). The Cronbach alpha is calculated as:

$$\alpha = \frac{K\bar{r}}{(1+(K-1)\bar{r})} \quad (4)$$

Where: k = number of indicators or number of items

$\bar{r}$ = mean inter-indicator correlation

α = percentage of the reliable variance

Cronbach alpha is expressed as a number between 0.0 and 1.0. A value of 0.0 means no consistency in measurement while a value of 1.0 indicates perfect consistency in measurement (Tavakol and Dennick, 2011). The acceptable range is between 0.70 and 0.90 or higher depending on the type of research (How2Statsc, 2015). As a rule of thumb, a questionnaire with α of 0.8 is considered reliable (Field, 2009).

During the survey and focus group discussion, institutional problems, constraints in dairy production and marketing were assessed. Opportunities in production and dairy marketing were also identified by different marketing actors.

3.4.2. Econometric analysis

This part of the analysis deals with identifying determinants of market participation decision and volume of milk supplied to market, contract arrangement and market channel choice of milk producers. For managing this, appropriate models are used which are double-hurdle model for the first, Probit for the second and Multinomial logit model for the last.

3.4.2.1. Analysis of determinants of market participation and supply

Double hurdle model was used to analyze the household characteristics, resource endowments, market access and institutional factors that are hypothesized to determine the milk produce farmers decision to participate (or not) and the level of market participation in milk markets by assuming farmers participation in milk sales as sequential decision-making process. The

estimation of the double hurdle requires the joint use of the probit model and the truncated regression model, in which the decision to participate and level of market participation are determined by two separate stochastic processes.

The double hurdle model (Cragg, 1971) involves two-step estimation procedure. In the first stage, probit model is used to identify factors affecting market participation decision. Probit model takes a value 1 and 0 that are assigned to represent the choice whether a farmer decides to sale milk or not. The standard probit model that assesses the household market-entry decision is described as follows:

$$D_i = \alpha'Z_i + V_i \text{ (Market participation decision equation)} \quad (5)$$

$$D_i = 1, \text{ if } D_i^* > 0 \text{ and } 0 \text{ if } D_i^* \leq 0$$

Where, D_i^* is a latent variable that takes the value 1 if the famer sales milk and 0 otherwise, Z is a vector of household characteristics (vector of independent variables hypothesized to affect households decision to participate in market) and α is a vector of parameter to be estimated and V_i error term.

In the second stage, the truncated regression model was used to analyze factors determining the extent of milk volume sold. Truncated regression excludes part of sampled observation based on the value of the dependent variable (Wooldridge, 2002). That is, the truncated regression was used observations only from farming households who reported positive and greater than zero. The intensity of milk sold was modeled as a regression truncated at zero. Therefore, the second hurdle represents the actual level of milk sales, expressed by the volume of milk sold in liters. Thus, the truncated regression model with the lower left truncation equal to 0 was used to determine factors affecting the proportion of milk sales.

$$y_i = \beta_i x_i + \mu \lambda_i + \eta_i \quad (6)$$

$$y_i^* = \beta_i x_i + u_i \text{ (Intensity of market participation equation)} \quad (7)$$

$$y_i = y_i^* \text{ if } y_i^* > 0 \text{ and } D_i^* > 0$$

$y_i = 0$ otherwise

Where, y_i^* and y_i are latent and the observed levels of market participation respectively, x_i is a vector of variables influencing households level of market participation and β is a vector of parameters to be estimated.

If both decisions are made by the individual farmer independently, the error terms are assumed to be independently and normally distributed as:

$v_i \sim N(0, 1)$ and $u_i \sim N(0, \sigma^2)$,

The log-likelihood function for the double-hurdle model that nests a univariate Probit model and a truncated regression model is given following (Cragg, 1971 cited in Adam, 2010) by:

$$LogL = \sum \ln \left[1 - \Phi(Z_i' \alpha) \left(\frac{x_i' \beta}{\sigma} \right) \right] + \sum_+ \ln \left[\Phi(Z_i' \alpha) \frac{1}{\sigma} \phi \left(\frac{y_i - X_i' \beta}{\sigma} \right) \right] \quad (8)$$

Where, Φ and ϕ refer to the standard normal probability and density functions respectively, Z_i' and X_i' represent independent variables for the Probit model and the Truncated model respectively, α , σ , and β are parameters to be estimated for each model.

3.4.2.2. Determinants of participation in contract sales

Probit model convenient if data is normal distributed. In this study, probit model was used since the distribution of the data was normal distributed.

The empirical specification of the probit model to be estimated by maximum likelihood estimation is defined as:

$$Y_i = \beta_0 + \sum_i^m \beta_i X_i + \varepsilon_i \quad (9)$$

Where: $i = 1, 2 \dots m$

Y_i , is a dummy variable indicating the probability of participating in contract sale that is related to the equation as $Y_i = 1$ if a farmer have been participate in contract sale, $Y_i = 0$, otherwise.

β_i , are the coefficients to be estimated,

X_i , are explanatory variables in the Probit regression model,

ε_i , is random error term

The probit functional form compels the error term to be homoscedastic because the form of probability depends only on the difference between error terms associated with one particular choice and other (Amemyia, 1985). The marginal effects were estimated on the variable means. This calculation involves taking the partial derivatives that measures the change in the probability of getting access per unit change in the independent variables.

3.4.4.2. Determinants of market outlet choice

Multivariate probit model (mvprobit) was applied for household variation in the choice of a market outlet and to estimate several correlated binary outcomes jointly. Multivariate probit approach simultaneously models the influence of the set of explanatory variables on choice of markets outlets, while allowing for the potential correlations between unobserved disturbances, as well as the relationships between the choices of different market outlets (Belderbos *et al.*, 2004, cited in Hailemariam *et al.*, 2012).

The observed outcome of market outlet choice can be modeled following random utility formulation. Consider the i^{th} farm household ($i=1, 2, \dots, N$), facing a decision problem on whether or not to choose available market outlets. Let U_0 represent the benefits to the farmer who chooses cooperatives, and let U_k represent the benefit of farmer to choose the K^{th} market outlet: where K denotes choice of cooperatives (Y_1), restaurants (Y_2) and consumers (Y_3).

The farmer decides to choose the K^{th} market outlet if $Y_{ik}^* = U_k^* - U_o > 0$. The net benefit (Y_{ik}^*) that the farmer derives from choosing a market outlet is a latent variable determined by observed explanatory variable (X_i) and the error term (ε_i):

$$Y_{ik}^* = X_i' \beta_k + \varepsilon_i \quad k = Y_1, Y_2, Y_3 \quad (10)$$

Using the indicator function, the unobserved preferences in equation above translates into the observed binary outcome equation for each choice as follows:

$$Y_{ik} = \begin{cases} 1 & \text{if } Y_{ik}^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (k = Y_1, Y_2, Y_3) \quad (11)$$

In multivariate model, where the choice of several market outlets is possible, the error terms jointly follow a multivariate normal distribution (MVN) with zero conditional mean and variance normalized to unity (for identification of the parameters) where $\mu_{y1}, \mu_{y2}, \mu_{y3}$ $MVN \sim (0, \Omega)$ and the symmetric covariance matrix is given by:-

$$\Omega = \begin{bmatrix} 1 & \rho_{y_1y_2} & \rho_{y_1y_3} \\ \rho_{y_2y_1} & 1 & \rho_{y_2y_3} \\ \rho_{y_3y_1} & \rho_{y_3y_2} & 1 \end{bmatrix} \quad (12)$$

Of particular interest are off-diagonal elements in the covariance matrix, which represent the unobserved correlation between the stochastic components of the different type of outlets. This assumption means that equation (15) generates a MVP model that jointly represents decision to choice particular market outlet. This specification with non-zero off-diagonal elements allows for correlation across error terms of several latent equations, which represents unobserved characteristics that affect the choice of alternative outlets.

Following the form used by Cappellarri and Jenkins (2003), the log-likelihood function associated with a sample outcome is then given by;

$$\ln L = \sum_{i=1}^N \omega_i \ln \Phi(\mu_i, \Omega) \quad (13)$$

Where is an optional weight for observation i, and Φ_i is the multivariate standard normal distribution with arguments μ_i and Ω , where μ_i can be denoted as;-

$$\mu_i = (k_{i1}\beta_1 X_{i1}, k_{i2}\beta_2, k_{i3}\beta_3 \chi_{i3}), \text{ while } \Omega_{ik} = 1 \text{ for } j = k \text{ and} \quad (14)$$

$$\Omega_{ik} = \Omega_{ik} = k_{ij}k_{ik}\rho_{jk} \text{ for } j \neq k, \quad k = 1, 2, 3 \dots \text{ with } k_{ik} = 2y_{ij} - 1 \quad (15)$$

3.4.2.3. Test of multicollinearity and endogeneity

Variance inflation factor (VIF) was also used to test for collinearity among continuous independent variables and for dummy or discrete variables respectively (Gujarati, 1995). VIF shows how the variance of an estimator is inflated by the presence of multicollinearity (Gujarati, 1995). If R^2 is the adjusted square of the multiple correlation coefficients that results when the explanatory variable (X_i) is regressed against all the other explanatory variables. VIF is computed as follows:

$$VIF(X_i) = (1 - R_i^2)^{-1} \quad (16)$$

As the adjusted R_i^2 approaches 1, the VIF approaches infinity. That is as the extent of collinearity increases, the variance of the estimator increases, and in the limit it can become infinity. If there is no collinearity between explanatory variables, the value VIF is 1. As a Rule of Thumb values of VIF greater than 10, is often taken as a signal for the existence of multicollinearity problem in the model (Gujarati, 1995).

Taking the endogenous variables their actual value can introduce endogeneity problem and resulting inconsistency in the parameter estimates of the model and the parameter estimates could not converge to their true population parameters. Hence, endogeneity test was made by regressed the suspected endogenous variables over the exogenous variables to get their predicted values. The predicted values of the endogenous variables are used to estimate the parameters.

3.5. Variables Definitions and Hypotheses

3.5.1. Dependent variables

Market participation decision of the household: Is a dummy variable that represents the probability of market participation of the household in the milk market. For the household who participate in milk market the variable takes the value of one where as it take the value of zero for the household who did not participated in milk market.

Quantity Supplied to Market (VVS): A continuous variable that represents the actual supply of milk by individual households to the market during the survey year, measured in liter.

Contractual Sale: This is a dummy variable that represents the probability of household use of contract in the milk market that takes a value of 1 if the dairy household sold milk through contract during the survey where as it takes the value of zero for the household who did not use contract sale in milk market.

Market Outlets (MktO): A categorical dependent variable measured by the probability of producers sells milk to either of the alternatives market outlets. It was represented in the model as Y_1 for those households who choose to sell milk to cooperatives, Y_2 for producers who choose restaurants and Y_3 for producers who choose consumers to sell milk.

3.5.2. Independent variables

Variables were identified based on economic theories and the findings of different empirical studies. Different independent variables were expected to influence the market participation decision, milk marketed supply, contractual sale and market channel choices in the study area. In order to identify factors influencing milk market participation decision, level of market participation, contractual sale and market channel choices both continuous and discrete variables were hypothesized based on economic theories and the findings of different empirical studies.

3.5.2.1. Independent variables of market participation and milk marketed supply

Age of the Household Head (HHAGE): It is a continuous variable measured in years. It was expected to have a positive effect on market participation and marketed surplus. The study by Woldemicael (2008) shows that age of the household head has a positive and significant impact on market participation decision. The positive and significant relationship between the two variables indicates that older dairy household head could have more milking cows increasing the probability of the household milk market entry decision.

Age Squared of the Dairy Household Head (AGESQR): The study hypothesized that the relationship between household market participation decision and level of decision, and age

squared of the dairy household may not be linear throughout. It is assumed that at some point the relationship may become non-linear or parabolic (U-shaped). According the study by Woldemicael (2008) at some stage of earlier period of the household head age, age of household head positively affect milk marketed supply, however latter on, as the household head gets older, the milk marketed supply declines as dairying is the function of active labour.

Education Level of the Household Head (HHEDU): It is a continuous variable measured in years of schooling. A study conducted by Gizachew (2005) and Rehima (2006) showed that formal education was positively related to household market participation and marketed volume. Therefore, in this specific study, formal education was hypothesized to affect milk market participation decision and sale volume of milk positively.

Sex of the Household Head (HHSEX): This is dummy variable that takes a value of 1 if the household head is male and 0 otherwise. Tshiunza *et al.* (2001) determined that male farmers tended to produce cooking banana for market and therefore participated in banana market more than female farmers participate. Further, study conducted by Awol (2010) indicated negative relation between sale volume of poultry and male-headed household. Mamo and Deginet (2012) found that sex of the household head has statistically significant effect on whether or not a farmer participates in the livestock market. The variable was expected to have a positive relation with milk sale volume.

Nonfarm Income (NFARMINC): It is a dummy variable and represents whether the household obtains income from different sources other than farm activities or not. Farmers who have financial capital from different sources are able to coping with different risks of production and consumption and enter to economic transactions (Gizachew 2005). It takes the value 1 if the household obtains income from nonfarm income sources activities, 0 otherwise. These households have income from nonfarm activities are expected to participate in the market and volume of milk supply to market.

Household Access to Market Information (MKTINFO): This is a dummy variable taking a value “1” if farmers received information about the market and “0” otherwise. Access to market information is important variable in marketing business. Marketed supply of malt

barley producers who had access to market information are greater than those who did not (Mahlet, 2013). According to Abreham (2013) access to market information affects marketed supply positively and reduces farmers risk aversion behavior of getting a market and decreases marketing costs of farmers that affects the marketable surplus. It was hypothesized to influence the milk supply positively.

Family Size (FMLYSIZ): This variable is a continuous explanatory variable and refers to the total number of family in the household. This source is an important factor to perform diversified agricultural activities and increases production and the more the production of agricultural produce increases, the more it marketed. The study conducted by Woldemicael (2008) shows that family size and market participation decision have positive relationship indicates larger family size provides higher labor to undertake dairy production and management activities easily which in turn increases daily marketable milk volume leading to increased capacity of dairy household milk market participation. In this context family size was hypothesized to have positive impact on milk market participation and volume of sale.

Distance to Nearest Market (MKTDIST): It is location of the dairy household from the nearest milk market and measure in kilometer. Distance from nearest milk market hypothesized to be negatively related to market participation decision and milk marketed surplus. The study conducted by Woldemichael (2008) states that the farther is a household from the milk market, the more difficult and costly to get involved in the milk market. Consequently, in this study distance from the nearest dairy market is hypothesized to effect participation decision and level of market participation negatively.

Access to Credit (ACCREDIT): It is a dummy variable taking a value of “1” if farmers have access to credit service and “0” otherwise. According to Birhanu and Moti (2012), expansion of credit services encourages farmers’ market participation. It is hypothesized that farmers who have access to credit service are more likely to participate in milk markets and expected to influence the marketed supply of milk positively.

Extension Contact (EXTCONT): This is continuous variable which is the number of days that farmer had contact with extension agent for agricultural work supervision in a year. It is

expected that extension service widens the household's knowledge with regard to the use of improved dairy production technologies and has positive impact on milk market participation decision and sale volume of milk. Different studies revealed that extension visit has direct relationship with market entry decision and marketable output. In this line, study conducted by Holloway and Ehui (2002) identified that extension visit was directly related to dairy household milk market entry decision and marketed milk volume. Furthermore, Rehima (2006) identified that extension visit was positively related to pepper market entry decision and marketed pepper volume. Therefore, extension contact is hypothesized to impact dairy household milk market entry decision and marketed volume of milk positively.

Number of milking cows (Cross breed (CRSBRD), Local breed (LOCBRD)): This variable is continuous and is measured in number of milking cow owned. The entry to milk market and marketed milk volume are assumed to be positively influenced by the number of milking cows owned. The study conducted by Holloway *et al.* (2002) in the Ethiopian high lands on expanding market participation among smallholder livestock producers indicated positive and significant relation between milking cow numbers and market participation and marketed milk volume. Further, study conducted by Gizachew (2005) confirmed positive and significant relation between milking cow numbers market participation decision by dairy household and marketed milk volume.

Landholding size (LAND): This is a continuous variable measured in hectare. It is expected that as the size of land increases, the proportion of land allocated for feed development and improvement increases. According to berhanu *et al.* (2013) the variable has shown negative relationship with milk market participation and volume of milk supply.

3.5.2.2.Independent variable of contract sale

Age of the household head (AGEH): Age is an important variable which affects the decision behavior on using contractual forms or not in milk marketing. It is a continuous variable measured in years. This variable was expected to decrease the probability of dairy household's to use contract or non-contract. As the age of the dairy producer household increases, he becomes reluctant to use formal contractual agreement and tends to use other market

alternatives such as personalized contracts. Bardhan *et al.* (2012) on their study on “market participation behavior of smallholder dairy farmers in Uttarakhand: a disaggregated analysis” indicated that as age of household increases, the tendency to participate in formal milk marketing decreases. Hence, this variable was assumed to decrease the probability of dairy households to use formal contractual agreement.

Sex of household head (SEX): Sex is an important variable in marketing decisions even though it depends on roles and responsibilities in different societies. In the management of livestock such as feeding, cleaning of shelters, milking and others activities, female contributes more labor. Sex is a dummy variable that takes the value 1 if the household head is male, 0 otherwise. This variable is expected to affect the milk market participation positively.

Education level of the household head (EDUC): With the increase in the education level, the household increases the tendency towards modern marketing system such as contractual based agreements. It is a categorical variable. Antoni and Mishra (2012) on their study on determinants of dairy farmers’ participation in the milk income loss contract program showed that educational attainment had positive effect on the likelihood of participation in contractual agreement. This variable is therefore expected to increase the probability of engaging in contract to sell milk.

Family size (FMLYSIZ): This variable is a continuous explanatory variable and refers to the total number of family in the household. This source is an important factor to perform diversified agricultural activities and increases production and the more the production of agricultural produce increases, the more it marketed. The increase in volume of production increases the probability of using contracts. Thus, this variable is expected to affect positively the probability of contract for selling milk.

Nonfarm Income (NFINC): It is a dummy variable and represents whether the household obtains income from different sources other than farm activities or not. Antoni and Mishra (2012) found in their study that other income obtained from nonfarm activities had increased the probability to use contract agreement programs. Thus, this variable is expected to increase

the probability of households in using contractual agreement with their buyers as compared to noncontract.

Cooperative Membership (COOPMEM): It is a dummy variable that indicates whether the dairy producer is a member of milk cooperative or not. The value takes 1 if the dairy producer is a member to milk cooperative, 0 otherwise. Being a member to milk cooperative initiates the producer to participate in milk selling and also it increases the likelihood to use contractual agreements. Therefore, this variable is expected to affect the likelihood of dairy producers use contractual agreements.

Landholding size (LAND): This is a continuous variable measured in hectare. It is expected that as the size of land increases, the proportion of land allocated for feed development and improvement increases. The variable has expected negative impact on use of milk contract sale.

Volume of Milk Produced (VLMILK): It is a continuous variable and represents the total volume of milk produced per day and measured in liters. Volume of milk produced is a determinant factor in decision of producer households either to use contractual agreement or not. Producers who produced large volume of milk tends to use contractual based market transactions because this selling approach reduces the potential losses that may result due to decrease demand for their produce especially such as milk which is exposed to spoilage. Thus, this variable is expected to increase the probability of household to use contractual agreements to sell milk.

Market distance (MKIDST): It is location of the dairy household from the nearest milk market and measure in kilometer. The households in far distance need to increase their ties with buyers through contractual agreement. Hence, this variable is expected to increase the use of contractual agreement by producer.

Access to credit (CREDIT): The accessibility of credit is an important in rural areas which help the farming community in fulfilling their financial requirements. Credit increases the financial capacity of producer households and they tend to expand their dairy business thereby

increasing milk market participation. It is a dummy variable and it refers to whether the household has access to credit or not. The value takes 1 if the dairy producer has access to credit, 0 otherwise. This variable was then expected to increase the probability of using contract to sale milk.

Number of Extension Contact (EXTCON): This is continuous variable which is the number of days that farmer had contact with extension agent. Extension is an important tool in boosting agricultural productivity both in production of crops and livestock. It serves as a source of information and knowledge. The contact with livestock extension agent helps the dairy producer in using modern technology outputs and this in turn helps in increasing their agricultural productivity. Those farmers who have more contact with livestock extension agent are more likely to know the advantages of producing and selling milk to which they might get greater benefits. It is a continuous variable and measured in number of visiting by the experts. Therefore, it is also expected to increase probability the contractual using behavior of dairy producers in selling milk.

Number of Milking Cows (Cross breed (CRSBRD), Local breed (LOCBRD): This variable is continuous and is measured in number of local and crossbred milking cow owned. The milk contract sales are assumed to be positively influenced by the number of milking cows owned.

3.5.2.3. Independent variable outlet choice

Education level of household head (HHEDU): It is a continuous variable and refers to the number of years of formal schooling a household attended. Educated person make better use of their time and available resources. Anteneh *et al.* (2011) in the study of coffee market outlet choice confirmed that level of education of household head significantly influenced market outlet choice of coffee producers. It is expected in this study that this variable has positive influence on milk market outlet choice.

Family Size (FMLYSIZ): This variable is the total number of members of the household. According to the study by Kadigi (2015) household size is positively related to the probability

of the choice of neighbor households as one of the milk marketing outlets. This may be due to the fact that larger household size represents labor resource. Household size is hypothesized to have positive impact on the milk market outlet choice.

Sex of Household Head (HHSEX): Sex is an important variable in marketing decisions even though it depends on roles and responsibilities in different societies. In the management of livestock such as feeding, cleaning of shelters, milking and others activities, female contributes more labor. Sex is a dummy variable that takes the value 1 if the household head is male, 0 otherwise. Even the females contribute more in livestock management, due to lack of capital and access to institutional credit and extension services, female's participation in dairy production and marketing faces obstacles (Berhanu *et al.*, 2014). Sex of household head hypothesized to have positive impact on the milk market outlet choice.

Distance to the Nearest Market (MKTDIST): It is a continuous variable measured in hours. It refers to the distance of the nearest market from the farmers' house. If the distance to the nearest market increases, the transportation cost will also increase. Riziki *et al.* (2015) confirmed that distance to the market is significant determinant of choice of marketing outlet. This variable is expected to have negative effect on milk market outlet choice.

Quantity of Milk Sold (VSS): It is a continuous independent variable measured in quintals and shows the quantity of milk sold per day during the survey year. If the marketable supply of milk increases, the ability of farmers to choose market increases. Daniel (2006) confirmed that the yield of *teff* has positive correlation with sales to cooperative as marketing agent. In this study it is expected to have positive impact on milk market outlet choice.

Access to Market Information (MKTINFO): It is dummy variable that takes a value 1 if obtained price information and 0 otherwise. According to Geoffrey (2015), access to price information had positive influence on the choice of local market outlet in the marketing of pineapple. It is clear that producers are severely constrained with regard to market information. Therefore, access to price information is hypothesized to have positive influence on the milk market outlet choice positively.

Number of Extension Contact (EXTCONT): This is a continuous independent variable and shows that households have number of extension contact days in a year. It is expected that agricultural extension service widens household knowledge with regard to use of improved agricultural technologies. Agricultural extension services are expected to enhance households' skills and knowledge, link households with technology and choice of markets (Lerman, 2004). Extension contacts hypothesized to have positive influence on the milk market outlet choice.

Nonfarm income (NFARMINC): It is a dummy variable that takes one if the household is involved in nonfarm activities and zero otherwise. Farmers who gain more income from nonfarm income want to supply their milk to any nearest market outlet with low price than to go far. Hence, non-farm income is hypothesized to influence market outlet choice decision of milk producers.

Number of Cross breed cows: This variable is continuous and is measured in number of crossbred milking cow owned. The number of crossbred cows ownership is hypothesized to have relation with market outlet choice to sell their product.

Table 1 Description of dependent and independent variables used in the models

Variable	Measurement	Expected effect on outcome			
		Participation decision	Quantity supply	Contract sale	Market outlets
Sex of households head	1 if Male, 0 if Female	+ve	+ve	+ve	+ve
Family size	Continuous (number)	+ve	+ve	+ve	+ve
Education level of households	Continuous (years)	+ve	+ve	+ve	+ve
Distance to nearest market	Continuous (minutes)	-ve	-ve	-ve	-ve
Age of household head	Continuous (years)	+ve	+ve	-ve	
Age square	Continuous (years)	-ve	-ve	+ve	
Access to non farm income	1 Yes, 0 Otherwise	+ve	+ve	+ve	+ve
Number of cows own	Continuous (number)	+ve	+ve	+ve	+ve
Extension Contact	Continuous (number)	+ve	+ve	+ve	+ve
Land holding	Continuous (hectares)	+ve	+ve	-ve	
Milk output per ay	Continuous (liter)	+ve	+ve	+ve	
Access to market information	1 Yes, 0 Otherwise	+ve	+ve		+ve
Access to credit	1 Yes, 0 Otherwise	+ve	+ve	+ve	
Cooperative membership	1 Yes, 0 Otherwise			+ve	
Volume of milk sold	Continuous (liter)				+ve

4. RESULTS AND DISCUSSIONS

This chapter presents the results of descriptive and econometric analysis of the study. The descriptive analysis employed to describe the general characteristics of sampled farm households and institutional arrangement and environment. The econometric analysis employed to identify factors that affect dairy farm households' decision to participate in milk market and milk sale volume, contract sale and market channel choice of the sampled dairy household in the Wukro-kilteawlalo district.

4.1. Descriptive Analysis

4.1.1. Socio-demographic characteristics of respondents

Socio-demographic characteristics of the farmers play an important role in either promoting or impeding their participation in agricultural markets (Sebatta *et al.*, 2014). Analysis of market participation of farmers showed that from the total of 139 sampled households, 51% were engaged in milk sales while the remaining 49% did not milk produced for home consumption.

4.1.1.1. Socio-economic characteristics of sample farm households

The average family size of the sampled households was about six members. The average family size of the study area is relatively similar with that of the national average which is six persons. The average age of the respondent was found to be 49.50 years. Average dairy production average farm experience of the respondents was 15.75 years. The two-sample t test result indicated that there were no significant difference between non-market participant and market participants in terms family size, age, and dairy farming experience in study area.

Sex: It was found that among the total sample respondents, 112(80.58%) were males while the remaining 27(19.42%) were female households. A chi-square comparison between seller and non-seller in terms of their sex showed that there is an evidence to conclude that there is significance difference between market participant and non participants in terms of sex of household head.

Table 2 Demographic characteristic of sample household heads

Demographic characteristics		Participants (n=71)		Non-participants (n=68)		Total Sample (n=139)		t-value
		Mean	Std. Dev	Mean	Std. Dev.	Mean	Std. Dev	
Age		49.04	7.98	49.94	9.63	49.50	8.80	0.572
Dairy experience		14.53	9.82	17.04	12.06	15.76	11.00	1.35
Family size		5.55	1.60	5.54	1.95	5.72	1.78	-1.1365
Variables		Participants (n=71)		Non- participants (n=68)		Total Sample (n=139)		χ^2 -value
		N	%	N	%	N	%	
Education	Illiterate	22	30.99	32	47.06	54	38.85	6.944*
	Informal education	4	5.64	0	0	4	2.88	
	Primary school	43	60.56	35	51.47	78	56.12	
	Secondary school	2	2.81	1	1.47	3	2.16	
Sex	Male	61	85.92	51	75	112	80.58	2.644*
	Female	10	14.08	17	25	27	19.42	
	Total	71	100	68	100	139	100	
Nonfarm income	Yes	29	37.66	48	6.34	77	55.39	12.44***
	No	20	32.26	42	67.74	62	44.60	

Source: Own Survey data, 2016; NS=Not-significant.

Education: Education level plays a crucial role in smallholder farmers' economic activities since education equips them with the necessary knowledge of how to make a living (Aman *et al.*, 2013). Out of the 139 sample households, about 58.27% of the respondents attended formal education but the remaining 41.73% did not attend formal education. The chi-square test result shows that milk sellers were more educated than non-sellers at 10% significance level.

Non-farm income: From total sample households, 55% of them participated in non-farm activities to generate additional income. Non-farm activities refers both to self-employments in non-farm sectors such as petty trade, craft work/carpentry, daily labor, and guard. About

38% of the sellers of milk participate in nonfarm income while 68% of them do not participate in nonfarm income generating activities.

4.1.1.2. Household resource ownership and economic variables

Livestock holding: Livestock are one of the major assets for the farmers and also indicates farmers' level of wealth in the study area. The average number of livestock owned by the households was about 5.07 TLU. Independent sample t-test result shows no statistically significant mean difference between market participants and non participants in terms of livestock holding of the household head. The average currently crossbred cows owned by respondents in the study area were 1.56 and 0.38 for market participant and non participants respectively. Independent sample t-test result shows statistically significant mean difference between market participants and non participants in terms of crossbred cows owned.

Table 3 Livestock Ownership and non-farm income of the sample household heads

Livestock ownership	Participants (n=71)		Non-participants (n=68)		Total Sample (n=139)		t-value
	Mean	Std. Dev	Mean	Std. Dev.	Mean	Std. Dev	
Total livestock unit	5.30	2.26	4.83	1.67	5.07	2.01	-1.39
Crossbred cow	1.56	1.21	0.38	0.65	0.98	1.14	7.10***
Local breed cow	0.59	0.60	0.65	0.75	0.62	0.67	0.48

Source: Own Survey data, 2016; ***, Significant at 1% and 5% level of significant.

4.1.1.3. Access to institutional service of farm households

Access to credit: Credit service is the important institutional service which was required by the respondents in the study area. However, the majority (89.21%) of the households did not have access to credit services due to shortage of credit service, high interest rate and short repayment period of the received loan. Credit and saving institutions, cooperatives, and micro finance institution are some of the credit provider institutions in the study area. From total sample respondents, only 10.79% had access to formal credit. Market participants and non participants were found to access formal credit with varying proportion of 16.90% and 4.41%

from their groups respectively. The Chi-square result also indicates that there was a significant difference between market participants and non participants in access to credit service indicating as there is a systematic difference in terms of access to credit service between milk market participants and non participants.

Table 4 Access to credit, market information and extension service of sample household

Variables		Participants		Non-participants		Total (n=139)		χ^2 -value
		(n=71)		(n=68)				
		Obs.	%	Obs.	%	Obs.	%	
Access to credit	Yes	12	16.90	3	4.41	15	10.79	5.63**
	No	59	83.10	65	95.59	124	89.21	
	Total	71	100	68	100	139	100	
Access to market information	Yes	55	77.46	1	1.47	56	40.29	83.38***
	No	16	22.54	67	98.53	83	59.71	
	Total	71	100	68	100	139	100	
		Mean	Std.	Mean	Std.	Mean	Std. Dev	t-value
Extension contact			Dev		Dev.			
		15	12.06	3.074	5.10	9.17	11.06	7.53***

Source: Own sample survey, 2016; ***, **: indicate significant at 1%, 5% significant level

Access to market information: Access to market information is the important institutional service which was required by the respondents in the study area. Out of 139 sample households, only 40.29% of the respondents had access to market information but the remaining 59.71% did not have access to market information. The chi- square test result shows that access to market information was significantly difference at less than 1% significance level between market participants and non participants.

Extension contact: The average extension contact of farmers with extension experts in the study area was 9.162 days in a year with standard deviation of 11.1. Means of extension contact by market participants and non participants farmers were 15day and 3day respectively with statistically significant difference among them at less than 1% significant level.

Distances nearest market: The average distance to travel from home to the nearest market by farmers in the study area was 2.51km with standard deviation of 2.40. Means of distance traveled to the nearest local market by market participants and non participants were 1.87km and 3.17km respectively with statistically significant difference between the two groups at 1% significant level.

Table 5 Distance of sample household residence to the nearest market

	Participants (n=71)		Non-participants (n=68)		Total (n=139)		t-value
	Mean	Std. Dev	Mean	Std. Dev.	Mean	Std. Dev	
Distance to nearest market center (km)	1.87	2.18	3.17	2.43	2.51	2.40	3.30***

Source: Own sample survey, 2016; ***: indicate significant at 1% level.

4.1.2. Socio-economic characteristics of sampled households based on contractual use

Different socioeconomic characteristics of households were analyzed for contract users and non user farmers. Variables are listed to show the distribution between contract user and non-user farmers. Among the dairy sample households who participated in selling milk, 62(87%) of them sold milk in contractual bases while only 9(13%) of them sold their milk without contractual bases. There was no significant difference in age and experience in dairy production and family size between contract users and nonuser sample households.

There was statistical significant association between market distance and contract using of the sample dairy producers. The contractual based sellers were far away with a mean of 1.7 km and the noncontract users were 3.1 km from nearest milk market.

As indicated in Table 5, significance difference between contract users and non users regarding to owning crossbred cow. Mean of 1.67 and 0.42 crossbred cow own by contract users and non users respectively. With regard to milk output, mean milk yield per day per contract user and non-users of contract was 15 and 7 litters, respectively and was found to be significantly different at 5% probability level. The mean value of milk produced per day per contract user household was two times higher than that of non-user households. This result

suggests that production volume was found to be the most important variable in determining the use of contract to sale milk.

Table 6 Household characteristics by milk contract use (continuous variables)

Variables	Mean value of variables			t-value
	Non-user (N=9)	Contract users (N=62)		
	Mean	Mean		
Age	49.77	47.9		0.6747
Family size	2.78	2.63		-0.3478
Experience in dairy production	16.44	14.25		0.6214
Crossbred cow	0.42	1.67		7.619***
Local breed cow	0.59	0.64		0.413
Quantity of milk produced per day	7.16	15.36		-2.28**
Market distance	1.69	3.11		1.8369*
Frequency of extension contact	5.66	14.37		-2.2822**

Source: Survey data, 2016, *and ** significant at 5% and 10% significance level.

The difference in the mean values in the number of extension visit was significant at 5% probability level. Contract user sample farm households have better number of extension visits than non user farmers.

Out of the total respondents who were participate in nonfarm activities, 39% of them used contractual based selling of milk while among the dairy producers who do not participate in off farm income generating activities, 61% of them used contractual based agreements to sale their milk. However, there was no statistical difference in nonfarm activities participate between contract user and non user milk producer households.

Table 7 Household characteristics by milk contract use (categorical variables)

Variables		Non-user (N=9)	Contract users N=62)	χ^2 -value
		%	%	
Sex	Male	88.89	85.48	0.0753
	Female	11.11	14.52	
Education status	Illiterate	22.22	32.26	5.6225***
	Informal education	22.22	3.23	
Credit access	Primary school	55.56	61.29	0.2460
	No	88.89	82.26	
Cooperative membership	Yes	11.11	17.74	9.6928***
	No	77.78	32.39	
Nonfarm Income	Yes	22.22	67.61	0.9231
	No	44.44	61.29	
	Yes	55.56	38.71	
	No			

Source: Survey data, 2016. *** Significant at 1% significance level

The survey result depicts that there was statistically significant difference between contract users and non users in terms of membership to dairy cooperative. The chi-square test revealed that dairy cooperative membership of contract user and non user sampled dairy household was found to be statistically different at less than 1% significance level. The majority of contract user sampled households were members of dairy cooperative than the non user of contract agreement.

4.1.3. Household characteristics by market outlet choices

Milk producer households in the study area sell their milk to different market actors based on different criteria. Among the major criteria were payment on agreed time for their milk, lack of awareness of any other buyers, good price for their milk, volume of sale, trust the dairy producer has on their buyers, and nearness to their buyers. Three major milk market outlets were identified in the study area those serve as alternatives of milk market to the dairy producers. The first market outlet channel was restaurants. The second outlet was selling

directly to consumers. The third identified milk market outlet channel at point of first sale was milk cooperative. 64(90.14%), 27 (38.03%), and 12 (16.90%) of the sample producers sold directly to consumers, to dairy cooperatives and to restaurant respectively.

Among the respondents who sold milk, 5 (45.45%), 8 (12.5%) and 2 (18.18%) of the respondents who were sale to cooperative, consumer and restaurants respectively were female producers. Whereas of the total male respondents who sold milk, 56 (87.5%) of them were found to sale to direct consumer, 21 (35%) and 10 (16.67%) sold to dairy cooperative and restaurants respectively. Among the milk producers who did have non farm income, 29 (45.31%) of them producers who sale to consumer have nonfarm income, and 12 (28.57%) and 7 (16.67%) of producers who sale to milk cooperative and restaurant respectively have nonfarm income. Whereas, 35 (45.69%), 14(48.28%) and 5(17.24%) of the sample producers who sale milk to consumer, cooperative and restaurants respectively have no additional nonfarm income. The producers have access credit, 31(51.67%), 20 (33.33%) and 9(15%) of them were found to sale milk to consumers, milk cooperatives and restaurant market outlets.

Respondents with nearest milk market sale to cooperatives whereas respondents who were far away from milk market chose consumers and restaurants for sale their milk. Milk producers who sale milk to cooperatives were in average 0.51 km distance far from market while the milk producers who sale to consumers and restaurant were located 1.93 and 2.74 km away from the nearest milk market respectively.

Table 8 Household characteristics by milk market outlet choice (categorical variables)

		Market outlet choice of dairy producers						
Variable	Category	Consumer		Cooperative		Restaurant		χ^2 -test
		N	%	N	%	N	%	
Sex of the respondent	Male	56	87.50	21	35	10	16.67	0.58
	Female	8	12.50	5	45.45	2	18.18	
Education level	Illiterate	34	53.13	4	18.18	3	13.64	9.73
	Informal education	4	6.25	1	25	-	-	
	Primary school	24	37.50	20	46.51	9	20.93	
Non farm income	Yes	10	34.48	14	48.28	5	17.24	3.34
	No	23	54.76	12	28.57	7	16.67	
Credit service	Yes	2	18.18	6	54.55	3	27.27	4.21
	No	31	51.67	20	33.33	9	15	
Market information	Yes	22	42.31	24	46.15	6	11.54	8.86**
	No	11	57.86	2	10.53	6	31.58	

Source: Survey data, 2016, ** significant at 5% significance level.

Milk producer households who sold to dairy cooperative were supply in average 15.84 liter per day and 8.73 liter per day and 6.5 liter milk per day were supply milk per day to consumers and restaurants respectively.

Table 9 Household characteristics by milk market outlet choice (continuous variables)

Variable	Market outlet choice of dairy producers					
	Consumer		Cooperative		Restaurant	
	Mean	St.dev	Mean	St.dev	Mean	St.dev
Family size	2.66	1.20	2.42	1.07	2.69	1.10
Crossbred cows	1.5	1.22	2.48	1.08	1.5	0.92
Market distances	1.93	2.28	0.51	0.67	2.74	1.55
Volume marketed	8.73	7.65	15.84	7.58	6.5	5.46
Extension contact	2.32	2.04	4.21	2.02	1.73	1.46

Source: Survey data, 2016,

4.1. Institutional Environments and Arrangements in Milk Marketing

Institutional environments consist of laws, regulations, policies, informal rules and so on. They are more general formal and informal rules mediating interactions. Institutional arrangements, on the other hand, are governance structures, formalized agreements, and contractual agreements between specific actors.

In this study, one aspect of institutional arrangement, which is, contractual agreement was examined. Two alternative institutional arrangements (contractual arrangements) for milk marketing were observed next to the default non-contract option. The first alternative was using formal contractual arrangements, while the other alternative was using informal contractual arrangements. Based on these arrangements, the institutional arrangements were examined especially in terms of the transaction costs associated with marketing and being exposed to formal and informal contractual agreement user producers to default of contractual agreement. In the institutional environment part of this section, how the laws or regulations, enforcement mechanisms, and informal norms such as trust were related with milk marketing was examined.

4.1.1. Institutional environment

4.1.1.1. Formal institutions in dairy marketing

Even if formal rules such as laws, regulations, and directives/principles are important in any marketing including dairy marketing, there are no as such formal rules at regional level as well as at national level regarding dairy marketing. The only proclamation regarding livestock is the “Live Animals Marketing Proclamation No.819/2014” issued on 26th of March, 2014 by the government of the Federal Democratic Republic of Ethiopia (FDRE). This proclamation was focused on selling, buying, and transporting of live animals and other marketing related activities. The other proclamation which has little relation with milk is the “Cooperative Societies Proclamation No. 147/1998” issued on 29th of December, 1998. This cooperative proclamation includes the establishment of milk cooperatives but it did not say about dairy marketing.

Due to the lack of such proclamations, regulations and principles, the dairy marketing in the study area was carried out in a traditional way. The lack of important rules with regard to a standard dairy marketing system and transaction safeguards lead to many complains by dairy marketing actors blaming for each other in measuring quality standards. There are no regulations in dairy marketing concerning quality standards to control the adulteration of milk with water and also weighting scales.

The cooperative sell milk in their shops and distribute to Mekelle that did not fulfill quality starting from neatness to the shops and containers. The cooperatives complained that the authority not create and facilitating favorable conditions for safety places for selling milk and milk products.

Lack of well-functioning legal system affects the agreement between buyers and sellers. The enforcement mechanisms for breaching of contracts were weak and negotiation was the better mechanism. As the respondent producers reported negotiation were the only solutions if faced conflicts because of any breaches in contractual agreement between the salers and buyers. The cooperatives have their own by-laws to resolve the conflicts of default in contractual agreement and the first mechanism was negotiation. The cooperative by-laws are set rules such as requirements necessary for membership, the rights and responsibilities of the members, and conditions for withdrawal and dismissal from memberships. The members of the cooperative respect the by-laws, directives and decisions of the cooperative but if the member failed to do so, they would be punished up to dismissal from the membership.

Even if there is no special regulation regarding dairy marketing, governmental legal courts were also responsible for conflicts resolutions in trading such as default in formal contractual arrangements between contracted parties if the contracted parties failed to resolve the conflicts and if they go to legal courts. In general, the formal institutional environment in dairy marketing was not adequate. Except the cooperative laws and by-laws there were no special rules or regulations regarding dairy marketing in the study area as a particular and in the region and in the country in general.

4.1.1.2. Informal institutions in dairy marketing

Informal institutions such as trust and strengthening personal relations are important mechanisms to secure the trading environment. Trust is the dominant informal institution producers used to govern the exchange of milk production in the study area. Trust plays crucial role in the relationship between producers and buyers of milk by increasing mutual benefits.

Out of the total sample dairy producers who participate in milk marketing, 98.59% of them have reported that they have trust on their buyers. Producers have trust on buyers in their payment for milk sale based on their agreement. In contractual agreements and spot market (non contract base sale), delay in payment up on the specified time was observed.

As the result reveals that the chi-square test comparison shows significant difference in delayed payment at 5% significance level among the noncontract, formal contract and informal contractual marketing arrangements. Among these three marketing arrangement forms, 89% of sample producers who use non-contract marketing have the lowest delayed payment. The next market arrangement which has lower delayed in payment was the informal contractual agreement (94.29%). In the formal contract, it has the largest proportion (70%) of delayed payment. As the result shows that trust of producers on their buyers have great role on keeping trading agreements between producers and buyer and operating the transactions process on smooth way.

Table 10 Delaying in payment for milk sale based on contract marketing arrangements

Payment delayed from milk buyer	Contractual arrangements						Chi2- value
	Non contract		Formal Agreement		Informal Agreement		
	N	%	N	%	N	%	
Yes	1	11.11	8	29.63	2	5.71	6.809**
No	8	88.89	19	70.37	33	94.29	

Source: Own survey result, 2016, **significant at 5% significance level.

4.1.2. Institutional arrangements

The institutional arrangements in dairy marketing in the study area were formal and informal contractual agreement. In this section different aspects of the two alternative institutional arrangements were examined. Spot Markets which is the default option for producers in milk marketing in the study area. Out of the total sample dairy producers who sell milk, 62 (87.32%) of them were use contractual agreement to sell their milk.

4.1.2.1. Formal contractual arrangement

This form of contractual arrangement was practiced by 27 (44%) of the total sample dairy producer households who sold milk in contractual agreement. This form of contractual arrangement was based on formal type of contract which was written agreement between producers and buyers of the milk. As the study observed that all of the sample dairy producers who used formal contractual agreement were sell their milk to dairy cooperatives. About 51.9% of the terms of agreement were based on quality of milk while the 48.1% was focused on specific price of milk. The agreement period of the 96% formal contract users were greater than one lactation period and the rest 4% users of formal contract were found to be one lactation period.

It was found that about 64% of the total volume of milk marketed by the sample respondent was transacted through the formal contractual arrangement in the study area. The study has showed that all of the sample respondents of the formal contractual user milk producers sold their milk in group. The practice of selling in group has an advantage in reducing losses cause by shortage of market because they supply total amount of milk they produce to cooperative and sale to market in group the other advantage was reducing transportation cost due to economies of scale and this made them to incur less transportation cost than the informal contractual arrangement users. In the formal contractual arrangement of selling milk, 77.4% of milk price in the study which were the producers sold their milk in contractual agreement was set by negotiation and the 19.4% was set by the decision of producers and the rest 3.2% was by buyers only. In the formal contractual arrangement the payment method between producers and their buyers in the study area was monthly payment based on the agreement at the starting

time of the contract. In the formal contractual arrangements, the respondents who had knowledge on legal enforcement mechanisms in case breaking contractual agreement were 93% and the rest 7% had no knowledge on the mechanisms.

4.1.2.2. Informal contractual arrangements

The informal contractual arrangement was practiced by 35(56%) of the total sample milk producer who sold milk in contractual agreement. This contractual agreement was based on mutual understanding without any written agreement and the governing factor in this arrangement was trust. Trust had important role on smoothing exchange arrangement between producers and buyers and enhances the success of milk marketing. The milk producer households those use the informal contractual arrangement sold their milk to consumers and restaurants. As the study revealed that about 23 % of the total volume of milk sold by the sample produces was transacted through informal type of contractual arrangement.

In an informal contractual arrangement of selling milk, 95% of producers sold their milk in contractual agreement were set by negotiation and the rest 5% was set by the decision of producers only. As the study shows that out of the total informal contractual arrangement users, 60% of them receive their payment of milk sale on monthly bases whereas 40% of the payment was made on immediate cash. As the study has revealed that all of the sample dairy producers who used informal contractual arrangement to sale their milk were found their buyer by themselves, no one of them were link to their buyers by any agent or organization.

The availability of knowledge on legal enforcement mechanisms in case of breaking contractual agreement faced was also shown in this study. Among the dairy producer households, who sold their milk in non contract base, 66.7% of them had no knowledge on legal enforcement mechanisms in case when breaking contractual agreement are faced while the rest 33.3% of the nonusers of contract had knowledge on legal enforcement mechanisms. In informal contractual arrangements, the respondents who had knowledge on legal enforcement mechanisms in case breaking contractual agreement were 11.4% and the rest 88.6% had no knowledge on the mechanisms. There was significant difference at less than 1%

significance level in availability of knowledge on legal enforcement mechanisms when breaking contractual agreement was faced among the different institutional arrangements.

Table 11 Knowledge on legal enforcement mechanisms

Knowledge on legal enforcement mechanisms in breaking contractual agreement	Institutional arrangements used						Chi2-value
	Noncontract		Formal Agreement		Informal Agreement		
	N	%	N	%	N	%	
Yes	1	11.11	18	66.67	11	31.43	11.85***
No	8	88.89	9	33.33	24	68.57	

Source: Own survey result, 2016.

In formal contractual agreement, an average 15.8 liters of milk was transacted per day which was the highest amount of liters transacted than the informal and non contract market. Through informal contractual arrangement a mean of 5.54 liters per day was transacted while 3.33liter milk per day was transacted through noncontract market.

As in table 11 shows average price of milk among the formal contract, informal contract and non-contract users there was no statistically significant difference in average selling price per liter. The non-contract users sold at a mean price of 12.33 Birr per liter. In the formal and informal contractual arrangement, the mean selling price of milk in formal contract was 12.27 Birr per liter while in informal contract users sold their milk at mean price 11.95 Birr per liter.

Table 12 Different attributes for milk by contractual arrangements

Variable		Institutional arrangements used						F-value
		Non contract		Formal contract		Informal contract		
		Mean	St.Dev	Mean	St.Dev.	Mean	St.Dev.	
Volume milk sold(Lt)		3.33	2.24	15.78	7.79	5.54	4.63	28.14***
Averagemilk price(Birr/Lt)		12.33	8.55	12.27	0.96	11.95	1.19	0.91
Transaction cost(Birr/Lt)		10.52	3.45	9.76	4.24	10.75	4.05	0.47
Transport cost	(Birr/Lt)	0.77	0.66	2.12	0.74	2.35	1.61	.39

Source: Own computation from survey, 2016, *** Significant at 1% significance level.

There was no statistical difference in transaction cost among the non-contract, formal and informal contractual arrangement users. The transaction costs of milk marketing spend based on the institutional arrangements which are non-contract, formal contract, and informal contract users was spend on average 10.52, 9.76, and 10.75 Birr per liter respectively. The mean transport cost spent by the non-contract users, formal contractual agreement users and informal contractual users was 2.77, 2.12, and 2.35 Birr/liter of milk respectively. Among the three contractual arrangement users, the formal contractual arrangement users incur smallest transportation cost than the others.

4.1.3. Relationships and trust among milk marketing actors

Trust is the most common informal institution practiced by the trading partners in the study area. In the dairy marketing, informal type of agreement which is based on mutual understanding or trust plays an important role in trading between the trading partners. The trade relationship between producers and buyers of milk which are consumers and restaurants was mostly informal based on mutual understanding, which is, trust but with cooperative producers have formal contract agreement.

Likert scale was used to measure the relationship and degree of trust the dairy producers have with cooperative in the dairy marketing. The study had indicated that 139 (100%) of the dairy producers reported that they had no relationship with traders and collectors because in the study area there were no any traders and collectors of milk. As it is observed from the table below, the relationship with different actors in the milk marketing was generally very weak.

Table 13 Evaluation of relationship status of producers with milk marketing actors

Dairy marketing actors	Relationship status with dairy producers							
	No relation		Very weak		Weak		Strong	
	N	%	N	%	N	%	N	%
Dairy producers	44	31.65	2	1.44	24	17.27	69	49.64
Collectors	139	100	-	-	-	-	-	-
Traders	139	100	-	-	-	-	-	-
Cooperatives	112	80.58	-	-	-	-	27	19.42
Consumers	75	53.96	-	-	31	22.30	33	23.74
Restaurants	127	91.37	-	-	12	8.63	-	-
Input suppliers	44	31.65	-	-	30	21.58	65	46.76
Government	4	2.88	5	3.6	53	38.13	77	55.40

Source: Own computation from survey result, 2016.

The study shows that 44 (31.65%) and 24(17.27%) of the sample producer samples confirmed that they had no relation and weak relation respectively and 69(49.64) of the sample producers had strong relationship with other dairy producers. This shows the linkage between producers were weak they did not have contact with each other regarding to dairy production and marketing. Regarding the relationship with dairy producers and the direct consumers, most 75 (53.96%) of milk producers reported that they had no relationship with consumers, 33(23.74%) of them reported that they had strong relationship with their direct consumers. Out of the sample producers 19.42% of producers who were members of cooperative had strong relationship with the cooperative the rest 112(80.58%) of sample producers had no any relation with the cooperatives. Regarding to the relation with input suppliers and government, 46.79% and 55.40% of producers had strong relationship respectively.

Trust the dairy producers have on different buyers and the government was also measured by Likert scale using proxy variables (question items). Many issues were raised concerning trust the member producers have on the cooperative. The survey results indicated that most of the sample dairy producers who were member of cooperatives had good trust on the cooperative. However, there were also indicators on dissatisfaction of members on the price of milk pay by

the cooperative, service provided by the cooperative and standing for the right of its members; also on issues that equal treatment of the cooperative to its members were dissatisfied to the producers.

Table 14 Trust status of member dairy producers on cooperative

Description	Scale							
	Strong disagree		Disagree		Agree		Strong agree	
	N	%	N	%	N	%	N	%
Cooperative establish to benefit producers	-	-	-	-	10	37	17	63
Cooperative has good relation producers	-	-	-	-	10	37	17	63
The cooperative treats producers with care	-	-	-	-	26	96.3	1	3.7
The cooperative treats all producers equally	-	-	1	3.7	10	37	16	59.3
The cooperative pays good price	-	-	14	51.9	12	44.4	1	3.7
The cooperative decisions benefit both the cooperative and producers	-	-	-	-	26	96.3	1	3.7
Cooperative provides services as expected	2	7.4	14	51.9	10	37	1	3.7
The cooperative stands for members right	3	11.1	10	37	12	44.4	2	7.4
The cooperative creates market linkages	-	-	-	-	26	96.3	1	3.7

Source: Own computation from survey result, 2016.

A reliability analysis was carried out on the sample dairy producers who are members of the milk cooperative comprising 10 items to test the reliability of the items included in the questionnaire. Cronbach alpha (α) was used to measure the internal consistency reliability of these items used in the study. As it is indicated in the result of the reliability analysis statistics, the coefficient of the Cronbach's alpha is 0.732 which shows that the questionnaire is reliable.

Table 15 Reliability Statistics for milk cooperative members

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Number of Items
0.732	0.876	10

Source: Own computation from survey result, 2016.

Item-total statistics analysis was also done to decide whether any item need to be deleted from the list of items to gives the Cronbach's alpha score that would higher than the obtained coefficient of 0.732. As it is observed from the last column of the table Cronbach's Alpha if item deleted, there is no higher score of α coefficient than 0.732 and this indicates that all the items used in the questionnaire are reliable. In addition to this, the "Corrected Item - Total Correlation" column that indicates how much each item correlates with the overall questionnaire score has a correlation r of above 0.30 indicating that the belongs on the scale.

Table 16 Item-Total Statistics for milk cooperative members

Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cooperative established to benefit producers	32.44	2.179	0.453	0.707
Cooperative has good relation with producers	32.44	2.179	0.453	0.707
The cooperative treats producers with care	31.85	2.746	0.465	0.710
The cooperative treats all producers equally	32.48	2.105	0.414	0.728
The cooperative pays good price to producers	31.85	2.746	0.465	0.710
Cooperative decisions benefit both	31.85	2.746	0.465	0.710
The cooperative provides services as expected	31.85	2.746	0.465	0.710
The cooperative stands for right of members	31.85	2.746	0.465	0.710
The cooperative creates market linkages	31.85	2.746	0.465	0.710

Source: Own computation from survey result, 2016.

Sample producers were also expressed their agreement on issues regarding government activities or government decisions on dairy marketing. The majority of the sample producers shows disagreement on issues such as decisions on benefiting the producers and equally treatments by the government, the expected of provision of services, on the laws or legal systems regarding dairy marketing, and on creating market linkages with buyers. They reported that the government showed low level of intervention to help the dairy producers to facilitate their dairying and creating sustainable markets in the area.

4.2. Econometric Analysis

In this section, the selected explanatory variables were used to identify the factors that determinants of farmers participation decision and volume of milk supply to market, factors affecting households' to use contract to sale milk and for estimates determinants of producers' market outlet choices decisions.

4.2.1. Determinants of milk market participation and level of participation

First, the probit regression model was run to find out why some farm households sale milk and others did not. Next, the truncated regression model was used to identify the decisive factors that determine the extent of milk sales. Endogeneity test was carried out for the explanatory variables. The coefficient of the residuals of the regression on the explanatory variables which are credit access, cooperative membership and extension contact were not statistically significant in any of the two hurdle regressions. These results suggest that credit access, cooperative membership and extension contact were not endogenous; therefore, the residuals were excluded from both hurdles and used the actual values. However, milk output per day was endogenous variable. As a result, the predicted value was used to estimate the model by adopting the instrumental variable method. Therefore, the predicted value of milk output is taken in both hurdle regressions.

4.2.1.1. Determinants of milk market participation

The probit regression model was used to analyze the participation decision of the respondents in milk markets (milk sales). The model chi square test indicated that the overall goodness-of-fit of the probit model was statistically significant at 1% probability level which in turn indicated the usefulness of the model to explain the relationship between the dependent and at least one independent variable. Pseudo R^2 values indicate that the independent variables included in the regression explain 60% of the variations in the likelihood to sell milk in markets. The result of probit model estimation shows that the decision made by respondents to sell milk in the study area is significantly influenced by age of household head, access to extension service, access to market information, and number of crossbreed milking cow.

Age of household heads (HHAGE): Age of household heads had a positive effect on the decision of milk sell at 10% level of statistical significance. This result implies that as the household heads age increase by one year, the probability of household heads to sell milk would increase by 5%, keeping other factors constant. This result is consistent with Woldemichael (2008) who found that age of household head influenced participation decision positively and significantly. The positive and significant relationship between the two variables indicates that older dairy household head could have more milking cows that increasing the probability of the household milk market entry decision.

Access to market information (MKTINFO): Access to market information had a positive and significant relationship with the households' decision to sell milk at 1% significance level. This result shows that the more information the farmers had on the market location, products' prices, the demand and supply situations about the produce of milk, the lesser the transaction cost they would incur which increases their likelihood of milk sold by 72 %, keeping other factors constant. This indicates that market information receivers were more likely participated in milk selling than non-receivers because market information boosts the confidence of market participants by providing information about markets. This result is in line with the findings of (Bekele *et al.*, 2009; Jari and Fraser, 2009; Gani and Adeoti, 2011; Adenegan *et al.*, 2012).

Table 17 Determinants of milk market participation decision

Variables	Coefficients	Std. Err	Marginal effect
CONSTANT	-5.290 *	2.937	
Distance from nearest market	-0.034	0.156	-0.012
Extension contact	0.0283	0.076	0.010
Family size	-0.108	0.099	-0.039
Age of household head	0.159	0.095	0.058
Age square	-0.001	0.001	-0.0004
Education level	0.434	0.390	0.162
Sex	-0.467	0.048	-0.178
Nonfarm	-0.003	0.048	-0.001
Access to credit	-0.079	0.611	-0.029
Market information	2.673***	0.805	0.724
Local breed cow	-0.309	0.297	-0.113
Crossbred cow	0.489**	0.248	0.179
Milk produced per day	0.090**	0.041	0.018
Land holding	-0.201***	0.075	-0.070

Source: Model result, 2016; ***, **, *: implies statistical significance at 1%, 5%, and 10% levels, Log pseudo likelihood = -38.641, Pseudo R^2 = 0.5988, Wald χ^2 (14) = 77.02, Prob> χ^2 = 0.0000, N = 139.

Number of crossbred cows (CRSBRD): As it was expected, this variable is positively related with household milk market participation decision and was statistically significant at 5% probability level. The positive and significant relation between the variables indicates unit increase in cross breed dairy milking cow leads the probability of dairy household milk market participation to rise by 18 %. This result is line with the study conducted by Woldemichael (2008) found that positive relationship between number of crossbred dairy cows and market

participation decision. Moreover, this result shows that increasing number of crossbred dairy cows is an important in encouraging the smallholder to be productive and enter to market and benefit from economic transaction.

Milk produced per day (MILKYLD): As it was expected, quantity of milk produced per day significantly and positively influenced market participation. An increase of milk yield by one liter increases the probability of participating in the milk market by 1.8%, all other factors held constant. This implies that as the milk output increases, market participation also increases. This result is in line with the finding of Embaye (2010) who found that quantity of butter produced increase the chance of household selling butter. Abay (2007) and Adugna (2009) found that an increase in amount of tomato and papaya yield augment the market supply of these commodities significantly.

Total Land Holding Size (TLAND): It contrary to prior expectation, total land holding size negatively and significantly at 1% level affected milk market participation. The marginal effect result indicated that as the land holding size increased by one hectare, the probability to participate in milk selling decrease by 7%. Berhanu Kuma *et al.* (2013) found that land holding have negative relationship with market participation. This can be explained by the fact that market oriented dairy production not require more land and holding large land may encourage producers for crop production than dairy production and it affects decision to sale milk to market.

4.2.1.2. Determinants of the volume of milk sold

The truncation model result shows that the model was statistically significant at less than 1% level indicating the goodness of fit of the model to explain the relationships of the hypothesized variables, in terms of at least one covariate. The estimation result also revealed that the volume of milk sell is influenced by households' participation in non-farm income, access to market information and number of cows owned.

Extension Contact (EXTCON): As a result, extension contact positively and significantly influenced the volume of milk market supplied. The result shows that an increase of farmer

extension contacts with agriculture experts by one day increase the volume of milk sale by 0.555. Gizachew (2005) found that extension contact exhibited positive and significant effect on volume of milk supply to market.

Table 18 Determinants of volume of milk supply

Variables	Coefficients	Std. Err.
CONSTANT	-33.209	25.590
Distance from nearest market	-0.062*	0.036
Extension contact	0.555 **	0.309
Family size household head	0.086	0.800
Age of household head	0.571	0.829
Age square	-0.003	0.009
Education level household head	-0.339	1.827
Sex of household head	-1.799	3.131
Nonfarm income	0.111 *	0.065
Access to credit	1.295	2.718
Market information	0.495	3.018
Number of local breed cows	2.260 *	1.012
Number of crossbred cows	3.476 ***	0.013
Milk produced per day	1.454***	0.511
Land holding	-3.164	2.899

***, *: statistical significance at 1% and 10% levels, Log pseudo likelihood = -191.061, Wald chi2 (14) = 142.39, Prob> chi2 = 0.000, N =71 Source: Model result, 2016.

Number of local breed cows (LCBRD): Consistent with *priori* expectation, owning more local breed cows had a positive influence on the farmers' volume of milk sold at 10% level of significance. The result implies that for each additional local breed cow, the respondents would raise volume of sale of milk by 2.26 liters, keeping other factors constant. The probable

reason could be that households with higher cow ownership would lead to higher probability of getting excess milk for selling.

Number of crossbred cows (CRSBRD): As hypothesized, this variable is significant at 1% probability level and has positive effect on volume of milk supply. The model output predicts that the addition of one crossbreed milking cow causes the marketed milk volume of the dairy household to rise by 3.47 liters per day per dairy household. This result is plausible and suggests that marketable milk surplus of the household in the study areas are more responsive to number of cross breed milk cow. Furthermore, this result elaborates that milk marketed supply per day increases in response to the increase in milking cow number. Holloway *et.al.* (2002), found that household with larger dairy cows was positively associated with value of sale of dairy products.

Nonfarm income (NFARMINC): Consistent with *priori* expectation, nonfarm income has positive effect on sale volume and found to be significant at 10% probability level. The positive relation between the variables may indicate that any additional financial income enables the dairy household to purchase more number of dairy cows which can contribute to increased milk production per day and then contribute to increased volume of milk supply to market. This result is consistent with Adenegan *et al.* (2012) who found that access to non-farm income influenced volume of maize supplied to market positively and significantly. They explain that farmers with an additional source of income take risk in producing more for the market and are market oriented.

Milk produced per day (MILKYLD): As hypothesized the regression coefficient of milk produced per day was positively and significantly related with volume of milk supply to market at 1% probability level. The positive and significant relationships between the two variables indicate that milk output is very important variable affecting household head volume of milk supply. The coefficient for milk yield implies that an increase in milk output per day by one liter resulted in an increase volume of milk supply by 1.45 liter, keeping other factors constant. Berhanu *et al.* (2013) also found that total quantity of crops produced have a significant and positive relationship with the degree of commercialization.

Market distance (MRKTDIST): Distance to the nearest market was found negatively and significantly affected milk volume of supply. The negative relationship therefore shows that as the farmer residence far from the point of sale by one km the volume of milk supply decrease by 0.06liter. According to Anthony (2009), milk is a perishable product, dairy farmers feared the risk of losing their milk during long distance transportation and high transport costs. A study by Omiti *et al.* (2009) concluded that distance from the point of sale is the major constraint to intensity of market participation.

4.2.2. Econometric estimation results of determinant of use of contract in milk sale

To analyze the factors affecting households' use of contract to sale milk, probit model was used. The Chi-square value of 29.14 showed that likelihood ratio statistics significant at 1% level of significant suggesting that the model had strong explanatory power. The pseudo-R square was 0.4899 indicating the explanatory variable explained about 48.99% of the variable in the use of contract agreement to sale milk. Variance Inflation Factor (VIF) was used to test the collinearity among the explanatory variables and the explanatory variables that were less degree of multicollinearity used for the analysis. In the model estimation, a robust estimation technique was used to correct for minor heteroscedasticity problems.

Out of hypothesized variables, five variables were found to be significantly affected the probability of households using contract agreement to sale milk. Three of them, family size, nonfarm income and age of household head were negatively associated with the probability of households using contract agreement. On the other hand, membership to milk cooperative and amount of milk produced affected positively.

Non Farm Income (NONFARMINC): The model result revealed that non farm income affected the contract using behavior of dairy producer negatively and significantly at 5% significance level. Participation in nonfarm income generating activities decreased the probability of using contract agreement by 1.5%. This may be because as the dairy producer obtains other non farm income, they become more risk takers and they may not want to depend on contractual bases but want to sell to other alternatives for better prices. The result

consistent with Velandia *et al.* (2009) who found that non farm income was negatively related to using contractual based transactions.

Membership to Milk Cooperative (COOPMEM): As expected, being member to dairy cooperative affected using contract agreement significantly and positively at 10% significant level. The marginal effect depicts that being membership to milk cooperative increase the probability of using contract agreement by 0.9%. Mailu *et al.*, (2014) have also found that collective action institutions such as milk cooperatives encourage farmers to engage in formal contractual agreements. It is also consistent with the findings of Odunze *et al.* (2015) who found that membership of farmer's association affected the participation in contractual agreement in maize and soya bean positively.

Age of household head (AGE): This variable affected the decision of using contract sale significantly and negatively at 10% significance level. As the age of the household head increases by one year, the probability of the dairy producer to use contractual agreement decrease by 1.7%. This implies that the younger people are more active to use contract sale than the older households. Barret *et al.* (2007) stated that younger people are more receptive to new ideas and are less risk averse than the older people.

Milk produced per day (MILKPERDAY): Amount of milk household produced per day was affected the use of contract agreement significantly and positively at 10% significance level. The marginal effect in the model revealed that as the milk production obtained per day increases by one litter, the probability of the dairy producer to use contract agreement increase by 0.41%. This may be due to the perishable nature of the milk, as an increased amount of milk production forces farmers need to sale their milk in contract base in order to reduce spoilage of milk.

Table 19 Probit estimates of contract use of dairy producers for milk sale

Variables	Coef.	Robust Std. Err.	Marginal Effect
Constant	17.15***	5.01	
Sex of household head	0.02	0.76	0.000
Nonfarm income	-0.61*	0.356	-0.015
Age of household head	-0.689***	0.360	-0.017
Age square	0.008	0.008	0.000
Education level	-0.337	0.339	-0.008
Family size	-0.550	0.493	-0.013
Extension contact	0.995	0.959	0.058
Access to credit	-0.043	0.645	-0.001
Distance to nearest market	-0.302*	0.181	-0.007
Local breed cow	0.492	0.307	0.012
Crossbred cow	1.579	0.995	0.038
Market information	2.134	1.930	0.236
Milk produced per day	0.171*	0.103	0.004
Member to cooperative	0.329 *	0.174	0.009

Source: Own computation from survey result, 2016.

Market distance (MRKTDIST): Distance was also another variable found to influence the decision of using contract sale. Market distance was significant at 10% and was negatively related to using contract agreement. The negative relationship therefore shows that as the farmer residence far from the point of sale by one km, the probability of using contract agreement decrease by 0.73%. As farmers become far from their market they may not have enough buyers and chances to sale milk in contract base. Consequently, as distance of farmers' residence increase, the probability of using contract agreement decreases. Transportation costs associated with moving the produce to the market therefore discourage farmers to participate in markets far from their residence.

4.2.3. Determinants of milk producers' market outlets choice

Based on findings of the multivariate probit (MVP) models, the difference, similarities and significance of the determinants influencing producers' decision in market outlet choice were discussed in this section. The Wald test ($\chi^2(44) = 3299.71, p=0.000$) is significant at the 1% level, which indicates that the subset of coefficients of the model is jointly significant and that the explanatory power of the factors included in the model is satisfactory. Furthermore, results of likelihood ratio test in the model ($LR \chi^2(3) = 8.039, p > \chi^2 = 0.0452$) is statistically significant at 5% level, indicating that the independence of the disturbance terms (independence of market outlets choice) is rejected. The likelihood ratio test of the null hypothesis of independence between the market outlets decision ($\rho_{21} = \rho_{31} = \rho_{32} = 0$) (ρ_{ij}) is significant at 5%. Therefore, the null hypothesis that all the ρ (Rho) values are jointly equal to 0 is rejected, indicating the goodness-of-fit of the model. Hence, there are differences in market outlet selection behavior among farmers, which are reflected in the likelihood ratio statistics.

Separately considered, ρ values (ρ_{ij}) indicated the degree of correlation between each pair of dependent variables. The ρ_{32} (correlation between the choice for restaurant and consumers outlet) are negatively interdependent and significant at 1% probability level indicating a competitive relationship of restaurant outlet with consumer outlet. This shows that in milk marketing producers used restaurant outlets as substitute for consumer outlets. The simulation results also indicate that the probability that milk producers choose cooperative, consumer and restaurant outlet were 38%, 90% and 18%, respectively. The joint probabilities of success or failure of choosing the three market outlets suggest that households were unlikely to succeed to jointly choose the three market outlets. The likelihood of households' success to jointly choose the three market outlets were 4.28% compared to their failure to jointly choose the three market outlets of them were 3.38%.

As depicted in Table 20 out of nine explanatory variables included in multivariate probit model, six variables significantly affected cooperative market outlet; two variables

significantly affected consumer outlet and one variables significantly affected restaurant market outlet choices at 1, 5 and 10 percent probability level respectively.

Sex of household head (HHSEX): sex of household head was positively and significantly associated with use of dairy cooperative outlet at 5% significance level. It implies that male head producers are more likely to sell milk to dairy cooperatives outlet than female head households. This may be because male-headed households are high likely to search other markets as compared to female headed households and this help them for searching other alternative market. This may be because male-headed households are not faced with time burden that limits from accessing alternative market for their milk so they have high likely to search other markets as compared to female headed households. The finding concurs with that of Geoffrey *et al.* (2014), that male-headed households tend to risk takers thus they are capable of searching markets but female household's head tends to be confined at home by household chores hence hindering them from attending the market places.

Education Level of Household head (HHEDU): Education level of household head has positively and significantly affected at 1% probability level of choosing cooperative outlet. This might be due to increase in education level increases the awareness of using formal marketing systems rather than informal marketing systems especially for perishable products like milk. This finding is consistent with the work of Mutura *et al.* (2015) who found that level of education increases the likelihood of dairy smallholder farmers to sell to cooperatives in their study of analysis of determinants of market channel choice among smallholder dairy farmers.

Family Size (FMLYSIZ): Family size is positively and significantly associated with selling milk to cooperative at 5% significance level. This result shows that those households with large family size are more likely to choose cooperative outlet than other market outlets. This may imply large household size is an indicator of labor availability for farmers to produce more milk and sell their milk production to cooperative outlets.

Table 20 Multivariate probit estimations for determinates of milk producers outlets choice

Variables	Cooperative		Consumers		Restaurant	
	Coef.	RSE	Coef.	RSE	Coef.	RSE
Constant	-75.988	19.412	6.808	1.463	0.232	2.004
Sex	48.718**	21.192	-0.919	0.663	0.354	0.563
Education level	15.356***	4.668	0.202	0.373	-0.063	0.507
Crossbred cow	0.693	0.548	-0.180	0.359	0.524	0.488
Family size	0.483**	0.223	-0.204	0.208	0.027	0.124
Nonfarm income	57.495***	22.201	5.260***	0.848	-0.381	0.413
Volume of milk supply	1.268***	0.374	-0.007	0.033	-0.041	0.029
Market information	5.398	3.398	-4.854***	0.740	-1.432*	0.711
Extension contact	8.910	5.841	0.682	0.832	-0.370	1.051
Distance to nearest market	-31.956**	12.563	-0.132	0.099	-0.010	0.105
Predicted probability	0.3803		0.9040		0.1854	
Joint Probability(Success)			0.043			
Joint Probability (Failure)			0.034			
Number Of Draws (#)			5			
Observations			71			
Log Likelihood			-37.503			
Wald($\chi^2(44)$)			3299.71			
Prob > χ^2			0.0000***			
Estimated Correlation Matrix						
	ρ_1		ρ_2		ρ_3	
ρ_1	1.0000					
ρ_2	0.0644		1.0000			
ρ_3	-0.3533		-0.3551***		1.0000	
Likelihood Ratio Test Of: $\rho_{21} = \rho_{31} = \rho_{32} = 0$						
$\chi^2(3) = 8.039$						
Prob > $\chi^2 = 0.0452$ **						

Note: *, ** and *** indicate statistical significance at 10, 5 and 1%, respectively. RSE is Robust standard error, Y1=cooperatives, Y2=consumers and Y3=restaurants

Source: Own computation from survey result, 2016.

Non-Farm Income (NFARMINC): The finding reveals that, those farmers who had non-farm income positively and significantly associated with both dairy cooperative and consumer outlet at 1% significance level. This variable increases the likelihood of the dairy producer to choose dairy cooperative and consumers to sale their milk. The result may imply that

producers who had non-farm income had capacity to sale milk to alternatives outlets. This result concur with the result of Geoffrey K.(2014) argue that producers who have income from other sources could purchase the dairy farm inputs such as feeds, veterinary drugs, labor payment and capital assets that helps producers to have good quality and large quantity of marketed milk that meet the demands for modern marketing channels.

Quantity of milk supplied to market (VVSS): The finding reveals that, milk quantity sold was positively influenced the likelihood of choosing cooperative market outlet at 1% significance level. This implies that the larger milk quantity sold the more a farmer was likely to sell to cooperative. The positive coefficient further implies that households tend to increase association with cooperatives when the amount they sold increase because cooperative has capacity to purchase large volume of milk. This is a line with Bezabih *et al.* (2015) reported that the likelihood of choosing market outlet was affected by volume of potato quantity sold to market.

Access to market information (MKTINFO): Access to market information had a negative and significant influence on the choice of consumer and restaurant outlet at 1% and 5% probability level respectively. The negative sign show that farmers who have market information are less likely to sell milk to consumer and restaurant outlet compared to those farmers who had not information about market. This finding is consistent with the study of Shiwaye (2016) who found having price information of different market outlets affect significantly the probability of haricot bean producer farmer's decision to choose market outlets to sell their produce and can create an opportunity to decide the best rewarding outlets.

Distance from the market (MKTDIST): The result shows that, distance from nearest market is negatively associated with likelihood of farmers selling to dairy cooperative at 5% level of significance. This might be due to the reason that as distance to market increases, the dairy producers sell to the nearby milk consumers in order to reduce the risk of spoilage and cost that may result in transporting it to other alternatives in distant areas. The finding of Chalwe (2011) showed that distance to nearest market was significantly and negatively related to best channel choice decision because of beans farmers are poor in resource endowment and lack

transport resources and high transportation costs they discourage farmers to participate in markets far from their premises.

4.3. Challenges and Opportunities in Dairy Production and Marketing

4.3.1. Institutional problems in dairy production and marketing

Sample dairy producers have mentioned some institutional problems in dairy marketing. As the study shows absence or shortage of legal protection in case of cheating on price and on weighting scales and proclamation focused on milk and milk product marketing was not consider as institutional problem by the sample producers.

Institutional problem raised by the sample dairy producers was cultural/religious influence. Out of the total respondents who have reported the existence of institutional impediments in dairy marketing, 62.6% of them mentioned that cultural/religious influence was considered as institutional problem. Their main argument was that the habit of drinking milk was not developed in the society. Even though some young society in the urban sample kebeles have drinking habit in restaurants and some households use milk to their children and sometimes for mothers having newborn generally consumption of milk as a whole in the society is at low level.

The limited number of suppliers of feed and improved cow breeds was also considered as an institutional problem. As it was raised by 82% of the sample respondents and group discussion participants, concentrate feeds and improved cow breeds were the major constraints for dairy production. This is mainly due to the existence of very few suppliers for both inputs mostly the government and private traders and cooperatives which were provided only for the members. Institutions and organizations such as the milk cooperatives were not in a position to fill the gap of input shortages in the study area.

Infrastructures especially access to water and road were considered by the 96.4% of the participants as problems in dairy marketing in the study area. Even the main road of Mekelle to Humera is passes through the kebeles especially Agulae and Negash, the respondent complain on the quality of the road and they reported that there are no other roads inside the

kebeles to transport the products. Lack of water access to animals and human was also considered as problem by producers.

Another problem raised by the dairy sample respondents was domination of marketing by few organizations. It was raised by 71.94% of the respondents who confirmed the existence of institutional problems. Few cooperatives dominated the milk marketing. In the study area there are no governmental or private institutions which process milk and also there are no milk traders and other organized buyers of milk. Milk marketing is dominated by few cooperatives and some restaurants. Hence, dairy producers have no other alternatives to sell out their milk and have less bargaining power for their milk and were forced to sell for what the cooperatives and buyers decide.

Table 21 Type of institutional impediments reported regarding dairy marketing

Institutional impediments/problems Response	Whether it is considered as institutional impediment or not		
	Response	N	%
Absence or shortage of legal protection in case of cheating on prices	Yes	0	00
	No	139	100
Absence or shortage of legal protection from cheating on measurment scales	Yes	0	00
	No	139	100
Cultural influences	Yes	87	62.6
	No	52	37.4
Input supply problem	Yes	114	82
	No	25	18
Infrastructural problem	Yes	134	96.4
	No	5	3.6
Incomplete land ownership	Yes	0	0
	No	139	100
Domination of marketing by few organizations	Yes	100	71.94
	No	39	28.06

Source: Own survey result, 2016.

4.3.2. Challenges for dairy producers in production

In the study area there were different dairy production and dairy marketing constraints which are mentioned by the sample dairy producers and group discussion participants. The most important constraints associated with milk production as prioritized by the respondents in the study area are indicated below. About 114 (82%) of the sample dairy producers mentioned shortage of feed as their first constraint for dairy production in the study area. Abebe *et al.* (2014) also confirmed lack of access to feed probably limit the milk production potential of cows and also the ability of producing quality milk more than any other single factor and is the most serious constraint to improve milk production.

The shortage of feed includes both agro-industrial concentrate feeds and improved forages. The dairy producers were not able to find enough supply as the source of supply was controlled by private traders and no other alternative suppliers other than cooperatives which supply only to its members. The sample dairy producers had also confirmed that shortage of supply and expensive price of concentrates were major constraint for dairy production in addition to shortage of improved forages.

The other issue raised by the participants and sample respondents was shortage of supply of improved breed cows was other challenge mentioned by the dairy producers. About 2.9% of the sample dairy producer mentioned the shortage of improved cross breed dairy cows. Lack of access to training was another constraint raised by the dairy producers. About 10.8% of the sample dairy producer mentioned lack of access to training as constraint on dairy production. The dairy producers in the study area obtain training mainly from government through extension agents and the training provided was not enough and also most of the time it was focused on crop production and natural.

About 3.6% of the sample dairy producer mentioned the limited access to land as one of the challenging factors in dairy production. This problem has forced them to decrease their milking cows. Shortage of land owned by the producers cause to produce low quantity of milk production because as Abebe *et al.* (2014) confirmed that the problem of shortage of land is

associated with problem of feed shortage and forced the producers to produce low quantity of milk production.

Table 22 Challenges facing the dairy producers during dairy production

Challenges in dairy production	N	%
Shortage of feed	114	82.0
Lack of access to training	15	10.8
Shortage of improved breeds	4	2.9
High cost of feed	1	0.7
Shortage of land	5	3.6
Total	139	100

Source: Own survey result, 2016.

4.3.3. Challenges for dairy producers in dairy marketing

Almost all dairy producer farmers responded that there were market problems in the study area. The major dairy marketing constraints raised by the sample respondents and group discussion participants were the following.

Lack of market linkage with different milk buyers was the major problem regarding dairy marketing. About 38.8% of the sample dairy producers have reported lack of market linkage as their major problem in dairy marketing. The producers were unable to sell their milk production due to lack of buyers. This problem was mentioned by the non member producers and also by members of cooperative because they did not sell their milk at fasting season especially at night time the cooperatives did not receive the milk produced by their members. In case they tried to sell it in noncontract market, it easily exposed to spoilage and consumers refuse to buy because they hesitate on its quality.

Demand fluctuation was another challenge and mentioned by 18.7% of dairy producers. Since milk is among the food stuffs which is restricted by the Christian Orthodox followers not to be consumed during fasting periods, its demand declines drastically during these periods.

The milk produced during these fasting periods then has no demand and the dairy producers either forced to sell it with low prices or try to process it to other products or it is left to be fed by the calf. It is obvious that demand fluctuation causes price uncertainty. According to the sample dairy producers, the price of milk declines up to 7 Birr / liter during fasting periods. The fluctuation of demand and price discouraged the dairy producers from increasing milk production. Absence of dairy cooperative was raised by participants as the first constraint in the study area. About 31.7% of the sample dairy producers have reported that there are too small numbers of milk cooperatives in the study area. Hence dairy producers are far from the city they could not transport their milk to the city easily cooperatives are very important for them to sale their milk.

Lack of milk processing plants was also raised by participants as the constraint in the study area. In the study areas governmental and private milk processors, and as the dairy producers were mentioned during fasting period almost all production have no demand so if there were processing plants the producers would not loss during the fasting period because it could be collect by the plants and packed or processed. Because of this and others, the dairy producers were discouraged to produce more milk and supply to the market.

Table 23 Challenges the dairy producer face during dairy marketing

challenges face during dairy marketing	N	Percent (%)
Price uncertainty	5	3.6
Product deterioration	4	2.9
Demand fluctuation	26	18.7
Shortage of marketing linkages	54	38.8
Lack of cooperatives	44	31.7
Lack of processors	6	4.3
Total	139	100.0

Source: Own survey result, 2016.

4.3.4. Challenges for consumers in milk marketing

The consumers were faced with different challenges that occur during milk marketing. Among the major challenges in milk marketing raised by the consumers are discussed below. The

major problem raised by the consumers was low quality of milk. The consumers reported that the quality of milk they bought was adulterated with water. They have also reported that the dairy producers mix the fresh milk with milk stayed for long time. The consumers claimed that there were no standard quality controlling methods for milk marketing in the area. Consumers state that dairy cooperatives had instruments to test quality of the milk when receive from producer so there was better quality in cooperatives.

Milk supply and price fluctuation was another challenge for consumers in the dairy marketing. The consumers claimed that there were times where there is good supply and times with low supply of milk. Moreover, the price of milk fluctuates within a year especially during fasting and non-fasting periods. During the fasting periods, price of milk declined up to 7birr/liter whereas during the non fasting periods, there were times in which the price raised up to 15birr/liter.

4.3.5. Challenges for milk cooperatives

According to the cooperatives managers and secretaries, major problems faced during milk collection and marketing were demand and price fluctuation, lack of access to improved breed cow, rise of input (feed cost), low quantity and quality of milk, lack of land for selling and storing the milk until the buyers taken and also low support from government and nongovernment organization was provided. Poor infrastructure such as lack of water and electricity access and standardized container material, and religious influences that was long fasting periods on milk consumption was the major problems which cooperatives faced in dairy marketing in the study area.

4.3.6. Opportunities in dairy production and marketing

Group participants and sample dairy producers, cooperatives have expressed their bright future or opportunities in dairy marketing and dairy production. Some of the major opportunities were the followings. Expansion of infrastructures such as roads, telecommunications and expansion of electricity were among the opportunities that could create favorable conditions for dairy production and marketing. The good infrastructure enables the dairy producers to get

inputs from suppliers and this can increase their milk production. These infrastructures can also help them in searching and to communicate with milk buyers. With good road, they can easily transport dairy products to nearby city on time. Increasing urban population the expansions of cities and population growth have been seen as future opportunities for the dairy producers. The increase in demand for dairy products due to population growth can encourage them to produce milk and milk products and increase their earning from selling these products.

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary and Conclusion

Institutional arrangement and institutional environment play a crucial role in facilitating any marketing in general and in dairy marketing in particular and increase satisfaction to actors in the dairy marketing. Despite the importance of institutional set-up in dairy marketing, the existing situation and problem with in this set up was not yet studied. Thus, this study was aimed to analyze the institutional environments and arrangements in dairy marketing in Wukro Kilte Awlalo in Eastern Zone of the Tigray National Regional State with the specific objectives of examining the institutional environments and arrangements; identifying factors that affect milk market participation and level of participation of dairy producers and identify the determinant factors of contract use; identify determinants of milk market outlet choices.

The study was carried out in four kebele including Agulae, Negash, Adiqisandid and Genfel kebele. Primary data was collected from a total of 139 dairy producer households; 10 consumers, 4 restaurants and 3 cooperatives. In addition to these, discussions with dairy producers and key informants were also made. Both descriptive and econometric methods were used for data analysis. In the econometric part, the study used econometric models including double hurdle model, probit model and multivariate probit model.

The descriptive part of the study revealed that sample selected milk market participants as compared with non-participants were characterized by their education level, resource ownership, volume of milk produced and number of cow owned. Moreover, age of household, access to different institutions including access to market information, access to land, nonfarm income and number of milking cow were found to be associated with sampled milk market participants. Similarly, volume of milk produced per day and market distance was associated with contractual agreement implying the need for stable market especially for perishable products such as milk to reduce the risk of spoilage in case demand for milk decreases. Education level and sex of respondent also showed positive significant association with choosing of formal marketing systems such as cooperatives. The study has also found that there was lack of formal institutions that govern dairy marketing except the rules and

regulations in the cooperatives associated with members of the cooperatives. Due to the lack and ineffective functioning of the formal institutions, informal institutions such as trust dominate the dairy marketing in the study area.

The double hurdle model result showed that access to market information positively and significantly affected the probability to participate in milk marketing. This implies information flows focusing milk market demand and price should be available to dairy producers to increase marketing participation and volume of supply. Non-farm income had a positive impact on the volume of milk sells. Number of crossbred and local breed cows of the producer, volume of milk production and extension contact positively and significantly affected the participation and volume of milk marketed. This implies that having many cows increase amount of milk production and this leads them to sale more volume of milk. Hence focus should be given towards improve the chance to access the cows and extension service.

The result of the Probit model has also indicated that volume of milk produced per day and member of dairy cooperative positively and significantly affected and nonfarm income, age of producers and market distance are negatively affected the probability of milk producers use contract agreement with buyers.

The multivariate probit model shows that correlations between the milk producers choice of restaurant and consumer outlet was negative and statistically significant. This shows that in milk marketing producers used restaurant outlets as substitute for consumer outlets in Wukro-kilteawlaelo district. This study has also shown that the milk producers in the study area have made their choice of market outlets for their produce based on quantity of milk supply to market, education level of household head, sex of household head, family size, distance to nearest market, nonfarm income.

In addition to the important significant variables estimated by the econometric models, the study has indicated that there was lack and low level of involvement of formal institutions in the dairy marketing. The dairy marketing is done mostly in a traditional way of trading with highly dependence on trust and mutual understanding. How the interaction between the formal

and informal institutions can be used to improve market transaction is a challenge that must be given great emphasis.

5.2. Recommendations

On the basis of the results of this study, the following policy implications are recommended so as to be considered in the future intervention strategies which are aimed to support milk production and marketing in the study area.

1. In order to overcome the lack and ineffective functioning of the formal institutions in dairy marketing in the study area policy makers should focus on devising appropriate regulations, formal rules and principles to govern the dairy marketing in the study area.
2. Government should intervene in dairy establishing cooperatives and large milk processor plants facilitate producers to supply their production easily without any loss of milk and use milk contract sale.
3. Expanding accessibility of infrastructures such as road and transportation facilities needs government intervention to promote the effective marketing of milk for faster delivery of farm produces especially perishable commodity like milk.
4. Government and other dairy sector partners are required to give due attention for integrating cross breed cows to the smallholders dairy sector through promotion of smallholders and large private investment which introduce new technology in the sector.
5. Expanding equal accessibility of infrastructures such as road and transportation facilities needs government intervention to promote the effective marketing of milk through all outlets.
6. Policy makers should focus more on enhancing producers' marketable supply of milk which could be attained through providing the marketing infrastructure, technical and organizational assistance, and access to market information by establishment of dairy cooperative and farmers' organizations.

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7. APPENDICES

Appendix Table 1 Variable inflation factor for variables in participation and volume of supply

Variable	VIF	Tolerance
Crossbred cow	1.20	0.834
Distance to the nearest market	1.15	0.870
Age of the households	1.06	0.946
Local breed cow	1.10	0.913
Land holding	1.10	0.913
Milk yield per day	1.82	0.54
Extension contact	2.02	0.494
Mean VIF	1.35	

Source: Survey data, 2016.

Note: In all cases, VIF is less than 10 hence, no high degree of multicollinearity

Appendix Table 2 Contingency coefficients for dummy variables participation and volume supply

	Sex	Non-farm income	Access to credit	Access to market information
Sex	1			
Non-farm income	-0.048	1		
Access to credit	0.053	-0.240	1	
Access to market information	-0.106	0.380	-0.234	1

Source: Survey data, 2016.

Note: In all cases contingency coefficient is less than one hence, no high degree of association is observed.

Appendix Table 3 Variable inflation factor for variables used in contractual

Variable	VIF	Tolerance
Access to market information	1.72	0.582
Number of own cow	1.44	0.694
Farm size	1.30	0.769
extension contact	1.30	0.769
Distance to the nearest market	1.27	0.7880
Sex	1.20	0.835
Educational level	1.15	0.868
Age of the households	1.13	0.882
Off-farm income	1.13	0.887
Access to credit	1.12	0.892
Mean VIF	1.28	

Source: Survey data, 2016.

Appendix Table 4 Conversion factors used to calculate Tropical Livestock Unit (TLU)

Animals	TLU-equivalent
Ox, cow, and adult horse	1.00
Bull and heifer	0.75
Weaned calf	0.34
Calf	0.25
Adult sheep and adult goat	0.13
Young sheep and Young goat	0.06
Adult donkey	0.70
Young donkey	0.35
Adult mule	1.10
Mature chicken	0.013

Source: Strock *et. al.* (1991).

Appendix 5: Survey Questionnaires

INSTITUTIONAL ANALYSIS OF MILK MARKETING IN WUKRO KLITE- AWLAELO DISTRICT OF TIGRAY REGION, ETHIOPIA QUESTIONNAIRE FOR DAIRY PRODUCERS

This interview is aimed at gathering information needed for this specific study and will not be used for other purpose. Accordingly I kindly request you to provide accurate information.

Instructions for Enumerators:

- Make brief introduction before starting any question, introduce yourself to the farmers, greet them in local ways and make clear the objective of the study.
- Please fill the interview schedule according to the farmers reply (do not put your own feeling).
- Please ask each question clearly and patiently until the farmer gets your points.
- Please do not use technical terms and do not forget local units.
- During the process write answers on the space provided.
- Prove that all the questions are asked and the interview schedule format is properly completed.

Questionnaire Code: _____

Name of the Enumerator: _____ Signature: _____

Date of Collection: _____

Region: Tigray Zone: _____ District: Wukro Kilte-awlaelo Kebele: _____

Section A: General Information

1. Name of respondent _____
2. Sex of the household head 1= male 0= female
3. Age of the household head _____
4. Marital status _____ 1= unmarried 2= married 3= divorced 4= widowed
5. Religion of the household 1= Orthodox 2= Muslim 3= Protestant 4= Catholic 5= No religion 6= others (specify) _____
6. Education level of household head 0. Illiterate 1.literate
7. Do you participate in leadership of social organizations in your area? 1= Yes 0=No
8. If yes, in which? 1= Kebele 2= religion 3= political leader 4= Idir 5= Mahiber 6=Equb 7= others (specify) _____
9. Family members' information

S. No	Name	Sex 0=F 1=M	Age	Relation to the household head (<i>code</i>)	Years spent in Education	Participation in Dairy Activities		
						Fully participate	Partially participate	Not participate

Code: 1=Husband 2=Wife 3=Child 4= Father/Mother 5=Sister/Brother 6= Grand Child 7= Hired labor
8=other relatives 9= Others (specify) _____.

Section B: Resource Ownership

- Total Land holding _____ ha in 2016.
- Total grazing land: _____ ha.
- Is there communal grazing land in your locality? 1=Yes 0=No
- Do you have your own transportation facilities? 1. Yes 0. No
- If your answer for Q. 4 is 'yes', what type? 1. Vehicle 2. Transport animals 3. Cart
- Other ownership of resources

Resource	1=Yes 0=No	Number	Estimated value
Type of house owned -1=Grass roofed			
-2= Iron sheet roofed			
-3=Both types			
Hoe			
Harrow			
Motor pump			

- Do you have livestock? 1. Yes 0. No

- If your answer for Q.7 is 'Yes', livestock Number: Livestock ownership (Currently) and estimated values

Livestock type		Number	Estimated Average Price (Birr)	Total Price (Birr)	Sold in the last 12 months(Birr)	Remark
Ox						
Bull						
Cow	Cross					
	Local					
Heifer	Cross					

Livestock type		Number	Estimated Average Price (Birr)	Total Price (Birr)	Sold in the last 12 months (Birr)	Remark
	Local					
Weaned calf	Cross					
	Local					
Calf	Cross					
	Local					
Adult sheep						
Young sheep						
Mature goat						
Young goat						
Donkey (adult)						
Donkey (young)						
Horse (adult)						
Horse (young)						
Mule (adult)						
Mule (young)						
Mature chicken						
Honey bee colony	Modern					
	Transitional					
	Traditional					

9. Did you participate in crop production in last cropping season 2015/16? 1=yes 0=no

10. If 'yes' what type crops and amount production during the last cropping season(2016)

No	Type of crop	Area in ha	Quantity produced (qt)	Quantity consumed (qt)	Quantity sold (qt)	Price/qt
1	Maize					
2	Sorghum					
3	Wheat					
4	Teff					
5	Barley					
6	teff					
7	Cabbages					
8	Carrots					
9	Potato					
9	Onion on					
10	Others (specify)					

Section C: Economic Activity and Income sources

1. Experience and revenue from activities

Activity	Did you participate in activities 1=yes 0 =No	Years experience of	Estimated Annual income (Birr)
Farming			
Off farming			
Non-Farming			

2. Number of years involved in agriculture (other than dairy)_____.

3. How long have you practiced production of dairy? _____ Years experience.

4. What is your primary source of income? 1= dairy keeping 2= crop production
 3= other livestock keeping 4= business (trading) 5= government employment
 6= wage employment 7= remittance 8= others (specify) _____.

5. Income generating activities in the last 12 months

Description	Participation of family members in the last 12 months 0=No 1=yes	Total number of family members participated	Average monthly income (Birr)	Total yearly income (Birr)
1=Trading of food crops				
2=Selling of fuel wood				
3=Selling of construction wood				
4=Selling of wood charcoal				
5=Selling of feed				
6=Trading of livestock				
7=Trading of livestock products				
8= Cash for work				
9=Wage working				
10=Government employment				
11=Metal or wood work				
12=Traditional weaving products(<i>Shimena</i>)				
13=Remittance				
14=Others _____				

6. Do you record every detail of your expenses and incomes? 1=Yes 0=No

7. If no, what is the reason? 1=no knowledge of record keeping 2=no need to record keeping
 3= carelessness 4=others (specify) _____

Section D: Dairy Production

1. Production of livestock products during 2016 (last 12 months)

Product description	Unit	Average Quantity per week	Average unit price of the year (Birr)	Buyer (Code)	Total price	Remark
1=Milk						
2=Butter						
3=Cheese						
4=Yoghurt						
5=Eggs						
6=Meat						
7=Honey						
8=Skin						
9=Hides						
12=Others						
Code: 1=consumer 2= dairy cooperatives 3=milk processors 4= wholesaler 5=brokers, 6= hotels 7=restaurants, 8=cafeterias 9= educational institutions 10= health institutions 11=retailer						

2. How many milking cows do you have currently? _____

3. Volume of milk produced per day (in liters):

Time	Breed of cow	No of cows in milk	Volume of milk produced per time (in liters)			Average milk produced per cow (liters per day)	Total milk produced (liter/day)	Remark
			Minimum	Maximum	Average			
Morning	local							
	Cross breed							
Evening	local							
	Cross breed							

4. Average lactation period of cows (in months) 1=local cows _____ 2= cross breed _____

5. How is the trend of volume of milk production? (✓)

cow	Trend of production			If increasing, why?	If decreasing, why?
	Increasing	Decreasing	Same		
local					
Cross breed					

6. Type of feeding system the household practices 1= free grazing 2= semi grazing 3= zero grazing 4= others (specify) _____.

7. What is the labor source for dairy production? 1. Family labor 2. Hired labor 3. Labor exchange

Section E: Dairy Marketing Aspects

1. Do you sell milk? 1= Yes 0= No (**Skip to Q-9**)
2. To whom do you sell your milk? 1=consumer 2= dairy cooperatives 3=milk processors
4= traders, 5=brokers, 6= hotels, 7=restaurants, 8=cafeterias 9= educational institutions
10= health institutions
3. If you do not sell, what is the reason? 1=low production of milk 2=low price of milk
3=no demand (market) for milk 4= others (specify) _____
4. If you sell milk, use of milk and milk products of the total milk produced (%)

Period	Breed of cow	Sold as raw milk (%)	Consumed as raw milk (%)	Processed for different products	Buyer of raw milk (Code A)	Average price of milk (Birr per
Non-Fasting	local					
	Cross breed					
Fasting	local					
	Cross breed					

Code A: 1=consumer 2= cooperatives 3=milk processors 4= traders 5=brokers 6= hotels
7=restaurants, 8=educational institutions 10= health institutions 11= retailer

5. If you sale raw milk in the past 12 months, please answer the following?

Breed of cow	Quantity sold (L)	Place to sell (where)(use cod) A	Distance to market (km)	Means of Transport(use cod) B	To whom do you sell? (use cod) C	Advantage (use cod) D	Terms of sell (use Code) E
local							
Cross breed							
Where (A) 1.Farm gate 2.Local market 3.Wukro 4.Mekelle 5.Adigrat		Means of Transport (B) 1= On donkey 2= Vehicle 3=On foot (Being carried)	To whom do you sell? (C) 1=consumer 2= cooperatives 3=milk processors 4= traders, 5=brokers, 6= hotels, 7=restaurants, 8=education institutions 10= health institutions 11= retailer		Advantages (D) 1.Lesser transport cost 2.Give high price 3.Easily negotiate 4.Others specify		Terms of sell (E) 1. Cash 2.Credit 3.(both)

6. Who sets the price of milk? 1= producer 2= buyer 3= negotiation 4= whole seller
5=retailer 6= government 7=(others specify)_____
7. How do you find your buyer? 1= physically 2= by telephone 3= we were arranged by
government 4=arranged by NGO 5=by brokers 6=others (specify)_____
8. What is the criterion to prefer your buyer? 1= good price 2= immediate payment 3=
providing credit 4= payment on agreed time 5=volume of sale 6=trust 7=relative
8=providing containers 9=provides market information 10= provides training 11=I do
not have awareness of any other buyers 12=others (specify) _____
9. Do you take the milk to your buyer or does your buyer come to you?
1= I go to the buyer 2= the buyer come to me 3=others (specify) _____
10. Have you ever been faced with spoilage of milk? 1=Yes 0=No
11. If yes, could you estimate the volume and estimate price of the milk spoiled during the last
12 months. In liter_____, Birr _____.
12. What was the reason for the spoilage of milk? 1= due to poor hygiene 2= due to
delayed delivery to the selling (collecting) center 3= due to breaching of contracts with
the buyer 4=others (specify)_____
13. What do you do with unsold milk? 1=consumed at home 2= processed for cheese
3=processed for yoghurt 4= processed for butter 5=others (specify) _____
14. How do you sell your milk? 0= individually 1= in group
15. Did your buyer complaint about the quality of your milk? 1=Yes 0=No **(Skip to Q-24)**
16. If yes, what was the problem? 1= adulterated with water 2=stayed for long time 3=low
fat content 4= poor containers 5=contaminated 6=others (specify) _____.
17. Is there milk demand fluctuation within one year? 1=Yes0=No
18. If yes what is the month with the lowest demand for milk? _____
19. What is the price of milk in the month with the lowest demand? _____
20. What is the month with the highest demand for milk? _____
21. What is the price of milk in the month with the highest demand? _____
22. What is the method of payment for your milk sale? 1= immediate cash payment
2= weekly payment 3= monthly payment 4= others (specify) _____
23. Is there delayed payment from your buyers? 1=Yes 0=No
24. Do you have trust on your milk buyer? 1=Yes 0=No
25. If no, what is the distrust the buyer has? 1= cheating of price 2=cheating on
measuring scales 3=delayed payment 4=others (specify) _____.
26. Do you have contractual agreement with your milk buyers? 1=Yes0=No
27. If yes, type, nature, and terms of agreement:

Milk Buyer		Type of contract(A)	Nature of agreement(B)	Terms of agreement(C)
1=Consumers				
2=cooperatives/ processors	Cooperatives			
	Processors			

3=Market	Traders			
	Brokers			
	Hotels			
	restaurants			
	Education institutions			
	Health institutions			
	Others _____			

Codes:

A=Type of contract	B=Nature of contract	C=Terms of agreement
1= short term (One month)	1=Formal (written) agreement	1=Specified milk price
2=medium term (one lactation period)	2=Informal agreement (based on mutual understanding)	2=Specified volume of milk
3= greater than one lactation period	3=Others(specify)_____	3=Quality of milk
4=others_____		4=Others(specify)_____

28. Do you have knowledge on the availability of legal enforcement mechanism in case of breaking contractual agreement? 1= Yes 0=No

29. Have you ever been faced with any breach of contractual agreement with your buyer? 1=Yes 0=No

30. If yes, is there any legal enforcement to correct these breaches? 1=Yes 0= No

31. Who is responsible to make sure that laws and responsibilities are enforced? 1=the government 2= the contracted parties 3= cooperatives or processors 4=others(specify)_____

32. How do you resolve the breaching problem?

1=by negotiation 2=by going to court 3= others (specify) _____

33. Are you satisfied with the legal enforcement mechanisms taken to correct the breach? 1=Yes 2=No

34. What is the reason for breach of contractual agreement with your buyer?

Section F: Institutional support services

1. Do you get any support concerning dairy production or marketing? 1=Yes 0=No

2. If yes, what support do you obtain? 1=credit 2=market information 3=market linkage 4= collective marketing 5=dairy training 6=marketing training 7=input supply 8=others specify) _____.

3. Who provides you the support? 1=Government 2=NGO 3=Buyer 4=other (specify)_____.

4. From whom do you get input supply.? 1=from cooperatives 2=from traders 3= from processors 4=from market 5=others (specify) _____

5. How do you trust your suppliers? 1=no trust 2=low 3=moderate 4= high

6. Did you have extension contact relation to dairy production in the past 12 months? 1= Yes 0=No

7. If yes, number of visit made by extension in the last 12 months _____

8. Who provides the extension service? (Multiple response is possible)

1. Development agents 2. NGOs (specify) _____

3. Research centres (specify) _____ 4. Woreda OoARD experts
 5. Neighbours and friends _____ 6. Others (specify) _____
 9. How do you get the advisory service? (✓) (Multiple response is possible)
 1. Farm to farm visit by the development agent 2. Experience sharing tour
 3. Visit to model farmers' site 4. Training
 5. Others (specify) _____
 10. What was the extension advice specifically on dairy production?

 11. . Do you have access to credit institutions? 1=Yes 0= No
 12. Have you received credit in 2016 for dairy production purpose? 1= Yes 0 =No
 13. If yes, how much did you take for dairy production purpose? _____birr.
 14. For what purpose did you take the credit in relation to vegetable production? 1. To
 purchase cow 2. To purchase animal feed 3. To purchase transporting animals 4. To
 rent land 5. To purchase container material 6.Others(specify)_____
 15. From whom did you get credit for dairy production? 1. Relative 2. Bank 3.Micro finance
 institution 4. Friends 5. Traders 6. NGO 7.Peasant association 8. Cooperatives
 16. What is the advantage of obtaining credit from this source? 1= low interest rate 2= long
 repayment period 3=provision of enough credit 4=no bureaucracy 5=no other alternatives
 6=others (specify) _____
 17. How do you get credit? 1=by collateral 2=by group formation 3=no need of any
 preconditions 4=others (specify) _____
 18. If collateral, what is that? 1=house 2=land 3=livestock 4=others (specify) _____
 19. Distance to nearest infrastructure and marketing facilities

infrastructure and marketing facilities		Distance
All weather road	Walking (minutes)	
	Driving (minutes)	
	km	
Milk cooperative	Walking (minutes)	
	Driving(minutes)	
	km	
Milk processor	Walking (minutes)	
	Driving (minutes)	
	km	
Nearest main milk market place (other than cooperative)	Walking (minutes)	
	Driving (minutes)	
	km	
Input supplier	Walking (minutes)	
	Driving(minutes)	
	km	
Development office	Walking (minutes)	
	Driving(minutes)	
	km	

20. What is the condition of road to the nearest market? 0=Poor 1=Good

21. Do you have contact with extension agent? 1=Yes 0=No
 22. Have you contacted livestock extension agent? 1=Yes 0=No
 23. If yes, frequency of contact with livestock extension agent: 1= daily 2=weekly 3= every two weeks 4=others (specify) _____.
 24. Do you know the market prices in Wukro before you sold milk in 2016? 1=Yes 0=No
 25. How did you get information on supply, demand & price of milk in other markets?

	Use code	Source of information
Supply		1 Other vegetable traders 4 personal observation
Demand		2 Radio 5 Broker 7 TV 8 Cooperative
Price		3 Telephone 6 News paper

26. How did you qualify your source of information?
 1 it was reliable 3 it was timely
 2 it was adequate 4 other (specify) _____

Section G: Membership to Cooperative or other group

1. Is there any dairy cooperative in your locality? 1= Yes 0= No
 2. If yes, are you a member of that cooperative? 1=Yes 0=No
 3. If you are a member of that cooperative, what service and/or benefits do you get from the cooperative? 1= provision of training, extension, breeding, or veterinary services 2= input supply 3=market linkage 4=provision of credit/loan 5= others (specify)_____
 4. How long have you been a member (years)? _____.
 5. Are you a member of any other collective action group or association other than milk cooperative? 1=Yes 0=No
 6. If yes, what is the name of that collective action group? _____.
 7. What benefits do you get from this group association? 1=No benefit 2= market information 3=marketing training 4=marketing linkage 5=credit 6= dairy inputs 7=dairy training 8=collective marketing 9=others (specify) _____.
 8. Is there traders association in your locality? 1= Yes 0= No
 9. If yes, have you get any benefit from the association? 1= Yes 0= No
 10. If yes, what benefit did you get?_____

Section H: Institutional Aspects

1. Is there any regulation /laws or bylaws governing dairying in your locality? 1= Yes 0=No
 2. If yes, what are the regulations? 1= regulations regarding milk quality 2= selling to specified agency (buyer) 3=restriction of free grazing 4=others (specify) _____.
 3. Who is responsible for making sure that laws and regulations are enforced? 1= the government 2= the local community 3= the dairy cooperative 4=others (specify) _____.
 4. Is there any penalty in case of breaking the above law? 1=Yes 0=No
 5. If yes, what is the penalty? 1=penalty in Birr 2= prison 3=prohibiting from the service 4=others (specify) _____.
 6. Are the laws enforced as required? 1=Yes 0=No
 7. What regulations /law or bylaw is affecting your dairy business? _____.
 8. Do you have social network in your locality? 1=Yes 0=No
 9. If yes, how many networks do you have? _____.

10. What is the nature of contact? 1=poor 2= medium 3=good 4= strong
11. Do you have knowledge on grades and standards of milk? 1=Yes 0=No
12. What challenges do you face during dairy production (Multiple answer is possible)? 1= shortage of dairy production training 2= shortage of dairy product handling training 3=shortage of feed 4=shortage of improved breeds 5=others (specify) _____
13. What challenges do you face during marketing (Multiple answer is possible)? 1=price uncertainty 2=un trusted customer 3=product deterioration 4= unreliable buyer 5= demand fluctuation 6= high competition 7=shortage of marketing linkages 8=absence of cooperatives and/or processors 9=others (specify)_____.
14. Is there any institutional problem regarding dairy marketing?1=Yes 0=No
15. If your answer is yes, what are they?

Description	Do you consider them as problems during marketing 1=Yes2=No	Remark
1=Absence or shortage of legal protection in cheating on prices and weighting scales		
2= Poor government policy		
3= Cultural influences		
4= Input supply problem		
5= Infrastructural		
6= Incomplete land ownership		
7=Domination of marketing by few organizations		
8= Others (specify)		

16. If you are member of dairy cooperatives, please respond the following TRUST indicators

Description	Scale			
	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly agree (4)
The cooperative is established to benefit the dairy producers				
There is good relationship between producers and the cooperative				
The cooperative treats producers with care				
The cooperative treats all producers equally				
The cooperative pays good price to dairy producers				
The cooperative cheats the dairy producers				
The cooperative decisions are to benefit both the cooperative and the dairy producers	Union			
The cooperative provides services to producers as expected				
The cooperative stands for the right of its producer members				
The cooperative creates market linkages				

17. Trust the household has on processors

Description	scale			
	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly agree (4)
The processor is established for mutual benefit				
There is good relationship between producers (suppliers) and the processors				
The processor treats producers with care				
The processor treats all producers equally				
The processor pays good price to dairy producers				
The processor cheats the dairy producers				
The processors decisions benefit both the processors and the dairy producers				
The processor provides services to producers as expected				
The processor stands for the right of its suppliers				

18. Trust the household has on traders

Description	scale			
	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly agree (4)
There is good relationship between producers (suppliers) and the traders				
The traders treat producers with care				
The traders treats all producers equally				
The traders pay good price to dairy producers				
The traders cheat the dairy producers				
The traders' decisions benefit both the traders' and the dairy producers				
The traders provide services to producers as expected				
The trader stands for the right of its suppliers				

19. Trust the household has on Government

Description	scale			
	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly agree (4)
There is good relationship between producers and the government				
The government treats all producers equally				
The government decisions are to benefit the dairy producers				
The government provides services to producers as expected				
The government creates market linkages				

The government laws are to benefit the dairy producers				
The legal system are trusted by the producers				

20. Transaction and transport costs for the last 12 months

Description	Milk	
	Time (minutes)	Cost (Birr)
Searching for trading partner (buyer)		
Searching for price information		
Screening for potential partner		
Negotiation (bargaining) to reach agreement		
Enforcement of law(settling case) for breaching contract		
Transport cost (during transporting the product)		
Others (specify) _____		

21. How do you evaluate your relationship with dairy marketing actors regarding dairy marketing? (Use $\sqrt{\text{mark}}$)

Dairy marketing actors	Relationship status with the dairy actors					Remark
	No relation at all	Very weak	Weak	Strong	Very strong	
Dairy producers						
Village collectors						
Traders						
Commission men/brokers						
cooperatives						
Processors						
Consumers						
Health institutions						
Education institutions						
Restaurants/hotels/cafe						
Input suppliers						
Government						
Others _____						

40. Any additional suggestions you would like to say:

“Thank you for your cooperation”

Checklist for Group discussion with dairy producers

Date of interview _____

Region: Tigray Zone: _____ **District:** _____ **Kebele:** _____

1. How do you evaluate the dairy market? (Such as market linkage with customers) and have producer power in the dairy market?
2. Do you know any institutions work on or regarding to dairy production and marketing?
3. What is the role of formal institutions (such as government laws, policies, regulations or interventions) and their disadvantages in the dairy marketing?
4. What is the role of informal institutions and their disadvantages in dairy marketing?
5. How do you evaluate the relationship and interaction of dairy producers with the following dairy marketing actors (regarding dairy marketing)?
 - A. with other dairy producers
 - B. with dairy traders
 - C. with cooperatives
 - D. with processors
 - E. with consumers
 - F. with private and governmental institutions
5. What are the constraints you assume in dairy production and in dairy marketing?
6. What solutions do you suggest for the constraints?
7. What laws do exist that promote and hinder dairy marketing?
8. Who is your preference for selling your milk? Why?
9. What is the current situation in market arrangements and contractual agreement with milk buyers?
10. What are the institutional problems regarding to dairy marketing?
10. What are the opportunities in dairy production and marketing?
11. How do you evaluate the transaction cost in affecting from getting high prices for your milk?

Checklist for Key Informants (Zone and District Dairy Experts)

Date of interview _____

Region: Tigray Zone: _____ **District:** _____ **Kebele:** _____

1. Name of Expert _____ Phone No _____

2. How do you evaluate the dairy production and dairy marketing in your district? Are the trend declining? Why?

✓ Dairy Production

✓ Dairy Marketing

3. What are the threats for the dairy extension service and input supply? And who is responsible for this?

4. What are the most important constraining infrastructures or other institutional factors affecting dairy marketing?

5. What are the possible solutions to improve these constraints?

6. What is the role of FTC in dairy production and marketing?

Checklist for dairy marketing stakeholders/institutions

Date of interview _____

Region: Tigray Zone: _____ **District:** _____ **Kebele:** _____

1. Name of respondent _____ Phone No _____

2. Job title _____

3. Name of Organization _____

4. Year of establishment _____

5. What is the contribution of your organization in dairy marketing?

6. How do you evaluate the relationship/interaction between your organization and the dairy producers and other marketing actors?

7. What kind of support does your organization provide to dairy marketing actors (Such as credit, market information, and training)?

8. What criteria do you consider in providing support to dairy producers?

9. What are the institutional environments (such as formal laws, by laws, regulations) that govern milk production, processing, transporting, and marketing..., in your district?

10. Are there any contractual agreement between your organization and other actors in dairy marketing? Yes/ No. If there are contractual agreements, what is the kind of contract and with whom?

11. What do you think are the major constraints in dairy marketing?

12. Who is responsible for the above constraints?